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Idaho National Engineering and Environmental Laboratory Environmental Monitoring Plan

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ABSTRACT

This plan describes environmental monitoring as required by U.S. Department of Energy Order 450.1, "Environmental Protection Program," and additional environmental monitoring currently performed by other organizations in and around the Idaho National Engineering and Environmental Laboratory. 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 INEEL, the rationale for monitoring, the types of media being monitored, where the monitoring is conducted, and where monitoring results can be obtained.

EXECUTIVE SUMMARY

This plan describes environmental monitoring as required by U.S. Department of Energy Order 450.1, "Environmental Protection Program," and additional environmental monitoring currently performed by other organizations in and around the Idaho National Engineering and Environmental Laboratory (INEEL).

Environmental monitoring consists of two major activities: effluent monitoring and environmental surveillance. This Environmental Monitoring Plan covers all routine monitoring of airborne and liquid effluents, environmental surveillance, and meteorological monitoring performed in and around the INEEL. Nonroutine activities, such as special research studies and characterization of individual sites for environmental restoration, are outside the scope of this plan.

The INEEL consists of eight major facilities in southeastern Idaho, typically referred to as the "Site," as well as several laboratories and administrative buildings located approximately 30 mi east of the INEEL boundary in Idaho Falls, Idaho. Environmental monitoring activities are conducted both onsite and offsite in the vicinity of the INEEL by a variety of organizations to verify compliance with permitting requirements, with applicable regulations, and with environmental protection policies and commitments. Environmental monitoring is also performed to identify key contaminants released to the environment, to evaluate different pathways through which contaminants move in the environment, and to determine the potential effects of these contaminants on the environment.

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ACRONYMS

AMWTP	Advanced Mixed Waste Treatment Project
ANL-W	Argonne National Laboratory-West
ARA	Auxiliary Reactor Area
ARLFRD	Air Resources Laboratory Field Research Division
BBWI	Bechtel BWXT Idaho, LLC
BNFL, Inc.	British Nuclear Fuels Limited, Inc.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFA	Central Facilities Area
CFR	Code of Federal Regulations
DEQ	Department of Environmental Quality
DOE	U.S. Department of Energy
DOE Idaho	Department of Energy, Idaho Operations Office
EDE	effective dose equivalent
EPA	Environmental Protection Agency
ERAMS	Environmental Radiation Ambient Monitoring System
ESER	Environmental Surveillance, Education and Research
HPIC	high-pressure ion chamber
IEMP	Idaho Environmental Monitoring Program
IET	Initial Engine Test Facility
IDAPA	Idaho Administrative Procedures Act
INEEL	Idaho National Engineering and Environmental Laboratory
INEEL OP	INEEL Oversight Program
INTEC	Idaho Nuclear Technology and Engineering Center
IRC	INEEL Research Center
M&O	management and operating
MDIFF	mesoscale diffusion
MSC	Monitoring and Surveillance Committee
NESHAP	National Emission Standard for Hazardous Air Pollutants
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRF	Naval Reactors Facility
OU	Operable Unit
QA	quality assurance
QAPjP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RESL	Radiological and Environmental Sciences Laboratory

ROD	Record of Decision
RWMC	Radioactive Waste Management Complex
S-B Tribes	Shoshone-Bannock Tribes
SDA	Subsurface Disposal Area
SDWA	Safe Drinking Water Act
SMC	Specific Manufacturing Capability
SRPA	Snake River Plain Aquifer
STF	Security Training Facility
STP	Sewage Treatment Plant
SWPPP-IA	Storm Water Pollution Prevention Plan for Industrial Activities
TAN	Test Area North
TLD	thermoluminescent dosimeter
TRA	Test Reactor Area
TSA	Transuranic Storage Area
TSF	Technical Support Facility
USGS	United States Geological Survey
WAG	Waste Area Group
WLAP	Wastewater Land Application Permit
WRC	Water Resources Committee
WROC/PBF	Waste Reduction Operations Complex/Power Burst Facility

Idaho National Engineering and Environmental Laboratory Environmental Monitoring Plan

1. GENERAL INFORMATION

1.1 Purpose

This plan describes environmental monitoring as required by U.S. Department of Energy (DOE) Order 450.1, "Environmental Protection Program," and additional environmental monitoring currently performed by other organizations in and around the Idaho National Engineering and Environmental Laboratory (INEEL). 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 INEEL, the rationale for monitoring, the types of media being monitored, where the monitoring is conducted, and where monitoring results can be obtained.

This plan replaces the 1996 Environmental Monitoring Plan in which detailed environmental monitoring information was provided. Because of the complexity of INEEL environmental monitoring programs, this plan presents a summary of the overall environmental monitoring performed in and around the INEEL without duplicating detailed information of the various monitoring procedures and program plans currently used to conduct monitoring. Instead, detailed procedures, program plans, or other governing documents followed by contractors or agencies to implement requirements are incorporated into this plan by reference. This plan covers all routine monitoring of airborne and liquid effluents, environmental surveillance, and meteorological monitoring. Nonroutine activities, such as special research studies and characterization of individual sites for environmental restoration, are outside the scope of this plan.

1.2 Site Description

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

Subsurface geology at the INEEL consists of successive layers of basalt and sedimentary strata, overlain by wind- and water-deposited sediments. Most of the INEEL 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 drain mountain watersheds located to the north and northwest of the INEEL. All three drainages may flow onto the INEEL 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 INEEL.

The primary groundwater source of the region is the Snake River Plain Aquifer (SRPA; Figure 1-2). The SRPA is approximately 199 mi long and 20 to 60 mi wide and encompasses an area of about 9,650 mi^2. It is one of the most productive aquifers in the United States, is designated as a

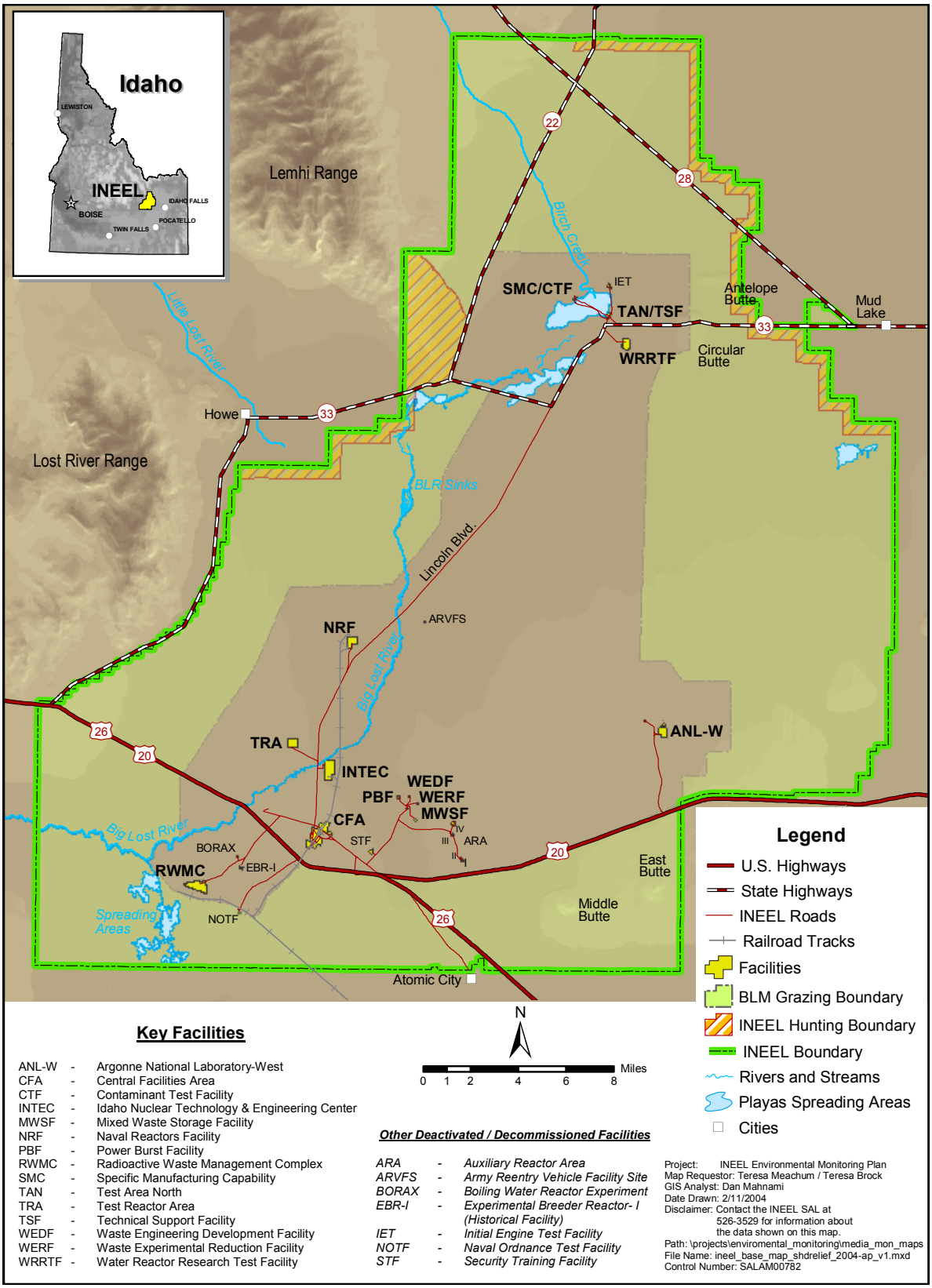

Figure 1-1. Idaho National Engineering and Environmental Laboratory.

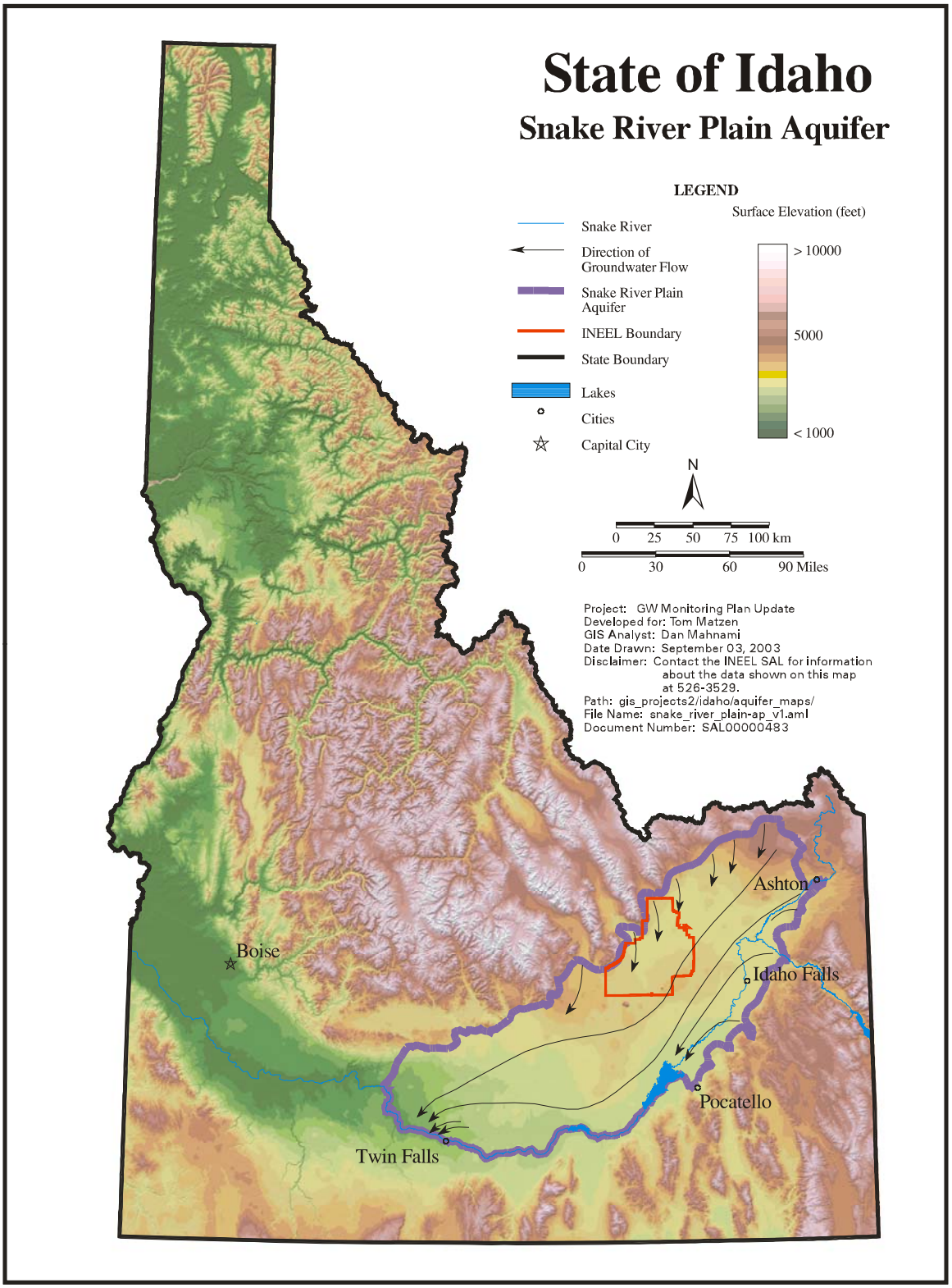

Figure 1-2. Idaho National Engineering and Environmental Laboratory in relation to the Snake River Plain Aquifer.

sole-source aquifer, provides a source of drinking water to more than 200,000 people, and supplies irrigation water to a large, regional agricultural and aquaculture economy. As such, it is the source of process water and drinking water both on and off the INEEL.

The depth to the SRPA varies from approximately 200 ft in the northern part of the INEEL to over 900 ft in the southern part. The aquifer is recharged from infiltration of 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 INEEL range from approximately 5 to 20 ft per day.

Annual rainfall at the INEEL is light, and the region is classified as arid to semiarid (Clawson, Start, and Ricks 1989). The long-term average (from March 1950 through 2002) annual precipitation at the INEEL is 8.5 in. (at the Central Facilities Area station). Monthly precipitation is usually highest in April, May, and June and lowest in July and October. The average daytime maximum temperature is 87°F (in July), and the average daytime minimum temperature is 5°F (in January) (Hukari 2003). The INEEL 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 INEEL.

1.3 Summary of INEEL Facilities

The INEEL consists of eight major facilities in southeastern Idaho, typically referred to as the "Site," as well as several laboratories and administrative buildings approximately 30 mi east of the INEEL boundary in Idaho Falls, Idaho.

Argonne National Laboratory-West (ANL-W), is operated by the University of Chicago under the leadership of the DOE Chicago Operations Office and is the prime testing center in the United States for demonstration and proof-of-concept of nuclear energy technologies. Research and development is 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.

Central Facilities Area (CFA) houses many technical and support services, including administrative offices, monitoring and calibration laboratories, fire protection, medical services, warehouses, vehicle and equipment pools, and bus operations.

Idaho Nuclear Technology and Engineering Center (INTEC) provides safe interim storage for government-owned spent nuclear fuels. INTEC currently develops new approaches and technologies to prepare spent fuel and other nuclear materials for eventual disposal in a national repository.

Naval Reactors Facility (NRF) is operated by Bechtel Bettis, Inc. for the Naval Nuclear Propulsion Program. Developmental nuclear fuel material samples, naval spent fuel, and irradiated reactor plant components/materials are examined at the Expended Core Facility. The knowledge gained from these examinations is used to improve current designs and to monitor the performance of existing reactors. The naval spent fuel examined at the Expended Core Facility is critical to the design of longer-lived cores, which results in less spent fuel requiring disposition. NRF is also preparing naval fuel for dry storage and eventual transportation to a repository.

Radioactive Waste Management Complex (RWMC) manages solid transuranic and low-level radioactive waste. RWMC supports research on strategies for waste storage, waste retrieval, processing, and disposal. Approximately 65,000 m^3 of waste are stored at RWMC. British Nuclear Fuels Limited, Inc.

(BNFL, Inc.) operates the Advanced Mixed Waste Treatment Project (AMWTP), which will retrieve mixed transuranic waste in temporary storage, treat the waste to meet disposal criteria, and package the waste for shipment to the Waste Isolation Pilot Plant in Carlsbad, New Mexico.

Test Area North (TAN) is located at the north end of the INEEL, and was originally built to house the nuclear powered airplane project in the 1950s. Currently, TAN facilities support the Specific Manufacturing Capability Project, which makes armor packages for army tanks. In addition, TAN personnel are applying research technologies (such as a biological remediation technique for destroying organic solvents underground) to cleanup environmental contamination from prior operations.

Test Reactor Area (TRA) 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.

Waste Reduction Operations Complex/Power Burst Facility (WROC/PBF) is in an area formerly used for reactor operations. WROC/PBF provided safe treatment, storage, and recycling of INEEL radioactive, mixed, and industrial/commercial wastes.

The Idaho Falls Facilities are a collection of administrative and laboratory buildings located in Idaho Falls, Idaho, including the INEEL Research Center (IRC). The IRC is the primary INEEL research complex. IRC personnel perform fundamental and applied research and development in science and engineering areas critical to national and DOE missions.

2. INEEL ENVIRONMENTAL MONITORING OVERVIEW

Environmental monitoring organizations at the INEEL provide information to verify compliance with permit requirements, with applicable regulations, and with environmental protection policies and commitments. Environmental monitoring is also performed to identify key contaminants released to the environment, to evaluate different pathways through which contaminants move in the environment, and to determine the potential effects of these contaminants on the environment. Environmental monitoring activities are conducted both onsite and offsite in the vicinity of the INEEL.

Environmental monitoring consists of two major activities: effluent monitoring and environmental surveillance. Effluent monitoring is the collection and analysis of samples or measurements of liquid or airborne effluents for the purpose of:

- Characterizing and quantifying contaminants at the source prior to release to the environment
- Assessing radiation exposures to members of the public using predictive models that estimate the concentration of contaminants after they have been released to the environment
- Demonstrating compliance with applicable standards and permit requirements.

Liquid and airborne effluents from the INEEL facilities are monitored for radiological and nonradiological parameters. Effluent monitoring activities are discussed in more detail in Section 3.

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 for the purpose of:

- Determining compliance with applicable standards and permit requirements
- Assessing radiation exposures to members of the public
- Assessing the effects of operations on the local environment.

Environmental surveillance activities are discussed in more detail in Section 4.

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

A separate system of environmental monitoring and surveillance is activated during environmental events, such as unplanned/accidental operational events or wildland fires. This environmental event monitoring is discussed in Section 6.

2.1 History of Environmental Monitoring at the INEEL

Much of the following summary on the history of environmental monitoring is taken from the *Long-Term Ecological Monitoring Plan for the Idaho National Engineering and Environmental Laboratory* (VanHorn, Fordham, and Haney 2004).

Created in 1948 to support the National Reactor Testing Station, the Air Resources Laboratory Field Research Division of the National Oceanic and Atmospheric Administration (NOAA) completed

some of the earliest environmental monitoring on the INEEL. The Division'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 prereactor radionuclide background in soil, plants, animals, etc. at the Site (Singlevich et al. 1951). The United States Geological Survey (USGS) also began monitoring hydrologic conditions of the Snake River Plain Aquifer at the INEEL in 1949 with the sampling of nine onsite wells.

In 1959, the first of several aerial radiological surveys of the INEEL was performed under the direction of the Idaho Operations Office in an attempt to determine the extent of natural and manmade radioactivity. Subsequent aerial surveys performed in 1965, 1974, 1982, and 1990 focused mainly on characterizing facilities and associated regions of the INEEL Site (EG&G RECO 1976).

Between 1956 and 1963, ecological research was conducted onsite by Health Services Laboratory that focused on movement of radioactive contaminants through the food chain. Rabbits were sampled as indicators of the extent of contamination around Site facilities. In 1970, Health Services Laboratory established a routine soil sampling and monitoring program for radionuclides in the surface soils near INEEL facilities and off the INEEL. A biological component, which included extensive studies of radionuclide-contaminated areas and transport by biota from these areas, was incorporated into the program in 1973. In 1977, Health Services Laboratory became the Radiological and Environmental Services Laboratory (RESL) and the RESL Program continued onsite and offsite monitoring through 1993.

In 1989, the INEEL was placed on the National Priorities List, and in 1991, DOE, the Environmental Protection Agency (EPA), and the state of Idaho signed the Federal Facility Agreement and Consent Order (DOE-ID 1991a) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA; 42 USC § 6901) to ensure that environmental hazards associated with contaminant releases were identified and remediated. 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 some areas have been remediated. 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 INEEL. In 1990, Idaho became the first state in the nation to negotiate an agreement with DOE (entitled the Environmental Oversight and Monitoring Agreement) to provide funding for independent environmental oversight and monitoring of a DOE facility. Over the years, the state of Idaho INEEL Oversight Program (INEEL OP) has developed an effective monitoring network to verify and supplement INEEL monitoring programs.

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

In 1996, the DOE awarded a private contract to British Nuclear Fuels Limited, Inc. (BNFL, Inc.) to construct and operate the Advanced Mixed Waste Treatment Project (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. Starting in 2003, BNFL, Inc. assumed responsibility for

environmental monitoring within the perimeter of the Transuranic Storage Area (TSA) from the prime M&O contractor.

Environmental monitoring performed by the various contractors in charge of facilities 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 developed to ensure compliance with applicable federal, state, and local regulations and to ensure the protection of human health and the environment.

2.2 Environmental Monitoring Organizations

A number of organizations currently operate facilities at the INEEL and conduct environmental monitoring activities on and/or in the vicinity of the INEEL. Currently, the University of Chicago operates Argonne National Laboratory-West (ANL-W) under the direction of the DOE Chicago Operations Office; Bechtel Bettis, Inc. operates the Naval Reactors Facility (NRF) for the Naval Nuclear Propulsion Program; British Nuclear Fuels Limited, Inc. (BNFL, Inc.) operates the AMWTP; and the remainder of INEEL facilities are operated by the prime INEEL M&O contractor, Bechtel BWXT Idaho, LLC (BBWI).

Several other organizations perform INEEL-related environmental monitoring but do not operate facilities. Currently, the S. M. Stoller Corporation manages the Environmental Surveillance, Education and Research Program (ESER) under a contract with DOE Idaho. Two federal agencies, United States Geological Survey (USGS) and National Oceanic and Atmospheric Administration (NOAA), have interagency agreements with DOE Idaho to provide water monitoring and research, and meteorological monitoring, respectively. The state of Idaho INEEL Oversight Program (INEEL OP) continues to perform independent, nonregulatory monitoring and verification of INEEL environmental monitoring activities. The INEEL OP, the ESER Program, DOE Idaho, NOAA, and the Shoshone-Bannock Tribes collaborate in operating the Idaho Environmental Monitoring Program, which consists of community monitoring stations in Idaho Falls, Fort Hall, Blackfoot, Rexburg, the Big Lost River Rest Area, and Terreton.

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

2.2.1 Management and Operating Contractor

The current prime INEEL M&O contractor is responsible for (a) monitoring environmental media and facility effluents from non-CERCLA-related operations to assess the effects of the INEEL operations on the environment; to protect public health; and to demonstrate compliance with federal, state, and local regulations; (b) complying with all CERCLA-required environmental monitoring; and (c) addressing the long-term stewardship monitoring needs.

Non-CERCLA-related environmental monitoring consists of 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 were instituted to meet the monitoring requirements of federal, state, and local regulations, permits, and DOE orders. Requirements exist to sample drinking water, liquid effluents, storm water runoff, and groundwater. Those INEEL facilities with airborne emissions are responsible for performing airborne effluent monitoring to comply with the Clean Air Act (Public Law 91-604) and Idaho Administrative Procedures Act (IDAPA) 58.01.01 standards for control of air pollution in Idaho. Those facilities with Wastewater

Table 2-1. Summary of INEEL environmental monitoring organization activities.

	Effluent			Surveillance								
Organization	Airborne	Liquid	Storm Water	Ambient Air	Drinking Water	Ground Water	Surface Water	Soil	Biota	Agricultural Products	External Radiation	Meteorological
M&O contractor[a]	X	X	X	X	X	X	X	X	X		X	
ANL-W	X	X			X	X		X	X		X	
BNFL, Inc.	X											
NRF	X	X			X	X		X	X		X	
ESER Program[a]				X	X		X	X	X	X	X	
USGS[a]						X	X					
NOAA[a]												X
INEEL Oversight Program[a]		X		X	X	X	X	X		X	X	
Shoshone-Bannock Tribes[a]				X							X	

a. Monitoring includes offsite locations.

Land Application Permits (WLAPs) are monitored as required by their associated permits. The Environmental Surveillance Program monitors various media to comply with applicable DOE orders.

CERCLA monitoring at the facilities operated by the M&O contractor consists of groundwater, soil, and ecological monitoring. As remediation at the INEEL is completed, the end result will comply with environmental remediation agreements. Sites with residual contamination will need to be monitored, controlled, operated, and maintained to protect human health and the environment.

Long-term stewardship monitoring will be conducted to ensure both the effectiveness of the final remedies and that no additional contamination is occurring. Although CERCLA regulates most INEEL stewardship activities, the INEEL expects some stewardship activities to be regulated under the Resource Conservation and Recovery Act (RCRA), including postclosure groundwater monitoring. For those facilities operated by the M&O contractor, monitoring will continue at the remediation areas for the period negotiated in the five-year review reports associated with the RODs, in RCRA closure plans, or in other laws or agreements that govern the remedies.

2.2.2 Argonne National Laboratory-West

Argonne National Laboratory-West (ANL-W) conducts effluent monitoring to characterize and quantify contaminants, control effluents at or near the point of discharge, assess radiation exposures to members of the public, and demonstrate compliance with applicable standards and permit requirements. Continuous monitoring of two airborne effluent emissions sources is required under Subpart H of 40 Code of Federal Regulations (CFR) 61. Additional airborne effluent monitoring is performed periodically to verify that the potential dose from other ANL-W radioactive airborne effluent emissions sources are less than 0.1 millirem per year. Monitoring of one of the liquid effluent locations is conducted to comply with proposed conditions in the WLAP application submitted to the state of Idaho.

The ANL-W Environmental Surveillance Program monitors water, soil, vegetation, and external radiation to determine compliance with applicable standards and permit requirements, assess the effects of ANL-W operations on the environment, and comply with applicable DOE orders. Groundwater monitoring is conducted to track ANL-W groundwater quality parameters and to support the WAG 9 Operable Unit (OU) 9-04 ROD (DOE-ID 1998).

2.2.3 British Nuclear Fuels Limited, Inc.

In 2003, British Nuclear Fuels Limited, Inc. (BNFL, Inc.) assumed responsibility for environmental monitoring within the perimeter of the Transuranic Storage Area (TSA) from the prime M&O contractor. The AMWTP was designed to retrieve, characterize, and treat transuranic-contaminated waste stored at the TSA and prepare it for final offsite disposal. Two stacks at the AMWTP will be continuously monitored for radioactive effluent in accordance with Subpart H of 40 CFR 61, once the facility begins operation in 2004. All other stacks with the potential to emit radioactive airborne effluent less than 0.1 millirem per year will have periodic confirmatory measurements performed in accordance with 40 CFR 61 Subpart H.

2.2.4 Naval Reactors Facility

The Naval Reactors Facilities (NRF) environmental monitoring program, which includes radiological and nonradiological monitoring, is conducted in accordance with accepted monitoring procedures and management practices to ensure compliance with applicable federal and state standards. NRF environmental monitoring consists of liquid and airborne effluent monitoring, along with environmental surveillance of drinking water, groundwater, soil, vegetation, and external radiation.

Groundwater and soil gas monitoring are conducted to support WAG 8 remedial actions (DOE, EPA, DEQ 1998). NRF performs periodic confirmatory measurements to verify that radioactive airborne effluent emissions are less than 0.1 millirem per year. The requirements for the environmental monitoring at NRF are covered in the *NRF Environmental Monitoring Program Manual* (NRF 2003a).

2.2.5 Environmental Surveillance, Education and Research Program

The Environmental Surveillance, Education and Research (ESER) Program, currently operated by S. M. Stoller, primarily conducts offsite environmental surveillance at the INEEL for DOE Idaho. The ESER Program's primary responsibility is to monitor a number of different pathways by which radiological pollutants from the INEEL could reach the public. Currently, services provided by the ESER Program include offsite sample collection and analysis of air, water, soil, milk, wheat, lettuce, potatoes, and tissue samples; wildlife habitat and vegetation surveys, studies, and research on and near the INEEL; Site-wide research concerning endangered species, pollutants in the environment, and revegetation; environmental education concerning ecological issues around the INEEL; and preparing the Annual Site Environmental Report summarizing environmental monitoring activities across the INEEL.

2.2.6 United States Geological Survey

The U.S. Geological Survey (USGS) collects water samples and measurements in and around the INEEL boundary to describe the hydrologic and geochemical conditions and to evaluate effects of waste disposal and other activities at the INEEL on the hydrogeologic system. Much of the data are used to prepare interpretive reports.

The USGS monitors over 150 wells within a regional network in the Snake River Plain Aquifer, both onsite and offsite, to study contaminant migration and determine groundwater quality and quantity as they relate to INEEL operations. Well placement within the regional network and constituent selection supplement the existing M&O contractor, ANL-W, and NRF groundwater monitoring programs.

2.2.7 State of Idaho INEEL Oversight Program

The state of Idaho INEEL Oversight Program's (INEEL OP's) environmental surveillance network on and around the INEEL generates independent data used to verify and supplement monitoring performed by the M&O contractor, ANL-W, NRF, and the ESER Program, as well as results published by the USGS. Independent sampling is performed at selected locations. Analytical results of samples collected from these locations are used to verify data reported by DOE and other surveillance programs. Cosampling is also performed to verify the accuracy of analytical data reported for wastewater and groundwater collected by the M&O contractor ANL-W and NRF.

The INEEL OP's sampling program was not designed to duplicate the DOE's extensive sampling network, but rather to collect a sufficient number of samples to provide an additional level of confidence in the analytical data reported by the DOE. Currently, the INEEL OP monitors liquid effluent, ambient air, external radiation, soil, milk, drinking water, surface water, and groundwater.

2.2.8 National Oceanic and Atmospheric Administration

The National Oceanic and Atmospheric Administration (NOAA) provides meteorological services and supporting research to the INEEL through the Air Resources Laboratory Field Research Division (ARLFRD). ARLFRD operates a large meteorological monitoring network to characterize the meteorology and climatology of the eastern Snake River Plain, which includes the INEEL Site.

Meteorological monitoring data are required to characterize atmospheric transport and diffusion conditions in the vicinity of the INEEL 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.

2.2.9 Shoshone-Bannock Tribes

The INEEL lies within the treaty and aboriginal territories of the Shoshone-Bannock Tribes of the Fort Hall Reservation. The Reservation is approximately 55 mi southeast of the INEEL.

The Shoshone-Bannock Tribes operate an air monitoring station at the Fort Hall Reservation and participate in the operation of a community monitoring station in the Idaho Environmental Monitoring Program.

2.2.10 Idaho Environmental Monitoring Program

The Idaho Environmental Monitoring Program (IEMP) is jointly supported by the state of Idaho INEEL OP, the ESER Program, DOE Idaho, 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, the Big Lost River Rest Area on U.S. Highway 20/26, and in Terreton. 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 easy-to-understand information to the public about the function of the various sensors and the variables they measure. Specific climatological data are also displayed.

2.2.11 Site-Wide Monitoring Committees

2.2.11.1 Monitoring and Surveillance Committee. INEEL has a Monitoring and Surveillance Committee (MSC) with participating organizations from DOE Idaho, the M&O contractor, ANL-W, BNFL, Inc., NRF, ESER, the state of Idaho INEEL OP, 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*."

2.2.11.2 Drinking Water Committee. The INEEL Drinking Water Committee was established in 1994 to coordinate drinking-water-related activities across the INEEL and to provide a forum for exchanging information related to drinking water systems. The committee meets quarterly and includes participants from DOE Idaho, the M&O contractor, ANL-W, BNFL, Inc., 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.

2.2.11.3 Water Resources Committee. The Water Resources Committee (WRC) serves as a forum for coordinating and exchanging technical information on water-related activities. It is open to all INEEL agency (e.g., DOE Idaho, USGS, NOAA) and contractor personnel, and, in general, the meetings are open to those non-INEEL agencies that have an interest in INEEL water issues. The WRC was first chartered in 1991 as the INEEL Groundwater Committee. It broadened its scope in 1997 to include surface water and atmospheric issues.

3. EFFLUENT MONITORING

Operations of INEEL facilities have the potential to release materials, which may include both radioactive and nonradioactive contaminants, into the environment. These materials can enter the environment through two primary routes: into the atmosphere (as airborne effluents) and into surface water and groundwater (as liquid effluents or storm water runoff). The following subsections summarize the effluent monitoring currently conducted by various INEEL organizations.

3.1 Airborne Effluent

Airborne effluent measurements and/or estimates, required under the Clean Air Act (Public Law 91-604) and the "Rules for the Control of Air Pollution in Idaho" (IDAPA 58.01.01), are the responsibility of the regulated facilities. At the INEEL, these facilities include:

- Argonne National Laboratory-West (ANL-W)
- Central Facilities Area (CFA)
- Idaho Nuclear Technology and Engineering Center (INTEC)
- Waste Reduction Operations Complex/Power Burst Facility (WROC/PBF)
- Naval Reactors Facility (NRF)
- Radioactive Waste Management Complex (RWMC)
- Test Area North/Specific Manufacturing Capability (TAN/SMC)
- Test Reactor Area (TRA).

The INEEL currently has 16 state of Idaho *Permit to Construct* air permits granted by the Department of Environmental Quality. These permits include specific sources at the various facilities.

Additionally, the INEEL Research Center (IRC), in Idaho Falls, has a Title V Operating Permit (PER-110, 2003). The INEEL Title V permit application was submitted in 1995 and modified and resubmitted in 2001 (INEEL 2001a). However, the INEEL permit has not been issued at this time.

Numerous stack emissions at the INEEL are monitored for radioactive and nonradioactive constituents. The specific stack emissions monitored depend on the activities conducted at the facilities. Some monitoring is required by regulation, DOE order, or by permits held by the INEEL; other monitoring is conducted as best management practice or for facility information. Where monitoring is performed, these emissions are normally sampled just before the point of release. Otherwise, emissions are estimated on the basis of engineering calculations or process knowledge.

Continuous monitoring is required by Subpart H of 40 CFR 61 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 National Emission Standard for Hazardous Air Pollutants (NESHAP) standard of 10 millirem per year.

Monitoring conducted for compliance and screening purposes follows the guidance of 40 CFR 61, Appendix B, Method 114 and the air monitoring recommendations of the *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* (DOE/EH-0173T).

Figure 3-1 shows the locations of those emission points (i.e., sources) currently requiring continuous monitoring under Subpart H of 40 CFR 61.

3.1.1 Management and Operating Contractor

Each facility operated by the M&O contractor is responsible for performing airborne effluent monitoring. The M&O contractor currently continuously monitors airborne effluent emissions at the following locations, per 40 CFR 61, Subpart H:

- INTEC Main Exhaust Stack (CPP-708)
- INTEC New Waste Calcine Facility (CPP-659).

Temporary remediation activities at RWMC that require continuous monitoring, such as the recently completed Glovebox Excavator Method Facility and the Accelerated Retrieval Project currently scheduled to begin operations in late 2004, are not shown on Figure 3-1.

In addition to those sources that require continuous monitoring under Subpart H of 40 CFR 61, other sources with the potential to emit low quantities of radioactive emissions exist at those facilities operated by the M&O contractor. Emissions from sources that could cause annual doses to the maximally exposed individual greater than 10^{-5} millirem are monitored and included in the calculation of the INEEL'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.

The following information on airborne effluent emissions and sources associated with those facilities operated by the M&O contractor is summarized from the *National Emission Standards for Hazardous Air Pollutants-Calendar Year 2002 INEEL Report for Radionuclides* (DOE-ID 2003a).

- Minor releases occur from CFA facilities where work is routinely conducted with small quantities of radioactive materials. This includes operations at the Radiological and Environmental Sciences Laboratory (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 analysis, and site remediation.

- Radiological air emissions from INTEC are primarily associated with spent nuclear fuel management (e.g., fuel receipt and wet and dry storage areas) and waste management (e.g., Tank Farm Facility, Evaporator Tank System, Process Equipment Waste Evaporator, Liquid Effluent Treatment and Disposal). These 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, research and development, radiological and hazardous waste accumulation areas, and other miscellaneous emissions from radioactively contaminated buildings and liquids in tanks.

- The Subsurface Disposal Area at the RWMC provides permanent disposal of solid low-level waste generated at the INEEL. Currently, one active pit is used for contact-handled low-level waste

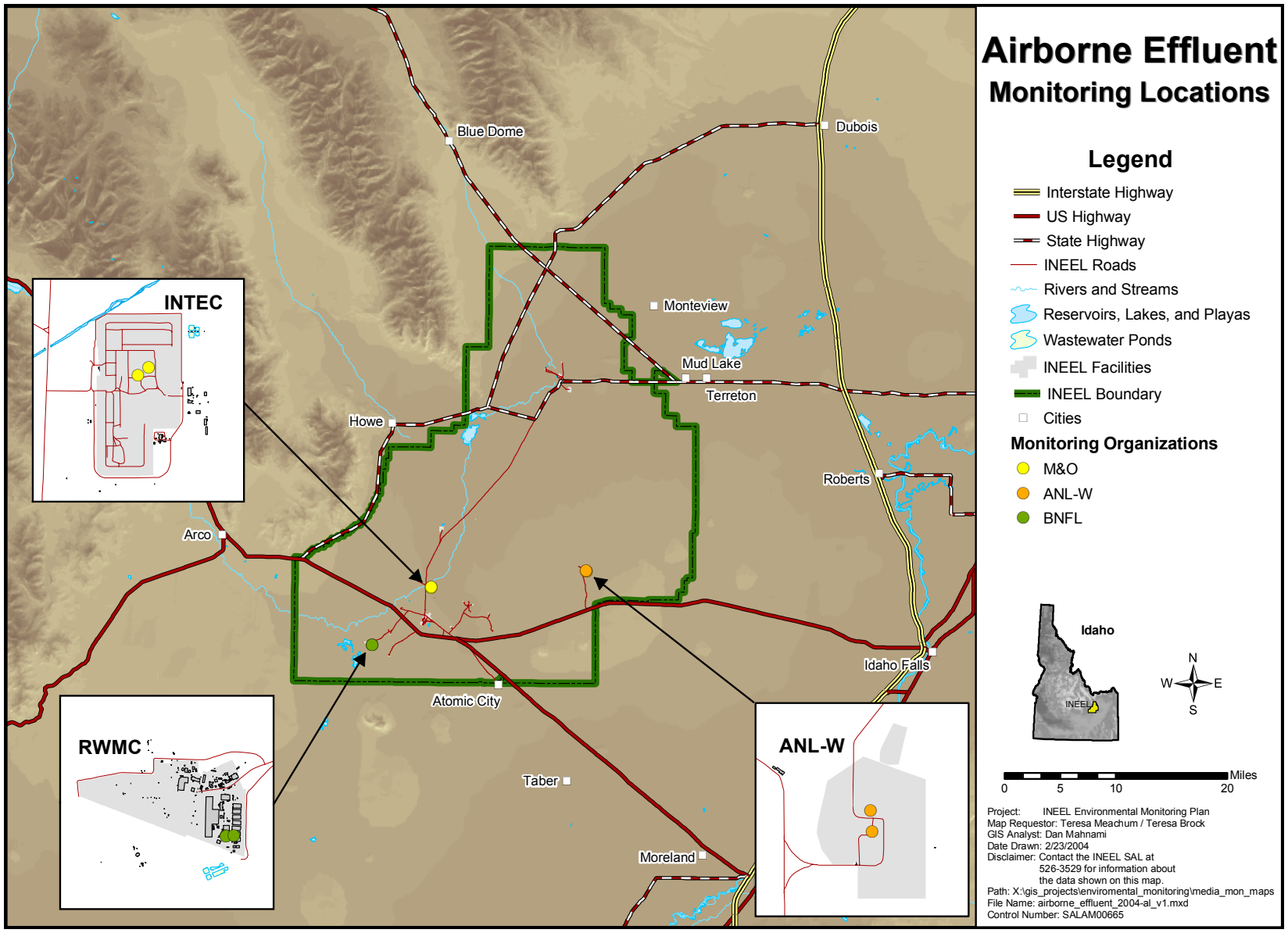

Figure 3-1. Airborne effluent monitoring locations.

disposal, and concrete-lined vaults are used for remote-handled low-level waste disposal. As the disposal areas are filled, they are covered with soil. Radiological air emission points at the RWMC include a Health Physics Laboratory stack, the Drum Venting Facility, a tent that is used intermittently for waste sampling and repackaging, and three vapor vacuum extraction units in the Subsurface Disposal Area. Ground level radionuclide emissions are generated by gases from the Subsurface Disposal Area and RWMC sewage lagoon.

- Radiological air emissions from TAN are primarily associated with Building TAN-607, which contains the TAN Hot Shop, TAN Hot Cell, TAN Storage Pool, TAN Hot Cell Annex, and TAN Warm Shop. Potential emissions from the TAN Hot Shop include noble gases, iodines, and other mixed fission and activation products. TAN Stack 734 exhausts ventilation air from the TAN Hot Shop, TAN Hot Cell, and TAN Hot Cell Annex. Particulate radionuclide emissions are continuously monitored through TAN Stack 734. Other radioactive emissions are associated with site remediation and waste management.

  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 development of tools and fixtures and preparation and testing of metallurgical specimens. Radiological air emissions from SMC are associated with processing of depleted uranium. Potential emissions are uranium isotopes and associated radioactive progeny.

- Radiological air emissions from TRA 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 research and development activities.

- The Idaho Completion Project performs remediation of contaminated environmental media across the INEEL. These activities are conducted in compliance with the Comprehensive Environmental Response, Compensation, and Liability Act and a Federal Facility Agreement and Consent Order. Radiological air emissions from these activities originate from three primary areas: emissions from vapor vacuum extraction treatment systems and the remediation activities at the RWMC, emissions from groundwater pump and treat via air stripping systems at TAN, and disturbances or fugitive emissions from contaminated surficial soils. The treatment facilities emissions are comprised primarily of volatile and water-soluble radionuclides. Emissions from contaminated soils include mixed fission and activation products.

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

3.1.2 Argonne National Laboratory-West

ANL-W operations could potentially result in the release of radiological and nonradiological pollutants to the atmosphere. Radiological air emissions are controlled and monitored or estimated at individual discharge points to ensure these air emissions comply with applicable permits and regulations and are accurately quantified and reported. Nonradiological air emissions from boilers are monitored, and emissions are estimated based upon fuel types and constituents, amounts used, and combustion rates.

ANL-W has two release points that require continuous emission monitoring as specified under 40 CFR 61, Subpart H. These include:

- Experimental Breeder Reactor-II/Fuel Conditioning Facility Main Stack (ANL-764)
- Hot Fuel Examination Facility Stack (ANL-785).

Additional radiological release points at ANL-W do not require continuous monitoring but are sampled monthly or as needed to provide emissions data for INEEL reports, permit requirements, and as a best management practice. Specific emission point locations and analytes sampled for are discussed in Chapter 3 of the *ANL-W Environmental Monitoring Program Plan* (ANL-W 2003) and associated procedures.

3.1.3 British Nuclear Fuels Limited, Inc.

Operational features associated with the Transuranic Storage Area (TSA) consist of waste storage buildings, processes to vent waste containers, nondestructive examination of container contents and waste certification, and assembling and loading waste containers for transport and disposal.

Operations at the Advanced Mixed Waste Treatment Project (AMWTP), operated by BNFL, Inc. within the TSA at RWMC, could potentially result in the release of radiological and other pollutants to the atmosphere. Currently, BNFL, Inc. monitors for radioactive particulates at two stack locations associated with the characterization facility (WMF-634) and TSA-RE (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 the calculation of the INEEL's annual EDE to members of the public.

Seven new treatment facility stacks associated with the Advanced Mixed Waste Treatment Facility are scheduled to come on-line in June 2004. Once operational, two of these stacks will require continuous monitoring under Subpart H of 40 CFR 61 because they will have the potential to emit radionuclides in excess of 1% of the NESHAP 10 millirem dose standard. These two stacks are at:

- Glovebox Extract (WMF-676-003)
- Zone 3 Extract (WMF-676-002).

The monitoring requirements are specified in the *AMWTP National Emissions Standards for Hazardous Air Pollutants Emissions for Radionuclides* (BNFL, Inc. 2002a).

3.1.4 Naval Reactors Facility

At NRF, radionuclide emissions can come from three main sources. These sources are:

- Expended Core Facility and associated buildings
- Shutdown prototypes and associated buildings
- Fugitive sources.

Stacks and vents associated with these sources have the potential to emit low quantities of radionuclides. These emissions are monitored and calculated and included in the calculation of the

INEEL's annual EDE to members of the public. However, none of the emission points at the NRF qualify for the continuous monitoring requirement because all emission points are below 0.1 millirem per year, which is 1% of the NESHAP standard. Confirmatory evaluations are performed as needed to verify that emissions are below 1% of the standard (DOE-ID 2003a).

More detailed information on the environmental monitoring performed by NRF can be found in the *Naval Reactors Facility Environmental Monitoring Report Calendar Year 2002* (NRF 2003b) and in the *Naval Reactors Facility Environmental Summary Report* (NRF 2002).

3.2 Liquid Effluent

Operations at the INEEL 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. In addition, monitoring (a) provides data to evaluate the effectiveness of liquid effluent treatment and control systems, (b) identifies potential contaminant source areas and environmental problems, and (c) provides a mechanism for the detection, characterization, and reporting of unplanned releases.

Direct discharge of wastewater to the land surface is regulated under Idaho Wastewater Land Application Permit (WLAP) rules (IDAPA 58.01.17). Currently, four facilities operated by the prime M&O contractor have WLAPs issued by the state of Idaho, and all four WLAPs require monitoring of the 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, "Radiation Protection of the Public and the Environment," and the recommendations of the *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* (DOE/EH-0173T).

Figure 3-2 shows liquid effluent monitoring locations currently monitored across the INEEL. 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. These in-line monitors are not depicted on Figure 3-2.

3.2.1 Management and Operating Contractor

The M&O contractor monitors for nonradioactive and radioactive parameters in liquid waste effluents generated at several INEEL facilities as required by their applicable WLAPs and DOE environmental protection objectives. The WLAPs issued to date require routine monitoring of nonradioactive parameters in liquid effluents associated with the following facilities:

- CFA Sewage Treatment Plant (STP)
- INTEC STP
- INTEC New Percolation Ponds
- Test Area North/Technical Support Facility (TAN/TSF) STP.

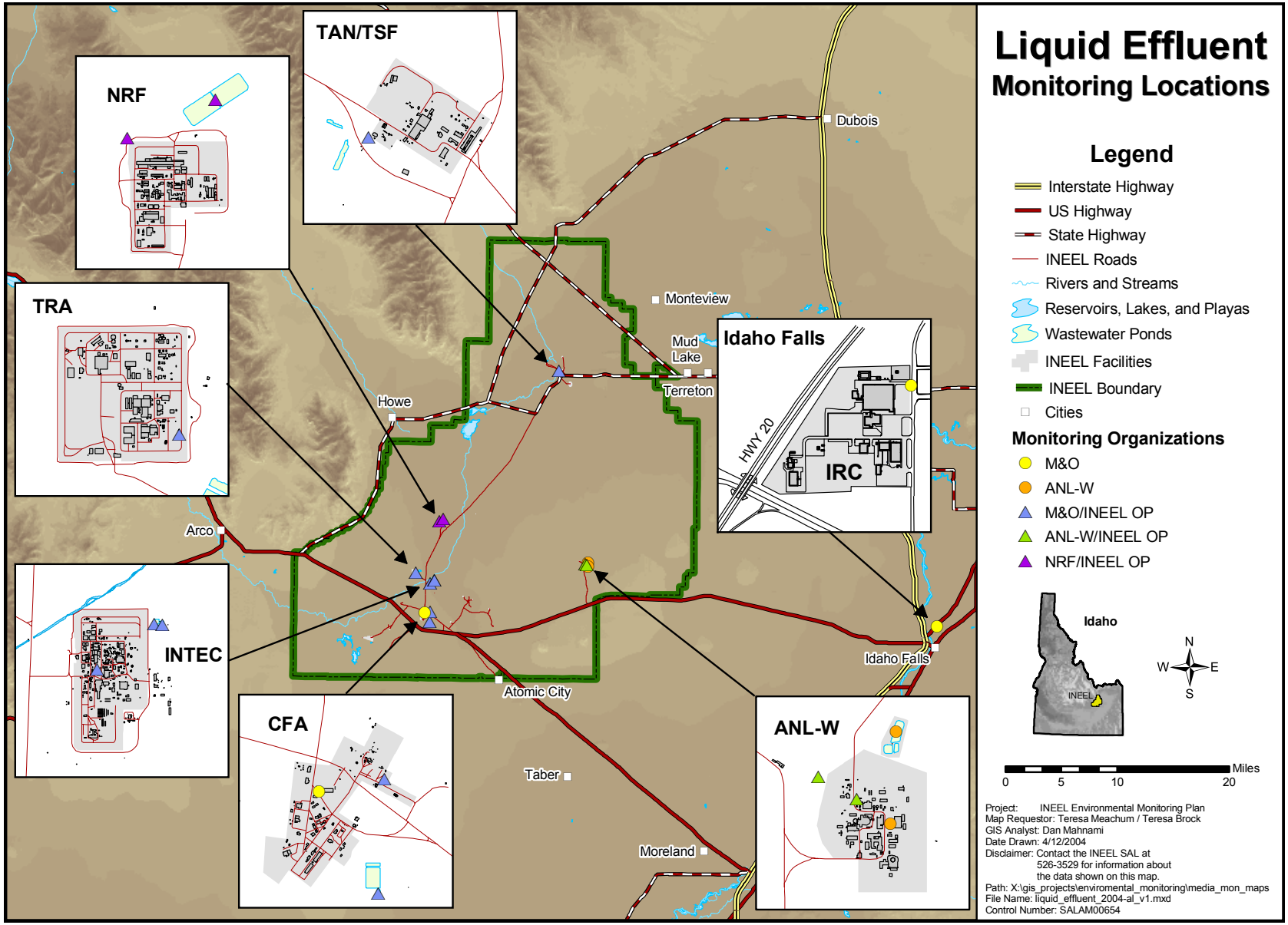

Figure 3-2. Liquid effluent monitoring locations.

A WLAP application has been submitted for the TRA Cold Waste Pond. In order to show compliance with the regulatory effluent limits for rapid infiltration systems, the M&O contractor conducts routine monitoring of the TRA Cold Waste Pond.

In addition to permit-required monitoring, the M&O contractor conducts routine monitoring at other facilities and of additional parameters at the WLAP-permitted facilities in support of DOE environmental protection objectives. A liquid effluent inventory conducted in 2001 (INEEL 2001b) is updated every two years to provide a comprehensive inventory of liquid effluent streams from facilities operated by the M&O contractor. A risk-based approach (Hull 1995), which considers the likelihood that an effluent measurement equals or exceeds a regulatory limit or environmental release level, and the severity of the exceedance if it were to occur, is used to determine which nonpermitted effluent streams or additional nonpermitted parameters require monitoring.

INEEL Idaho Falls facilities are required to comply with the applicable regulations in Chapter 1, Section 8, of the Municipal Code of the city of Idaho Falls (City Order 1994). 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 applicable to all facilities and specific monitoring requirements for the IRC due to the nature of the activities.

Specific liquid effluent monitoring performed by the M&O contractor is documented in the Liquid Effluent Monitoring Program Plan (PLN-729, 2003) and associated procedures.

3.2.2 Argonne National Laboratory-West

ANL-W personnel monitor nonradioactive and radioactive parameters in liquid waste effluents discharged to the following ANL-W facilities:

- Industrial Waste Pond
- Industrial Waste Ditch
- Sanitary Sewage Lagoons (secondary lagoon)
- Sanitary Lift Station.

The Industrial Waste Pond is monitored to meet DOE environmental protection objectives and to comply with proposed WLAP conditions in the WLAP application submitted to the state of Idaho. Sampling is conducted as described in Chapter 3 of the *ANL-W Environmental Monitoring Program Plan* (ANL-W 2003) and associated procedures.

ANL-W personnel monitor for nonradioactive and radiological parameters at the Industrial Waste Ditch, the Sanitary Sewage Lagoons, and the Sanitary Lift Station to satisfy Department of Energy environmental protection objectives. Sampling is conducted as described in Chapter 3 of the *ANL-W Environmental Monitoring Program Plan* (ANL-W 2003) and associated procedures.

3.2.3 Naval Reactors Facility

The purpose of the liquid effluent monitoring program is to confirm that no chemically hazardous or radioactive waste has been discharged to the environment. NRF personnel monitor the liquid effluent discharges to the following facilities:

- Industrial Waste Ditch

- Sewage Lagoon (northeast cell).

The Industrial Waste Ditch is monitored to meet DOE environmental protection objectives and to comply with proposed conditions in the WLAP application submitted to the state of Idaho. The Sewage Lagoon is monitored as a best management practice.

More detailed information on the environmental monitoring performed by NRF can be found in the *Naval Reactors Facility Environmental Monitoring Report Calendar Year 2002* (NRF 2003b) and in the *Naval Reactors Facility Environmental Summary Report* (NRF 2002).

3.2.4 State of Idaho INEEL Oversight Program

The state of Idaho INEEL Oversight Program (INEEL OP) cosamples selected liquid effluent streams annually from each of the major areas across the INEEL for parameters consistent with existing WLAP requirements, as well as other radiological and nonradiological parameters. The INEEL OP cosamples liquid effluent streams with the M&O contractor, ANL-W, and NRF to verify the accuracy of reported data. Cosampling is performed at the CFA Sewage Treatment Plant, the INTEC Sewage Treatment Plant, the INTEC New Percolation Ponds, the TAN/TSF Sewage Treatment Plant, the ANL-W Industrial Waste Ditch and Industrial Waste Ponds, and the NRF Industrial Waste Ditch and Sewage Lagoon.

Sampling locations, methodologies, and analytes are specified in the INEEL OP's *Environmental Monitoring Plan* (State of Idaho 2003).

3.3 Storm Water

The INEEL monitors storm water runoff during precipitation events or snowmelt conditions to evaluate potential pollutants in the storm water. Discharges of storm water are monitored at industrial activity locations to comply with the Clean Water Act (33 USC § 1251) and the National Pollutant Discharge Elimination System (NPDES) Storm Water Multi-Sector General Permit for Industrial Activities (63 FR 189). The *INEEL Storm Water Pollution Prevention Plan for Industrial Activities* (SWPPP-IA; DOE-ID 2003b) is prepared to comply with the NPDES Permit. The SWPPP-IA includes general compliance objectives and pollution prevention practices.

In addition, discharges of storm water to injection wells are monitored to comply with state of Idaho permits. At the INEEL, injection wells have been constructed to control flooding resulting from storm water or snowmelt runoff. Monitoring the runoff to these wells is required under the Safe Drinking Water Act (SDWA; Public Law 104-182) and state of Idaho injection well regulations and permits to protect underground sources of drinking water.

At the INEEL, currently only the M&O contractor performs routine storm water monitoring. Storm water monitoring locations are shown on Figure 3-3.

3.3.1 Management and Operating Contractor

The M&O contractor monitors discharges of storm water both at industrial activity locations and at injection well locations during large precipitation events or snowmelt conditions to evaluate potential pollutants in the storm water. Specific storm water monitoring performed by the M&O contractor is documented in the Storm Water Monitoring Program Plan (PLN-731, 2003) and associated procedures.

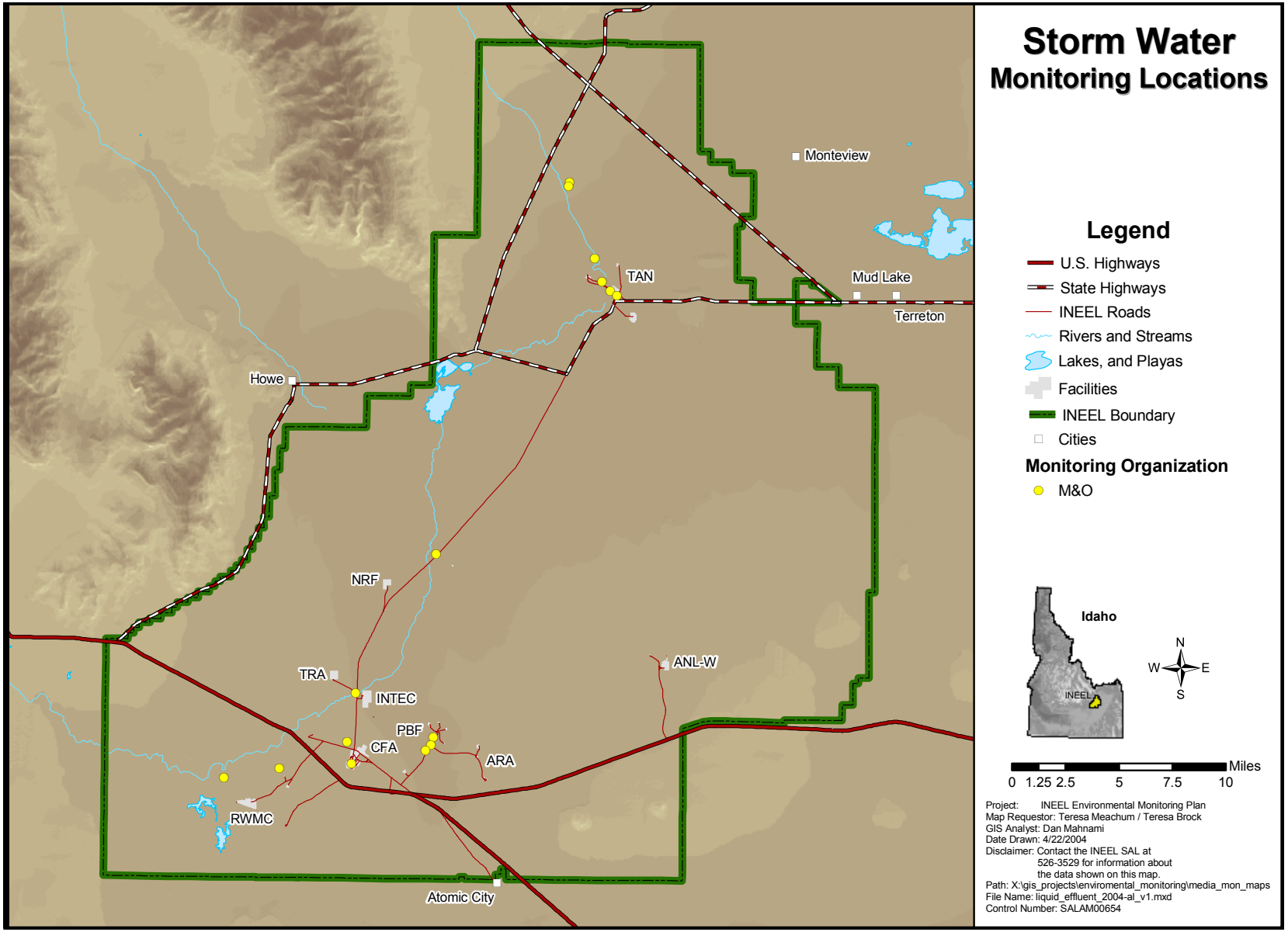

Figure 3-3. Storm water monitoring locations.

3.3.1.1 NPDES Storm Water Monitoring. Industrial activity locations were initially selected to comply with the 1992 NPDES General Permit (57 FR 175) and have been reevaluated periodically as new NPDES permits have been issued. Under the 2000 Multi-Sector General Permit (63 FR 189), up to 27 industrial activity locations were monitored.

In 2003, the EPA Region 10 determined that three sites at the INEEL (RWMC, INTEC, and the north part of the INEEL property near Birch Creek) do not have a reasonable potential to discharge storm water to waters of the United States. DOE Idaho then directed the M&O contractor to cease expending further resources on SWPPP-IA Program at the three sites addressed by EPA. As a result of this direction by DOE Idaho, industrial storm water monitoring and reports have ceased at those sites. DOE Idaho further directed the M&O contractor to conduct a technical analysis to determine any other areas at the INEEL that would also have the same or less potential to discharge storm water to waters of the United States.

The remaining storm water sites (i.e., landfills and gravel pits) will be evaluated through the technical analysis requested by DOE Idaho to determine potential to discharge. Required storm water monitoring and reporting will continue for these locations until the technical analysis is completed and approved by DOE Idaho. At that time, monitoring and reports at any additional locations that have no reasonable potential to discharge to waters of the United States, as determined through the technical analysis, will cease. Until the technical analysis is complete, the M&O contractor will continue to monitor the following locations at the INEEL:

- Landfills I, II and III extension at CFA
- Mineral mining and processing facilities (construction sand and gravel pits within the corridor of the Big Lost River System).

3.3.1.2 Injection Well Monitoring. The M&O contractor monitors storm water and snowmelt run-off that enters deep injection wells to comply with state of Idaho injection well permits. The permits require that samples be analyzed for drinking water parameters to assess potential impacts to the Snake River Plain Aquifer. The basins associated with seven deep injection wells (three at TAN, three at PBF, and one at CFA) collect storm water and snowmelt runoff for flood control. Runoff is monitored in the rare event that the injection well basins fill and water flows into the well.

4. ENVIRONMENTAL SURVEILLANCE

At the INEEL, 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 Site-wide compliance with DOE Order 450.1, DOE Order 5400.5, environmental laws and regulations, and DOE agreements, and follows the criteria in *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* (DOE/EH-0173T) 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." The Subsurface Disposal Area (SDA) at RWMC is the only low-level waste disposal facility at the INEEL 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 surveillance performed Site-wide. Waste management surveillance monitoring is performed at the SDA for ambient air, groundwater, surface water, soils, vegetation, and external radiation.

4.1 Ambient Air

INEEL operations release contaminants into the air, which may transport these materials from the INEEL to nearby populations. The air pathway has been found to be the most important transport pathway for the INEEL (DOE-ID 1991b). As such, ambient (outdoor) air is monitored in order to assess possible impacts both onsite and offsite.

Regional ambient air monitoring locations are shown on Figure 4-1, and detailed onsite ambient air monitoring locations are shown on Figure 4-2.

4.1.1 Management and Operating Contractor

The M&O contractor measures airborne radionuclides and monitors potential trends in radioactivity in the environment at the INEEL (PLN-720, 2003). Ambient air surveillance is also conducted to determine the impact of operations and wildland fires on the environment. The ambient air surveillance activities support INEEL Site-wide compliance with DOE Order 450.1 and state of Idaho Air Quality Permits to Construct.

Ambient air samplers are located both onsite and offsite so that air concentrations from onsite locations can be compared with concentrations from distant control locations. If INEEL operations have a measurable affect on the environment, samples from onsite locations would be expected to have higher concentrations than those from the control locations. Ambient air is monitored for:

- Atmospheric levels of radioactive particulates using a network of low-volume air samplers to collect particulate matter on filters and gaseous iodine on activated charcoal cartridges.

- Suspended particulate matter (i.e., dust burden) using the same low-volume filters used to collect the radioactive particulate samples (to provide comparison information to other monitoring programs and to DOE Idaho).

- Tritium in water vapor in the atmosphere at the Van Buren Boulevard and Experimental Field Station locations.

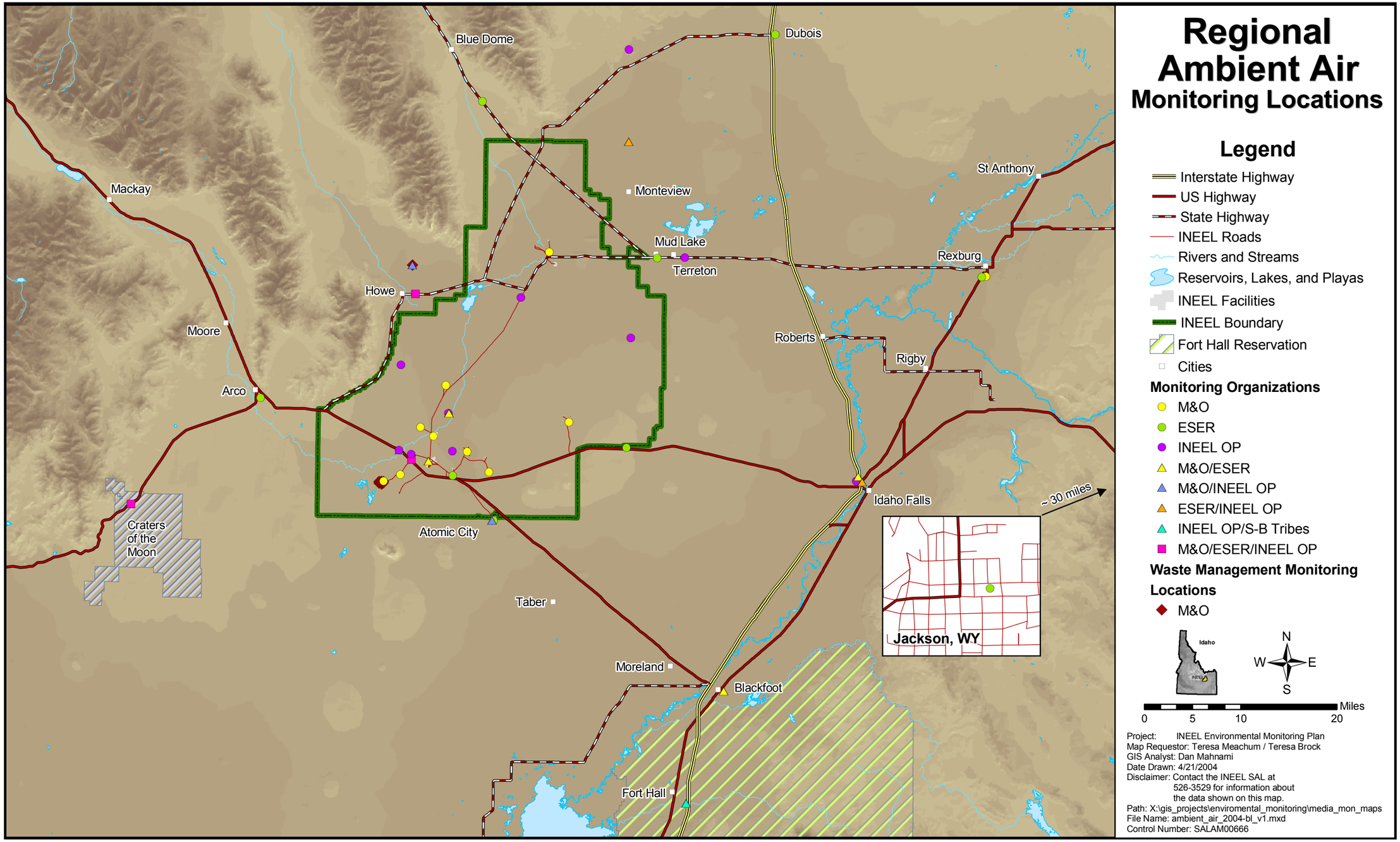

Figure 4-1. Regional ambient air monitoring locations.

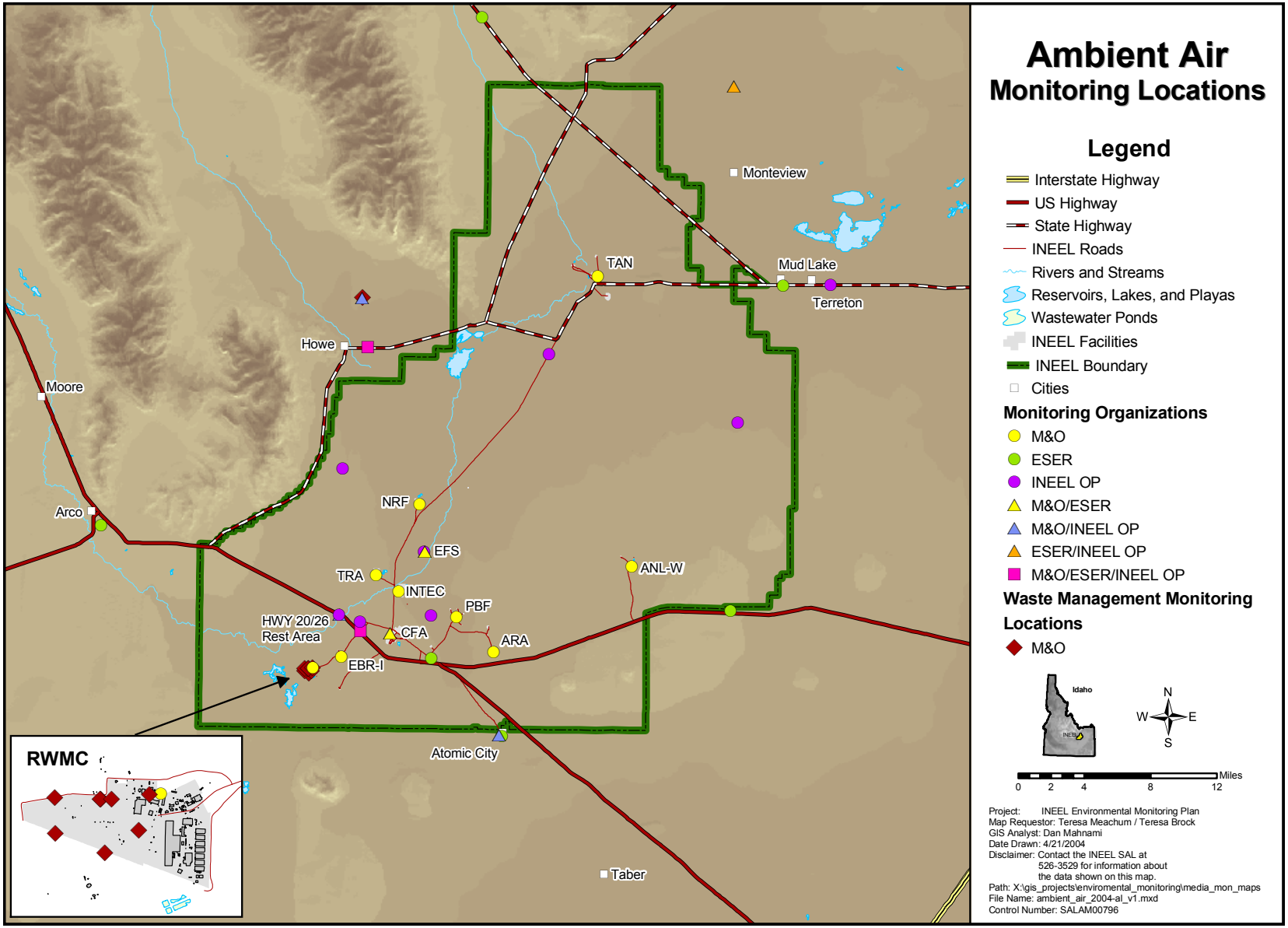

Figure 4-2. Detailed onsite ambient air monitoring locations.

In addition, to support the waste management facility requirements of DOE Order 435.1, a series of samplers that monitor for particulates is used around the RWMC SDA. Airborne materials from the SDA are predominantly fugitive dusts with small amounts of sorbed radionuclides. The samplers are along the periphery of the SDA in predominant wind paths from disposal activities and at a control location north of Howe.

Specific ambient air monitoring requirements are documented in PLN-720 and associated procedures. In addition, ambient air particulate matter and airborne radionuclides are sampled in the event of wildland fires or other emergency events. (Refer to Section 6.1.1 for a discussion of air monitoring performed for operational emergencies.)

4.1.2 Environmental Surveillance, Education and Research 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 increasing from the offsite locations toward the INEEL. These monitors include:

- A network of low-volume air samplers on and around the INEEL 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 regulatory requirements to monitor population centers.

- Three samplers that monitor for particulates less than 10 microns in diameter, located at Atomic City and the community monitoring stations in Blackfoot and Rexburg.

- One high-volume air sampler in Idaho Falls that is operated as part of the Environmental Protection Agency's (EPA's) Environmental Radiation Ambient Monitoring System (ERAMS). The ERAMS Program monitors environmental radioactivity in the United States in order to provide high quality data for assessing public exposure and environmental impact resulting from nuclear emergencies and to provide baseline data during routine operations. Filters collected from the Idaho Falls sampler by the ESER Program are shipped to EPA's Montgomery, Alabama laboratory to analyze for gross radioactive concentrations and the presence of specific radionuclides.

- Four atmospheric moisture monitors located offsite in Idaho Falls, Atomic City, and the 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 in Idaho Falls and is used as a control or background location, and two samplers are on the INEEL, one each at CFA and the Experimental Field Station near INTEC. The Idaho Falls station is operated as part of the EPA's ERAMS Program.

Ambient air monitoring locations, frequencies, methodologies, and analytes are specified in the ESER Program Description (ESER 2002a) and associated procedures.

4.1.3 State of Idaho INEEL Oversight Program

The state of Idaho INEEL Oversight Program (INEEL OP) measures airborne radionuclides and monitors potential trends in radioactivity in the environment on and around the INEEL. The monitoring locations were chosen based on accessibility, climatology, and dose projection model predictions of where contaminants are likely to be transported and accumulated, making detection more probable. The results are used to independently verify and supplement results reported by DOE and other surveillance

programs. The INEEL OP collects samples for airborne particulate matter, gaseous radioiodine, and atmospheric moisture (for tritium). Sampling locations, frequencies, methodologies, and analytes are specified in *Environmental Monitoring Plan* (State of Idaho 2003).

4.1.4 Shoshone-Bannock Tribes

The Shoshone-Bannock Tribes operate an air monitoring station at Fort Hall. The monitor is used for collecting airborne particulate matter and gaseous radioiodine. Because this station uses identical instrumentation and sampling protocol, the state of Idaho INEEL OP assists in the collection and reporting of data from this location. Sampling location, frequency, methodology, and analytes are included in INEEL OP's *Environmental Monitoring Plan* (State of Idaho 2003).

4.2 Drinking Water

Historic waste disposal practices have produced localized areas of contamination at the INEEL in the Snake River Plain Aquifer, which is the primary regional groundwater source. Because groundwater supplies the drinking water at the INEEL, drinking water is sampled onsite to ensure that the drinking water at INEEL facilities is safe for consumption. The INEEL Drinking Water Program meets the Idaho drinking water regulations and DOE environmental protection objectives. All contractors onsite participate in the INEEL Drinking Water Program and the INEEL Drinking Water Committee as a means to share information, but each contractor administers their own drinking water monitoring program.

INEEL drinking water systems are classified as either transient or nontransient, noncommunity water systems. Nontransient, noncommunity water systems have more stringent compliance requirements. The transient, noncommunity water systems on the INEEL are all operated by the M&O contractor and are at the Experimental Breeder Reactor-I, the Gun Range, and the Main Gate. The rest of the water systems at the INEEL are classified as nontransient, noncommunity water systems.

Offsite drinking water systems are also monitored because of the potential for contaminants related to INEEL operations to migrate beyond the INEEL boundary. Because these samples are taken from offsite drinking water systems and not directly from wellheads, these samples are included as drinking water samples. However, results from samples taken 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 taken from taps. Onsite drinking water samples are taken from the point of entry to each distribution system (i.e., manifolds), directly from the wellheads, and from all 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 INEEL. 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 Management and Operating Contractor

The M&O contractor drinking water systems are monitored to ensure that contaminant concentrations meet limits established by "Idaho Regulations for Public Drinking Water Systems," (IDAPA 58.01.08) and the Safe Drinking Water Act (Public Law 104-182). Currently, the M&O contractor monitors 17 wells and 10 distribution systems across the INEEL for both radiological and nonradiological parameters. Monitoring is based on the regulatory requirements for specific types of water systems (e.g., nontransient, noncommunity or transient, noncommunity). Because of known

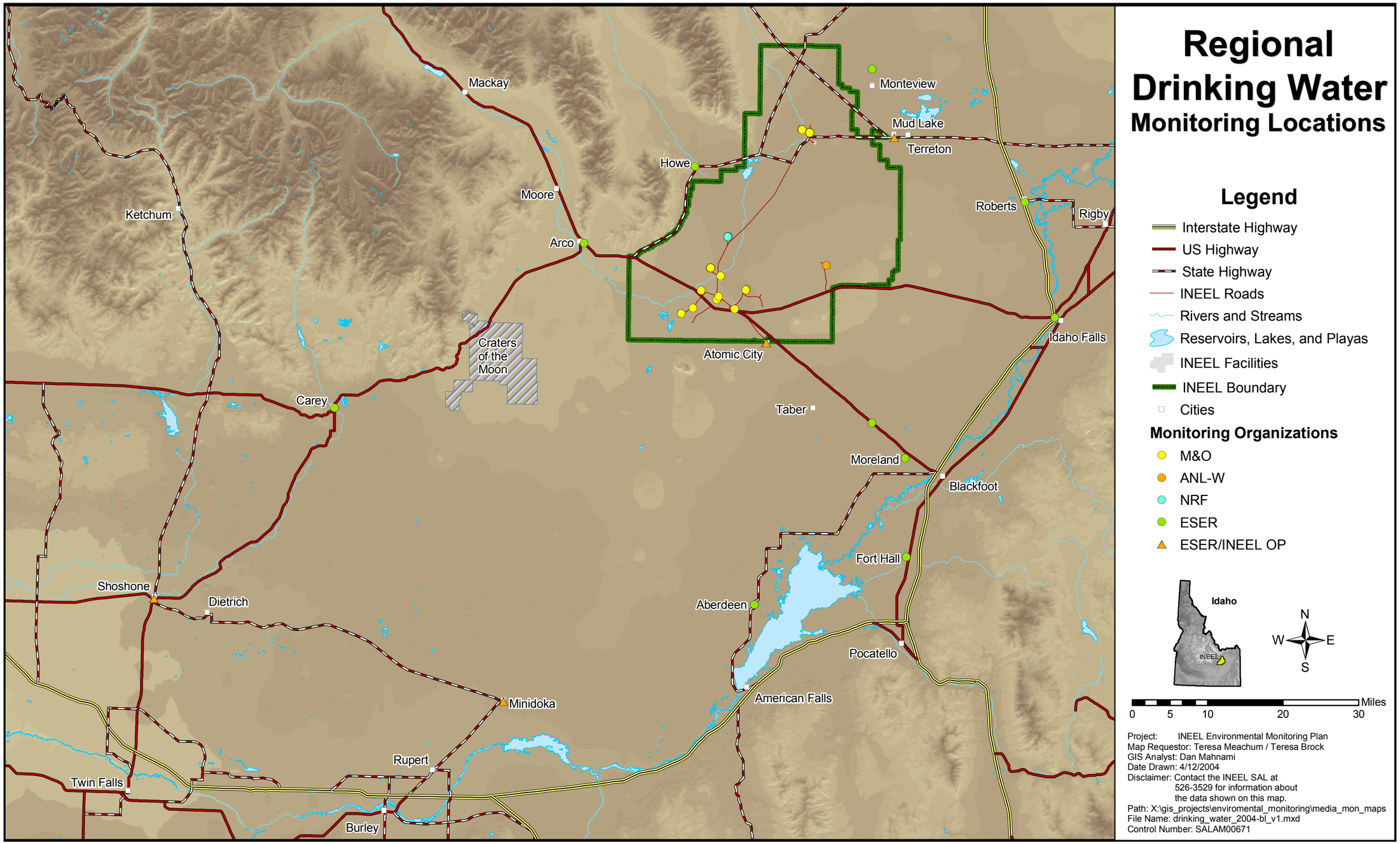

Figure 4-3. Regional drinking water monitoring locations.

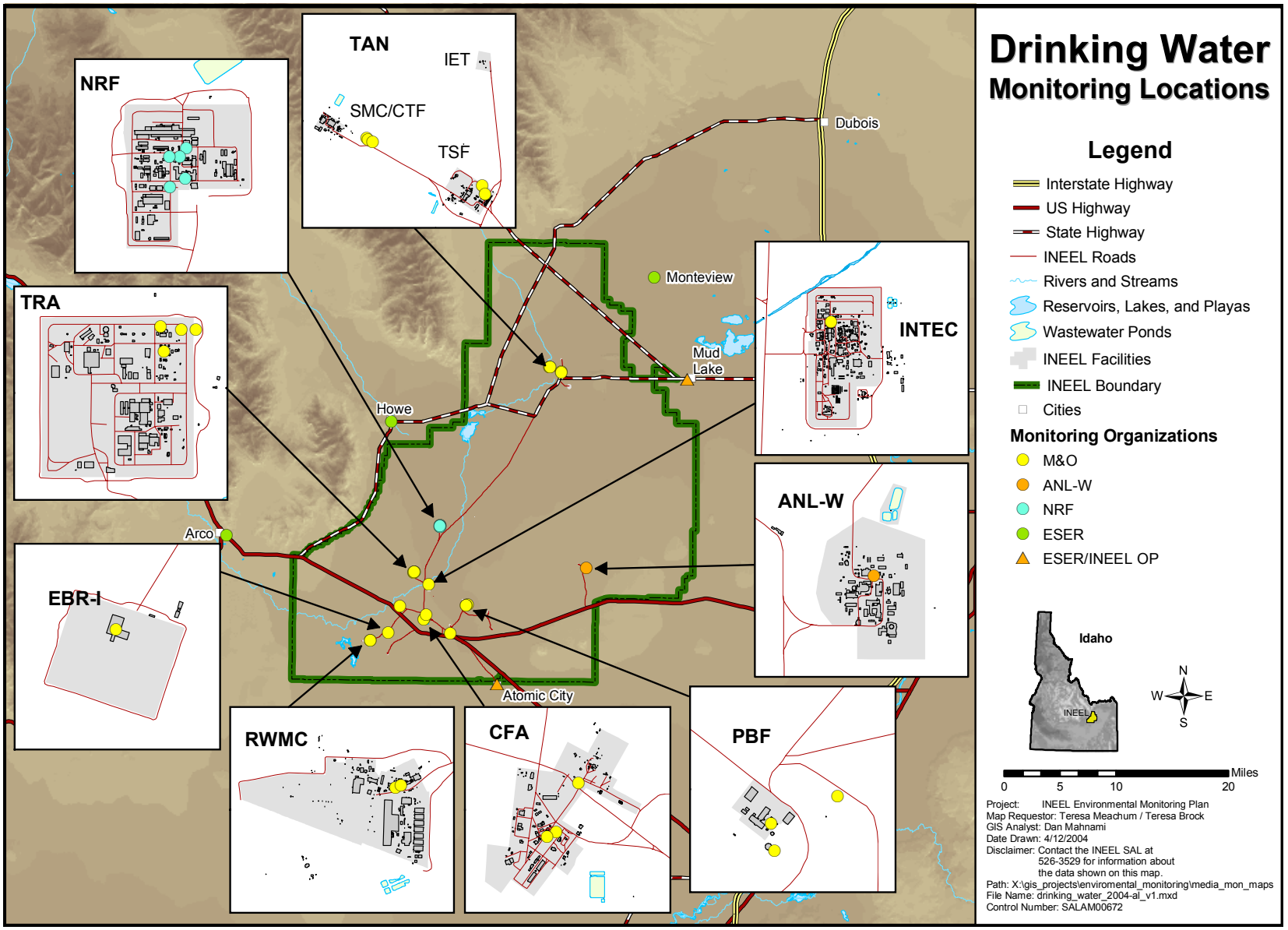

Figure 4-4. Detailed onsite drinking water monitoring locations.

contaminants, certain parameters are monitored more frequently than required. Sampling locations, parameters, and frequencies are documented in the Drinking Water Program Plan (PLN-730, 2004) and associated procedures.

4.2.2 Argonne National Laboratory-West

ANL-W monitors drinking water to ensure that the water at ANL-W is safe for consumption and meets applicable environmental regulations. Samples are collected from predetermined points in the distribution system and are analyzed for coliform bacteria and lead/copper. Other program samples are collected at a manifold downstream of final treatment, but before water enters the distribution system. Sampling is conducted as described in Chapter 3 of the *ANL-W Environmental Monitoring Program Plan* (ANL-W 2003) and associated procedures.

4.2.3 Naval Reactors Facility

NRF conducts a comprehensive drinking water monitoring program to ensure a high quality drinking water supply. NRF's drinking water program includes the collection and analysis of drinking water samples in compliance with requirements established by the state of Idaho and the Safe Drinking Water Act (Public Law 104-182).

More detailed information on the environmental monitoring performed by NRF can be found in the *Naval Reactors Facility Environmental Monitoring Report Calendar Year 2002* (NRF 2003b) and in the *Naval Reactors Facility Environmental Summary Report* (NRF 2002).

4.2.4 Environmental Surveillance, Education and Research Program

The ESER Program collects samples semiannually from offsite locations to monitor the drinking water pathway through which contaminants could potentially migrate beyond the INEEL boundary and reach the public. Results from these offsite samples are not used for compliance with drinking water regulations. Samples are collected from taps and are analyzed for gross alpha and gross beta activity and for tritium. Four sampling locations (Mud Lake, Atomic City, Minidoka and Shoshone) are collocated with sites sampled by the INEEL OP.

Drinking water monitoring locations, frequencies, methodologies, and analytes are specified in the ESER Program Description (ESER 2002a) and associated procedures.

4.2.5 State of Idaho INEEL Oversight Program

The state of Idaho INEEL OP cosamples four offsite water supply systems with the ESER Program (Mud Lake, Atomic City, Minidoka, and Shoshone) semiannually and independently in the first quarter of the year. Samples are analyzed for both nonradioactive and radioactive parameters. Results from samples taken from these offsite water supply systems are not used for compliance with drinking water regulations; instead they are used to assess groundwater quality.

Sampling locations, methodologies, and parameters are specified in the *Environmental Monitoring Plan* (State of Idaho 2003).

4.3 Groundwater

Historic waste disposal practices have produced localized areas of contamination beneath the INEEL in the Snake River Plain Aquifer (SRPA). 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 INEEL (including upgradient of INEEL operations). Offsite groundwater samples are taken downgradient of the INEEL near the INEEL boundary and near the terminus of the SRPA.

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

- Satisfy specific Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-related remedial action objectives and/or regulatory requirements contained in Records of Decision (RODs), Resource Conservation and Recovery Act (RCRA) regulations, Wastewater Land Application Permits (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 Waste Area Group [WAG] 10).

The groundwater monitoring programs established by the contractors responsible for INEEL facility management and operating, at a minimum, address regulatory compliance and remediation goals at each of the facilities for which they have management responsibility. The INEEL Groundwater Monitoring Plan Update (DOE-ID 2003c) 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 are met.

Offsite groundwater sampling is performed by the INEEL OP to monitor the groundwater pathway through which contaminants (both radioactive and nonradioactive) could potentially reach the public.

Figure 4-5 shows regional groundwater monitoring locations, and Figure 4-6 shows detailed onsite groundwater monitoring locations.

4.3.1 Management and Operating Contractor

M&O contractor personnel routinely collect groundwater samples required by the various CERCLA RODs, remedial investigation/feasibility study activities, WLAPs, RCRA permits, and DOE orders. Even though the INEEL Groundwater Monitoring Plan Update (DOE-ID 2003c) focuses on monitoring well sampling, the document references the individual monitoring plans for both monitoring wells and lysimeters. These monitoring plans discuss the specific monitoring, including sampling frequencies, locations, and parameters for the specific wells and lysimeters. The M&O contractor performs aquifer and perched water monitoring at all operated facilities and regionally across the INEEL. Vadose zone monitoring is performed using lysimeters at RWMC and INTEC.

4.3.2 Argonne National Laboratory-West

ANL-W personnel collect routine groundwater samples required by the CERCLA ROD (DOE-ID 1998) and to comply with the proposed conditions in the WLAP application submitted to the state of Idaho to meet state groundwater standards (IDAPA 58.01.11). Sampling locations,

methodologies, and parameters are specified in Chapter 3 of the *ANL-W Environmental Monitoring Program Plan* (ANL-W 2003) and associated procedures.

4.3.3 Naval Reactors Facility

The NRF groundwater monitoring program includes the collection and analysis of samples from monitoring wells surrounding NRF as required by the CERCLA ROD (DOE, EPA, DEQ 1998). Groundwater samples around NRF are collected by the USGS under an interagency agreement.

Sampling locations, methodologies, and parameters are specified in the USGS *Field Methods and Quality Assurance Plan for Quality-of-Water Activities* (USGS 2003). In addition, more detailed information on the environmental monitoring performed by NRF can be found in the *Naval Reactors Facility Environmental Monitoring Report Calendar Year 2002* (NRF 2003b) and in the *Naval Reactors Facility Environmental Summary Report* (NRF 2002).

4.3.4 United States Geological Survey

The 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 INEEL operations. Site boundaries are monitored to detect groundwater contaminants entering and leaving the INEEL, and wells within the INEEL 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 quarterly, semiannually, or annually, depending upon location. Samples are routinely collected and analyzed for radionuclides, volatile organic compounds, trace elements, and anions. Sampling locations, methodologies, and parameters are specified in the USGS *Field Methods and Quality Assurance Plan for Quality-of-Water Activities* (USGS 2003).

4.3.5 State of Idaho INEEL Oversight Program

The state of Idaho INEEL OP cosamples selected groundwater locations on and around the INEEL for both nonradioactive and radioactive parameters. Cosampling is conducted annually onsite with the contractors at WLAP and CERCLA post-ROD monitoring locations. Additional cosampling is performed with the contractors at other locations where WLAPs or RODs have not been issued.

Monitoring locations distant from the INEEL include wells (domestic, agricultural, industrial, and municipal wells) and springs in the regions south of the INEEL toward the terminus of the SRPA along the Snake River between Twin Falls and Hagerman. These sites are chosen based on geographic location, ease of sample collection, and prospects for long-term access. Locations cosampled with USGS on and near the INEEL are sampled annually and analyzed for radiological and nonradiological parameters, including trace metals, anions and nutrients. Parameters were selected to allow comparison with USGS and to monitor for INEEL impacts on the SRPA.

Sampling locations, methodologies, and parameters are specified in the *Environmental Monitoring Plan* (State of Idaho 2003).

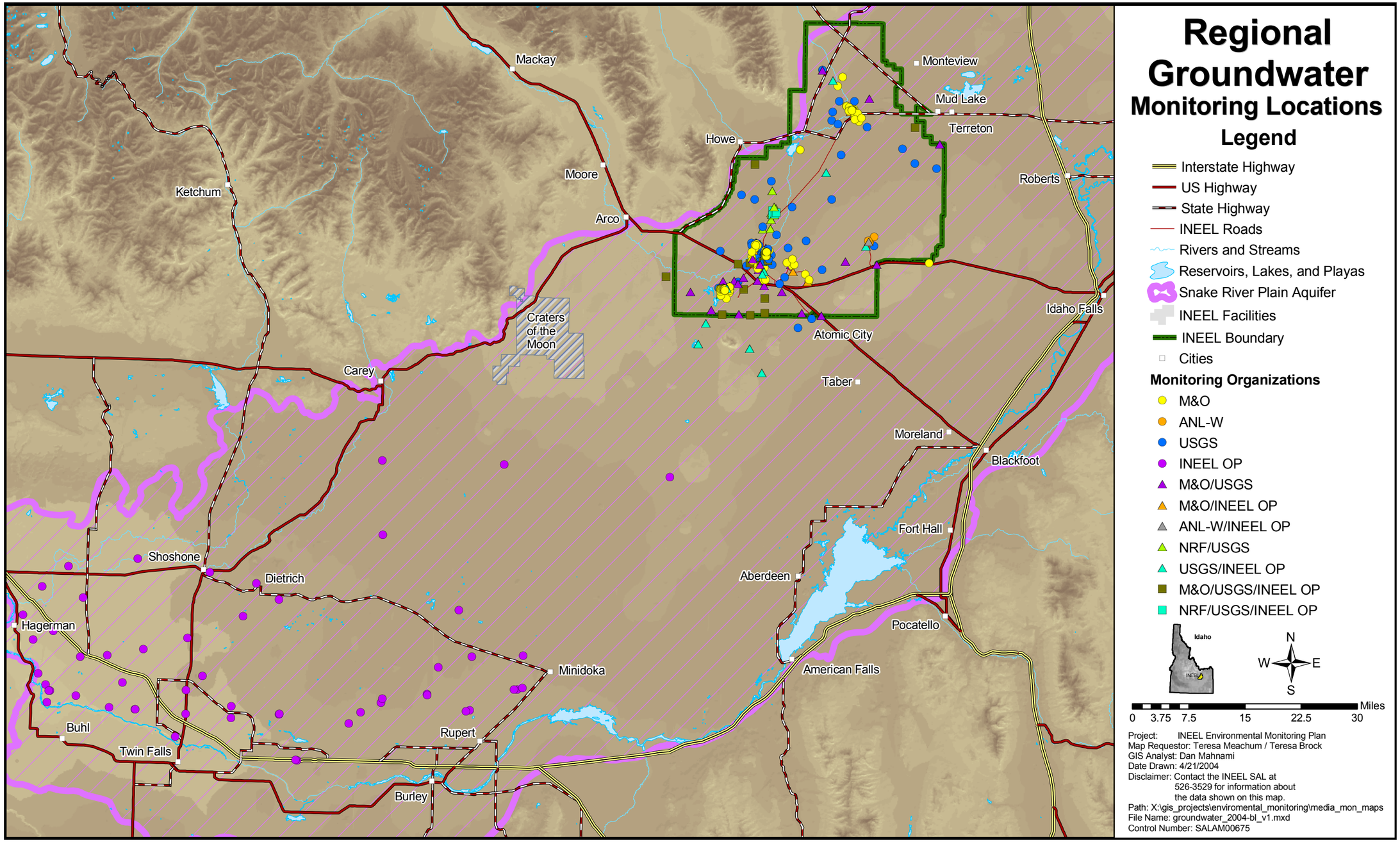

Figure 4-5. Regional groundwater monitoring locations.

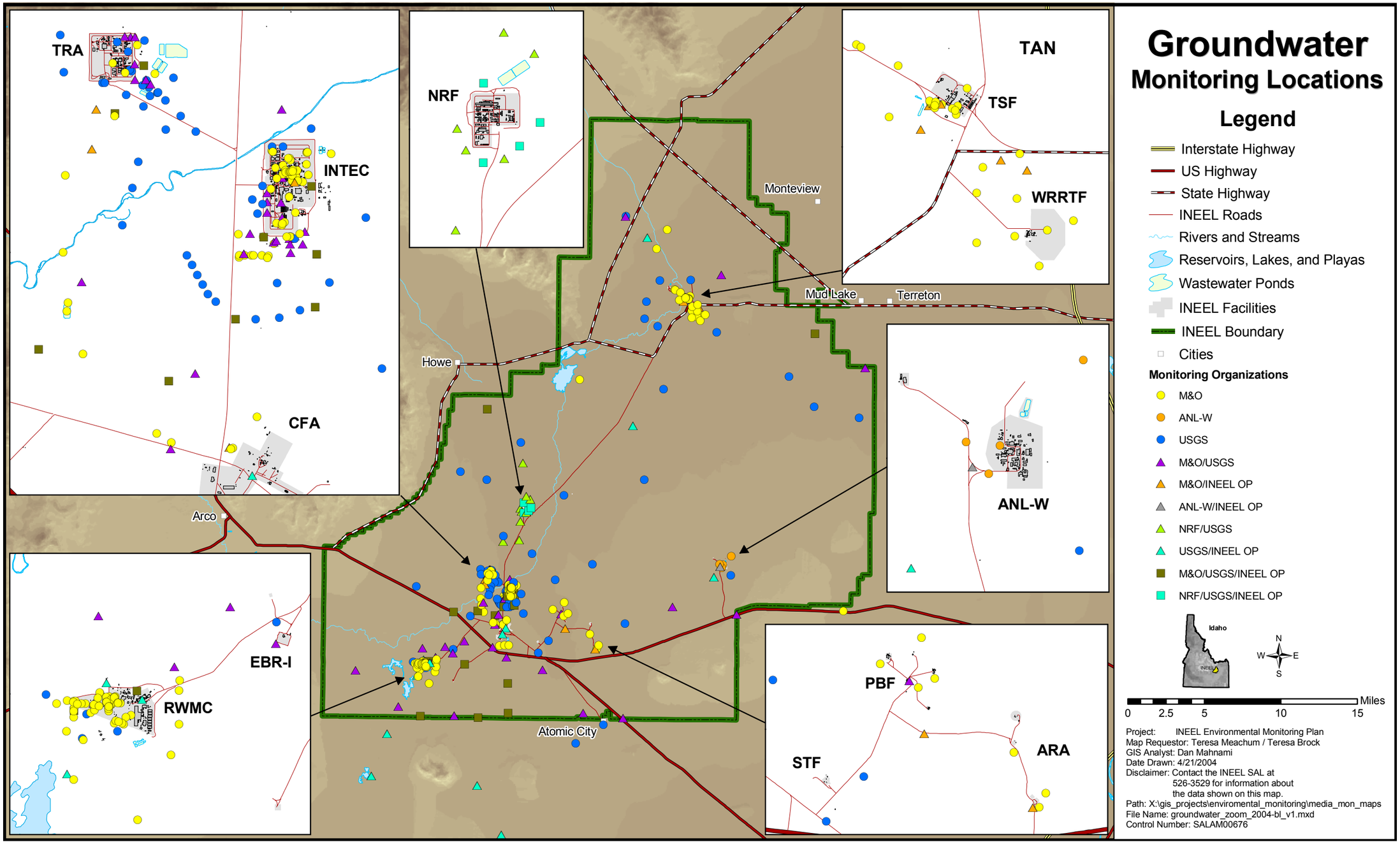

Figure 4-6. Detailed onsite groundwater monitoring locations.

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 wetlands. No streams or rivers flow from within the INEEL to locations outside the boundaries, and most years, the channels of the Big Lost River system on the INEEL are dry. However, surface water samples are taken when water is present both on and around the INEEL to monitor the surface water pathway. Currently, there are no discharges of storm water or liquid effluent from INEEL facilities that require monitoring under National Pollutant Discharge Elimination System.

Figure 4-7 shows all of the surface water monitoring locations, both onsite and offsite, that are currently monitored.

4.4.1 Management and Operating Contractor

Surface and near-surface soils at RWMC have become contaminated from past flooding of open pits, waste handling, and biotic intrusion. Surface water runoff is sampled at the SDA because of the potential for surface water runoff to become contaminated. These samples are collected to:

- Meet the requirements for waste management facility monitoring per DOE Order 435.1.
- 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.
- Detect and report significant trends in measured concentrations of radionuclides in surface waters leaving the facility.

Sampling locations, parameters, and frequencies are documented in the "Environmental Surveillance Program Plan" (PLN-720, 2003) and associated procedures.

4.4.2 Environmental Surveillance, Education and Research Program

Surface water samples are collected by the ESER Program at five offsite locations to monitor the surface water pathway through which radionuclides could potentially reach the public. Two locations on the Snake River, at Idaho Falls and Bliss, are sampled and analyzed for gross alpha and gross beta activity and tritium. Samples are also taken from three springs in the Thousand Springs area that flow into the Snake River: one near Hagerman, one near Buhl, and one from the Twin Falls area. These spring samples are also cosampled with the state of Idaho INEEL OP and are analyzed for gross alpha and gross beta activity and tritium.

Details on the surface water sampling performed by ESER are specified in the ESER Program Description (ESER 2002a).

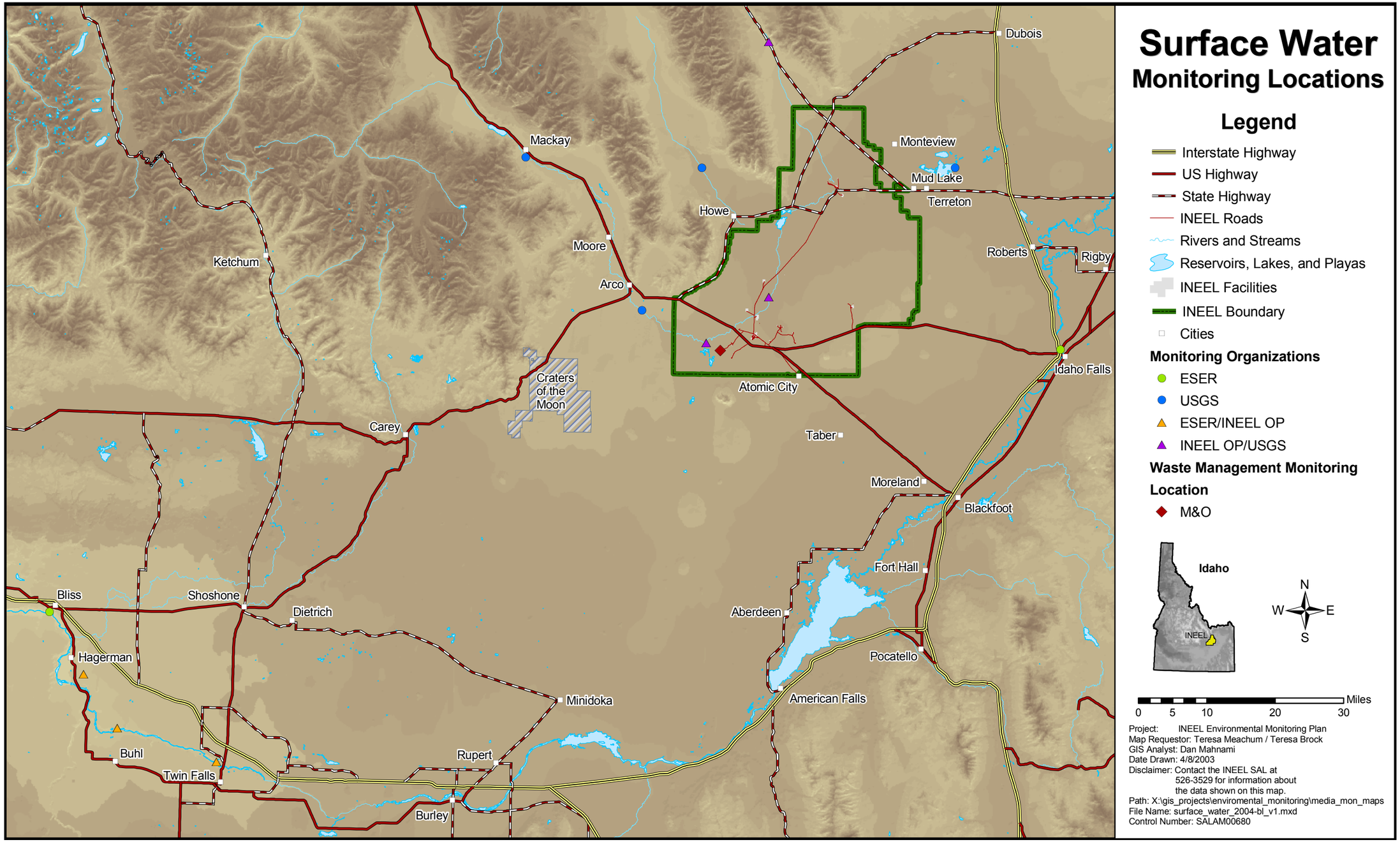

Figure 4-7. Surface water monitoring locations.

4.4.3 United States Geological Survey

If flow occurs in the Big Lost River or other selected streams, surface water samples will be collected and submitted for radionuclide and chemical analyses to determine the effect that surface water flow has on the chemistry of groundwater beneath the INEEL.

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 locations include two onsite at the INEEL Diversion Dam near RWMC and the Experimental Field Station near INTEC and two offsite near Mackay and Arco. Details on the surface water sampling performed by the USGS are specified in the USGS Field Methods and Quality Assurance Plan (USGS 2003).

4.4.4 State of Idaho INEEL Oversight Program

The state of Idaho INEEL OP samples three surface water sites: offsite from Birch Creek and onsite from the Big Lost River at the INEEL Diversion Dam near RWMC and the Experimental Field Station near INTEC. The locations are cosampled with the USGS and are analyzed for both nonradioactive and radioactive parameters. Samples are also taken from three springs in the Thousand Springs area that flow into the Snake River: one near Hagerman, one near Buhl, and one from the Twin Falls area. These springs are cosampled with the ESER Program. Sampling locations, methodologies, and parameters are specified in the *Environmental Monitoring Plan* (State of Idaho 2003).

4.5 Soil

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

- Determine present concentrations of nonradioactive contaminants and radioactivity (natural and anthropogenic) in soil
- Identify and quantify changes in contaminant concentrations in the soil due to 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 Management and Operating Contractor

4.5.1.1 Non-CERCLA Soil Monitoring. Soil surveillance is conducted to meet the following requirements:

- DOE Order 435.1, "Radioactive Waste Management," requirements for surveillance at waste management facilities
- DOE Order 450.1, "Environmental Protection Program" requirements for surveillance monitoring to determine the impacts of operations on the environment and public health

- WLAP requirements for the CFA Sewage Treatment Plant (STP) irrigation area.

Locations of soil samples taken at the RWMC to comply with DOE Order 435.1 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 3 years.

Soil surveillance activities performed under the "Environmental Surveillance Program Plan" (PLN-720, 2003) are conducted primarily to determine if long-term deposition of airborne materials released from INEEL facilities have resulted in a build-up of radionuclides in the environment. Soils are analyzed on a 2-year rotation schedule from selected INEEL facilities and regionally on and around the INEEL using portable in situ gamma spectrometers capable of detecting specific gamma radionuclides. Additional soil samples are collected at selected locations for specific alpha and beta analyses. Onsite locations that are routinely sampled are typically in areas with undisturbed soils, but other areas may be selected to help determine soil contamination, if any, from recent INEEL airborne releases.

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 WLAP and company-controlled procedures.

4.5.1.2 CERCLA Monitoring. Soil sampling is performed as required by the remedial investigation/feasibility study 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 INEEL-wide ecological impact of the contamination left in place remains within acceptable limits.

Under the CERCLA Long-Term Ecological Monitoring Program, soil samples are taken at locations identified as sites of concern and are monitored for both radiological and nonradiological contaminants. Soil samples are collected from the surface to no more than 2 ft below ground surface and 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 the Long-Term Ecological Monitoring Plan for the INEEL (VanHorn, Fordham, and Haney 2004). 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.

To comply with the WAG 4 ROD signed for the CFA landfills (DOE-ID 1995) and to support ongoing work for a WAG 7 remedial investigation/feasibility study of RWMC areas, additional soil monitoring is performed by the M&O contractor. 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 (INEEL 2003).

At RWMC, soil moisture and soil gas are monitored to support the WAG 7 Remedial Investigation/Feasibility Study. The data collected for WAG 7 are also used to satisfy the requirements of DOE Order 435.1. Soil moisture monitoring in the vadose zone using lysimeters at RWMC is addressed in Section 4.3.1. Soil gas is sampled in the waste zone using vapor probes placed directly in the waste at

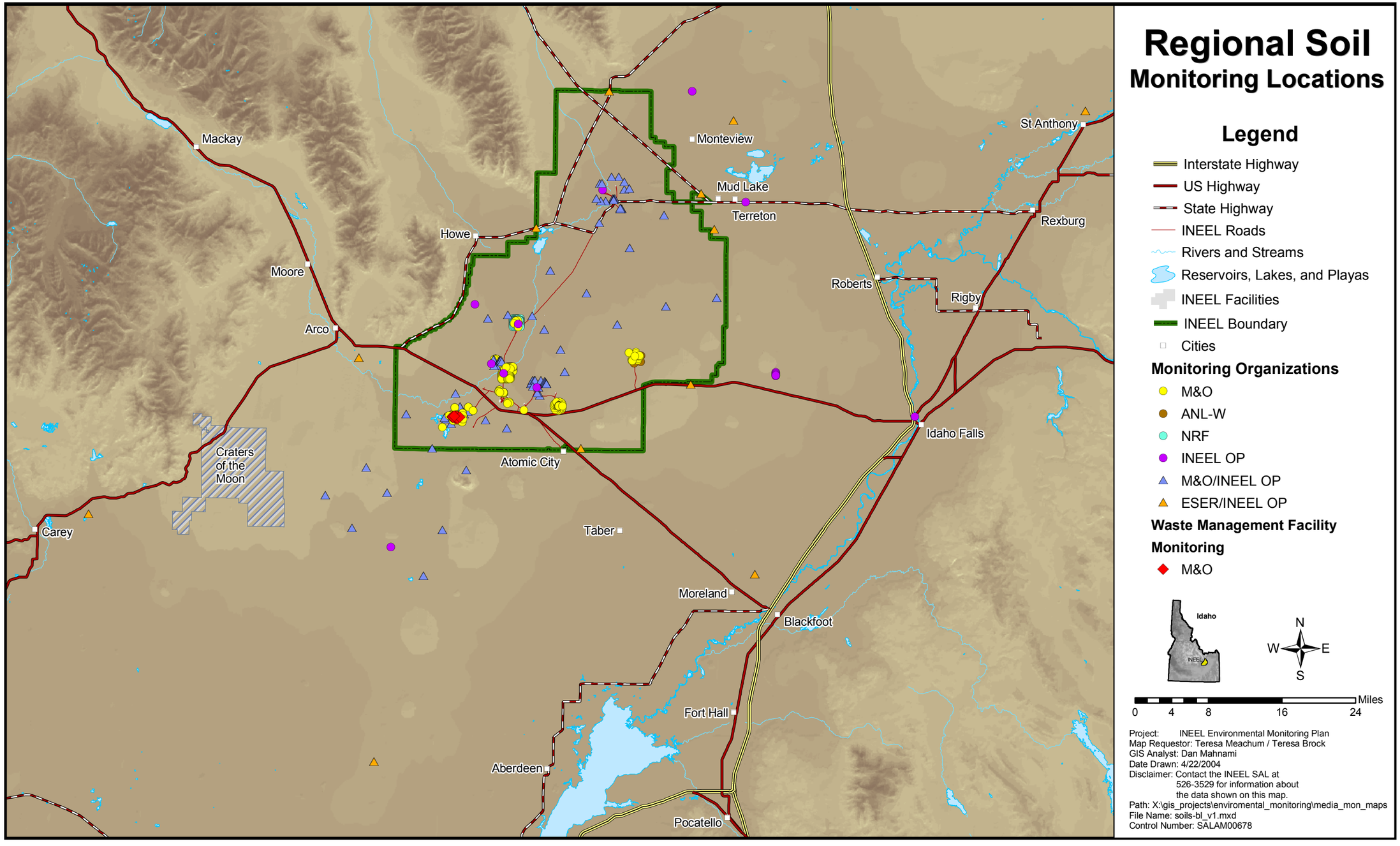

Figure 4-8. Regional soil monitoring locations.

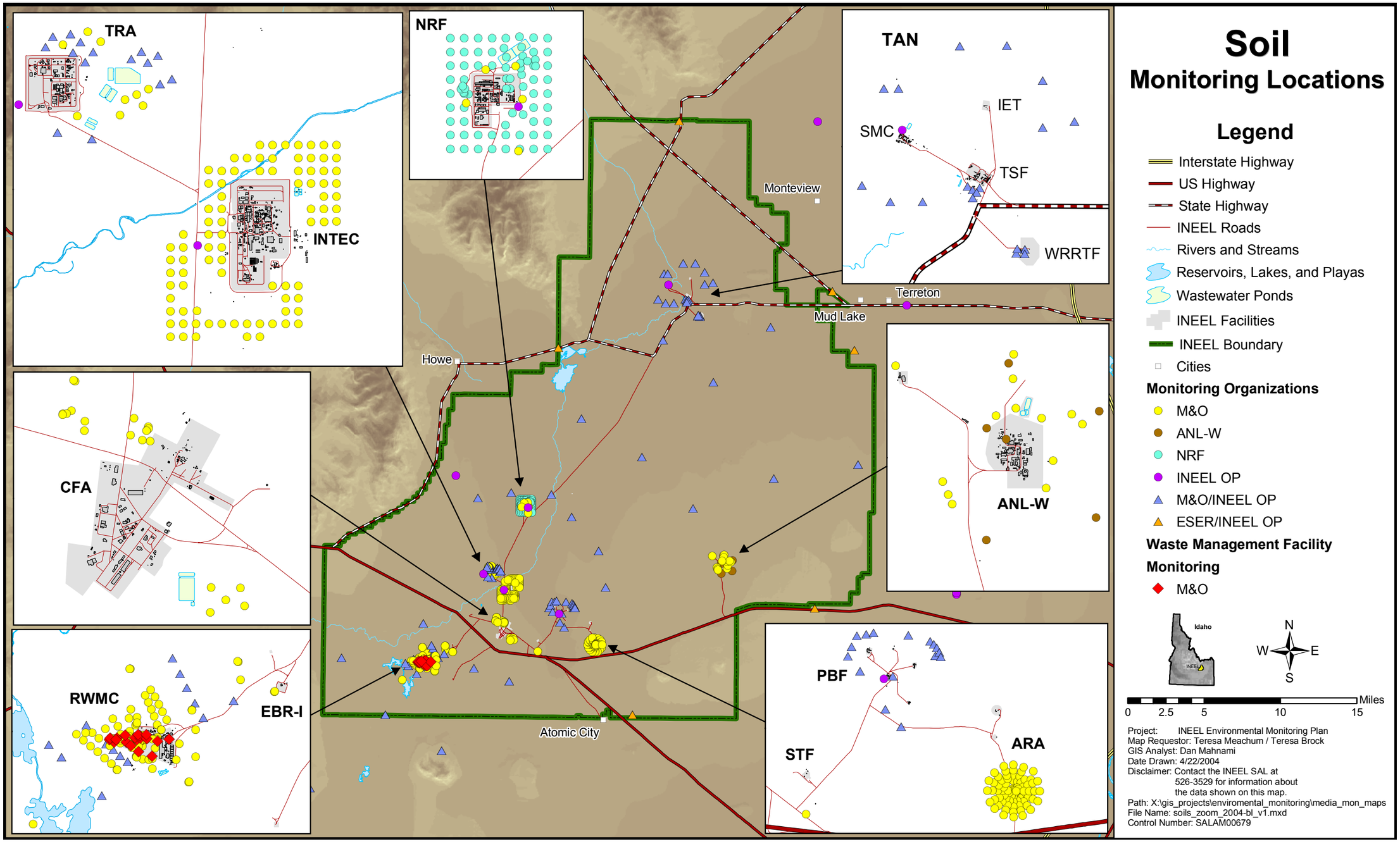

Figure 4-9. Detailed onsite soil monitoring locations.

selected locations. Soil gas is sampled in the vadose zone using an extensive system of soil gas sampling ports inside and outside the Subsurface Disposal Area boundary.

4.5.2 Argonne National Laboratory-West

Air emissions and wastewater discharges from ANL-W operations could result in an accumulation of contaminants in soil and sediment near the ANL-W. Soil samples are collected from locations adjacent to air monitoring stations to represent the most probable locations hypothetical airborne plumes or fallout would impinge on the ground surface and are analyzed for radiological contaminants. ANL-W personnel collect sediment samples from the Industrial Waste Pond inlet and the Industrial Waste Ditch to determine if releases of low concentrations of radiological and nonradiological contaminants are accumulating in the sediment in these areas. Sampling is conducted as described in Chapter 3 of the *ANL-W Environmental Monitoring Program Plan* (ANL-W 2003) and associated procedures.

4.5.3 Naval Reactors Facility

4.5.3.1 Soil Monitoring. The soil monitoring program at NRF has three purposes:

- Determine whether current NRF operations are adding any radioactivity to the environment surrounding NRF
- Verify continued containment of the few areas around the NRF known to contain residual low-level radioactivity from past operations
- Provide data used to calculate fugitive air emissions.

Several localized areas of soil within NRF's area of responsibility, such as the A1W and S1W Leaching Beds and the southwest cell of the sewage lagoon complex, contain small amounts of residual radioactivity, principally cobalt-60 and cesium-137 from past operations. All areas containing residual radioactivity are sampled annually to verify that the radioactivity is not migrating and are included in the scope of remediation activities under the NRF ROD for Operable Unit 8-08 (DOE, EPA, DEQ 1998). In addition, soil samples are collected from the surrounding NRF perimeter to confirm that radioactivity is not migrating from known areas of residual activity or deposited downwind of exhaust points.

More detailed information on the environmental monitoring performed by NRF can be found in the *Naval Reactors Facility Environmental Monitoring Report Calendar Year 2002* (NRF 2003b) and in the *Naval Reactors Facility Environmental Summary Report* (NRF 2002).

4.5.3.2 Soil Gas Monitoring. Soil gas monitoring is required by the CERCLA remedial action pertaining to the three NRF inactive landfills to:

- Verify that the migration of subsurface gaseous volatile organic constituents away from the landfill areas is minimized
- Assess the effectiveness of the landfill covers in limiting surface soil gas emissions.

The principal sources of soil gas are from residual volatile organic compounds that are in the buried waste at the three identified landfill areas. Soil gas samples are collected from permanent soil gas monitoring probes quarterly, and an annual soil gas emission survey is conducted.

More detailed information on the environmental monitoring performed by NRF can be found in the *Naval Reactors Facility Environmental Monitoring Report Calendar Year 2002* (NRF 2003b) and in the *Naval Reactors Facility Environmental Summary Report* (NRF 2002).

4.5.4 Environmental Surveillance, Education and Research 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 INEEL 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 ESER are specified in the ESER Program Description (ESER 2002a).

4.5.5 State of Idaho INEEL Oversight Program

Concentrations of gamma-emitting radionuclides in soil are measured at state of Idaho INEEL OP's routine air monitoring locations to evaluate the terrestrial component of the gamma radiation measurements. Soil measurements are performed at sites collocated with both the M&O contractor and the ESER Program to verify analytical results. In situ gamma measurements are performed annually at INEEL OP's air monitoring sites. Sampling locations, methodologies, and analytes of interest are outlined in the *Environmental Monitoring Plan* (State of Idaho 2003).

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 windblown 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 have access to some areas on the INEEL containing radioactive contamination. Because they have the potential to move offsite and be harvested by the public for consumption, they are 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 4-10 shows the biota monitoring locations.

4.6.1 Management and Operating Contractor

4.6.1.1 Non-CERCLA Monitoring. The objectives of the routine biotic surveillance activities are 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 and to monitor waste confinement integrity because radionuclides may migrate away from the facility. Vegetation is collected

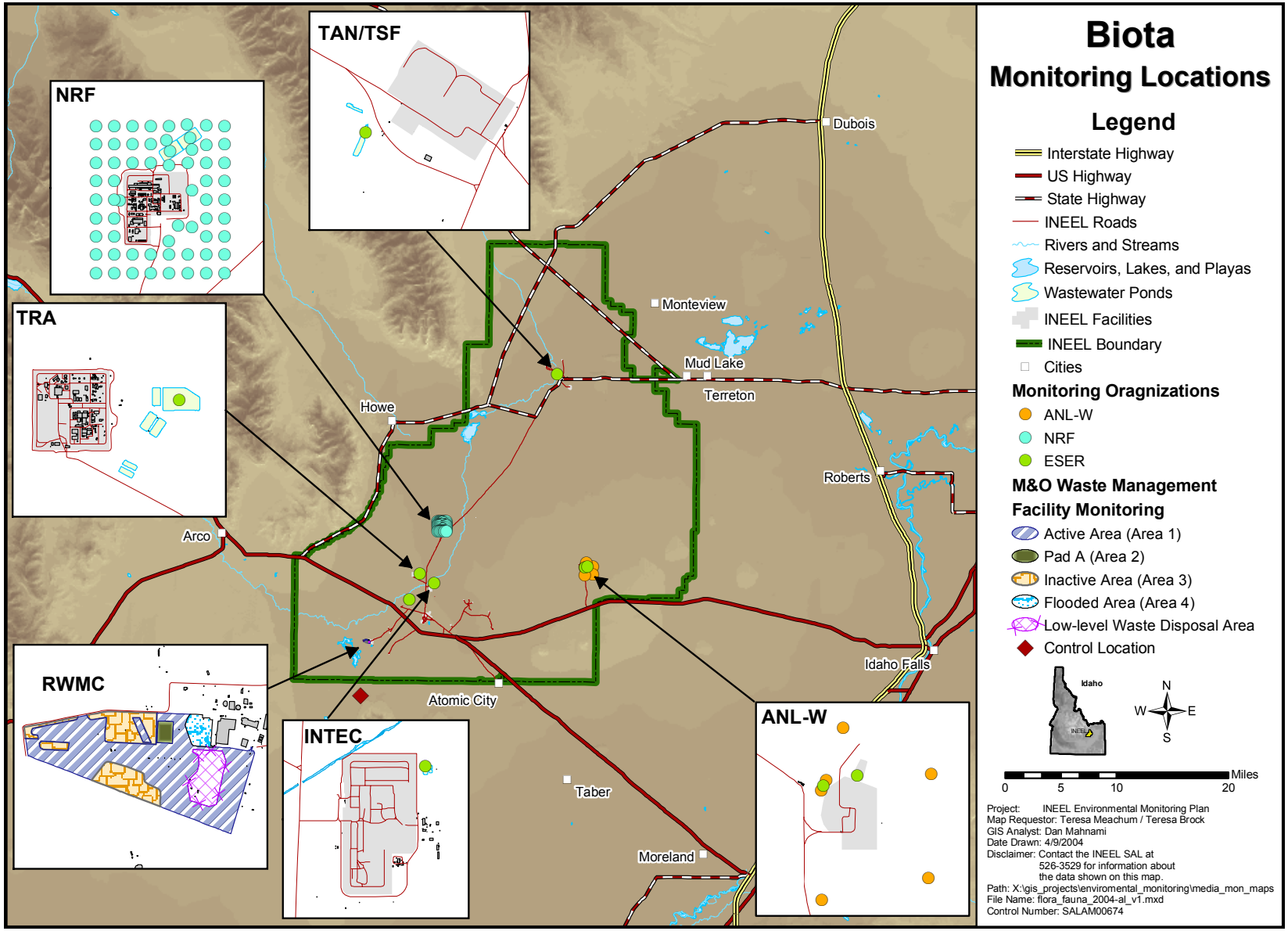

Figure 4-10. Biota monitoring locations.

from a control location approximately 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 the "Environmental Surveillance Program Plan" (PLN-720, 2003) and associated procedures.

4.6.1.2 CERCLA Long-Term Ecological Monitoring. 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 the long-term INEEL-wide ecological impact of the contamination left in place remains within acceptable limits.

Vegetation is harvested at each selected location and includes leaves, small stems, and inflorescences from sagebrush; and leaves, culms, and inflorescences from grass. The intent of this sampling is to gather plant material that is most likely to be browsed by herbivores.

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

Under the CERCLA Long-Term Ecological Monitoring Program, biota samples are taken at locations identified as sites of concern and are monitored for both radiological and nonradiological contaminants. These samples are collected in accordance with the Long-Term Ecological Monitoring Plan for the INEEL (VanHorn, Fordham, and Haney 2004). Because the locations of this monitoring can be extensive and vary within each area, the actual sample locations are not depicted on Figure 4-10.

4.6.2 Argonne National Laboratory-West

At ANL-W, vegetation samples are collected to determine the uptake of radionuclides from the soil by vegetation. Analytical data are used primarily to estimate the dose to wildlife via ingestion. Vegetation samples are analyzed for radionuclides that could be released from ANL-W facilities, other INEEL facilities, or are those that have been historically collected. Vegetation sampling is conducted annually at seven locations as described in Chapter 3 of the *ANL-W Environmental Monitoring Program Plan* (ANL-W 2003) and associated procedures. The sample locations include four adjacent to the air and soil monitoring locations, one south of the Industrial Waste Pond, one north of the Industrial Waste Pond, and one inside the security fence. Because, the sample inside the security fence can be taken anywhere inside the fence, this location is not shown on Figure 4-10.

4.6.3 Naval Reactors Facility

The purposes of the vegetation monitoring program at NRF are to:

- Determine whether current NRF operations are adding any radioactivity to the environment surrounding NRF
- Verify continued containment of the few areas around the NRF known to contain residual low-level radioactivity from past operations.

Several localized areas within NRF's boundaries, including the A1W and S1W Leaching Beds and the southwest cell of the sewage lagoon complex, contain small amounts of residual radioactivity, principally cobalt-60 and cesium-137 from past operations. All areas containing residual radioactivity are sampled annually to verify that the radioactivity is not migrating and are included in the scope of remediation activities under the NRF ROD for Operable Unit 8-08 (DOE, EPA, DEQ 1998). In addition,

vegetation samples are collected from the NRF perimeter to confirm that radioactivity is not migrating from known areas of residual activity or deposited downwind of exhaust points.

More detailed information on the environmental monitoring performed by NRF can be found in the *Naval Reactors Facility Environmental Monitoring Report Calendar Year 2002* (NRF 2003b) and in the *Naval Reactors Facility Environmental Summary Report* (NRF 2002).

4.6.4 Environmental Surveillance, Education and Research 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 INEEL. The collection of large game animal samples is described in the ESER Program Description (ESER 2002a). From each animal, the thyroid and samples of muscle and liver tissue are collected and analyzed for radioactivity. In addition, some basic biological information, such as weight, age, muscle condition, and the fat depth on various tissues, may be obtained from the animals when possible.

Annually, the ESER Program collects waterfowl from liquid waste disposal ponds on the INEEL and from offsite control areas. Ponds sampled include the Test Area North/Technical Support Facility (TAN/TSF) pond, the ANL-W Industrial and Sanitary Sewage Lagoons, the INTEC New Percolation Ponds, the INTEC STP infiltration ponds, and the hypalon-lined TRA disposal pond (ESER 2002a). Edible tissues from waterfowl (primarily ducks) are 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.

4.7 Agricultural Products

The INEEL 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 ingestion of contaminated water or feed.

Figure 4-11 shows the agricultural products monitoring locations.

4.7.1 Environmental Surveillance, Education and Research Program

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

Milk is a potential pathway for radioactive materials, particularly radioiodine and strontium-90, from the INEEL to the public; therefore, the ESER Program monitors milk at offsite locations. Currently some of the samples are taken from single-family dairies, and the remainder are taken from commercial dairies. The commercial dairy in Idaho Falls is sampled weekly; the rest are sampled monthly. The ESER Program Description (ESER 2002a) details the collection and processing of milk samples.

The ESER Program collects lettuce samples 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 (ESER 2002a) details the collection and processing of lettuce samples. Samples are taken from private gardens in offsite sampling areas.

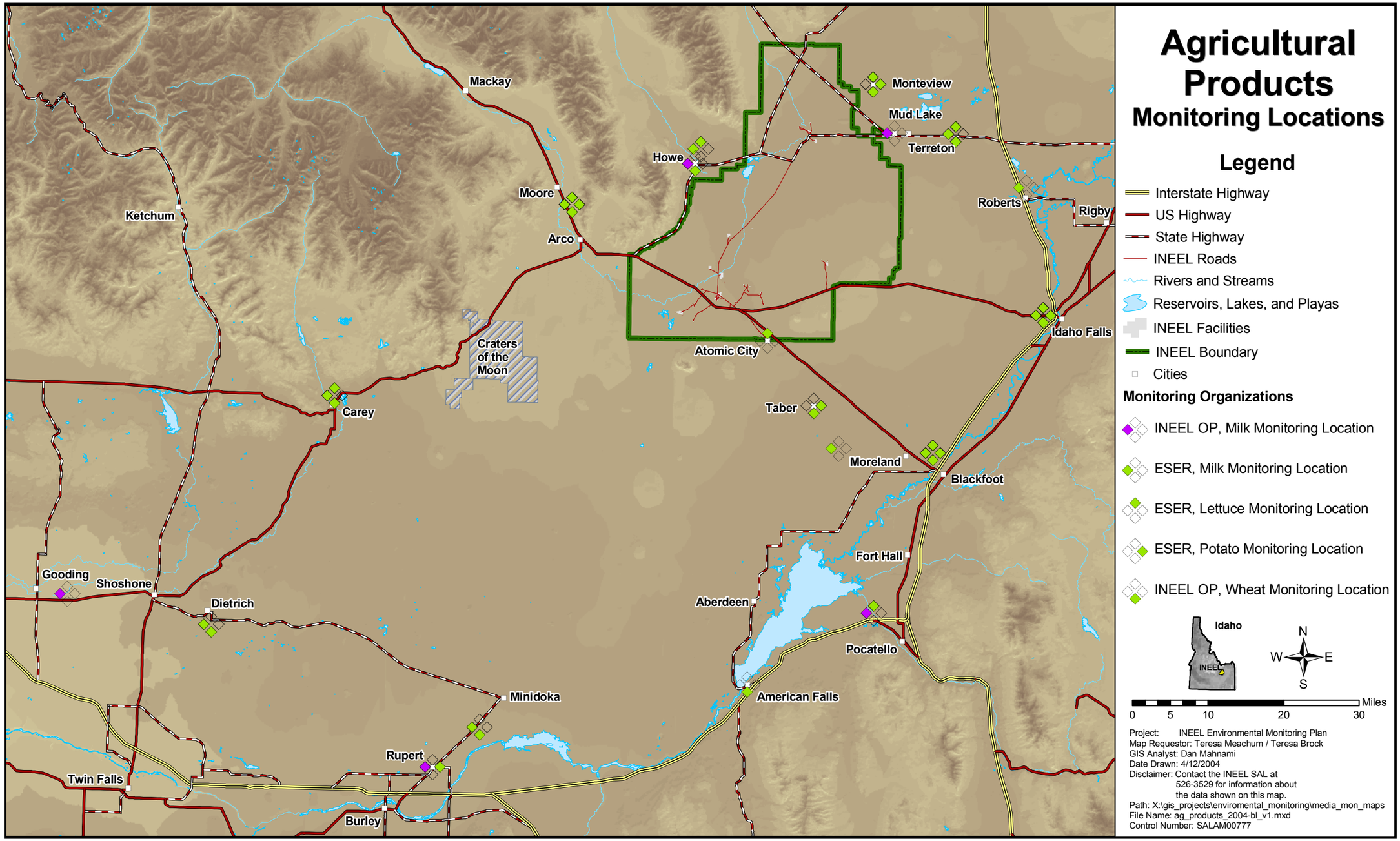

Figure 4-11. Agricultural products monitoring locations.

Wheat is sampled because it may represent a major part of the typical diet. The ESER Program Description (ESER 2002a) details the collection and processing of wheat samples. The ESER Program collects samples from several areas in southeastern Idaho. 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, due to public interest in Idaho's most famous product, the ESER Program resumed routine potato sampling in 1998. Potato samples are obtained annually during the harvest from potato warehouses located in the vicinity of the INEEL. Potatoes are also obtained out of state from areas as distant as Maine and Alaska to serve as control samples. The ESER Program Description (ESER 2002a) details the collection and processing of potato samples.

Grazing is allowed on certain portions of the INEEL in Bureau of Land Management allotments. Commonly used areas on the INEEL include the area between Atomic City and the Twin Buttes, the eastern part of the INEEL (in the area east of ANL-W known as Tractor Flats), and the north portion in the vicinity of Circular and Antelope Buttes. The ESER Program collects two sheep from each of the northern and southern allotments as described in the ESER Program Description (ESER 2002a), normally in May. Two sheep are also collected from an operator whose sheep grazed in areas distant from the INEEL as controls. From each animal, the thyroid and samples of muscle and liver tissue are collected and analyzed for radioactivity. Grazing areas are shown on Figure 1-1.

4.7.2 State of Idaho INEEL Oversight Program

Milk samples are collected to assess radioiodine concentrations in milk potentially due to radioactive iodine released to the environment due to fallout. In addition to routine milk samples, the state of Idaho INEEL OP performs verification sampling on two locations chosen by the ESER Program every month for analysis and comparison. Sampling locations, methodologies, and analytes of interest are outlined in the *Environmental Monitoring Plan* (State of Idaho 2003).

4.8 External Radiation

External (or penetrating) radiation is measured using 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 INEEL operations. The contribution of INEEL operations to background radiation exposure is determined by comparing exposures measured at the INEEL boundary locations to those at distant locations. Figure 4-12 shows the regional external radiation monitoring locations, and Figure 4-13 shows detailed onsite monitoring locations.

4.8.1 Management and Operating Contractor

The objectives of the radiation monitoring performed by the M&O contractor are to:

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

To meet these objectives, the M&O contractor measures gamma radiation exposure rates and cumulative exposures and performs gamma radiation surveys both onsite and offsite.

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

Thermoluminescent dosimeters (TLDs) are used to measure cumulative exposures to ambient penetrating radiation for surveillance locations. The TLDs detect changes in ambient exposures attributed to handling, processing, transporting, or disposing of radioactive waste. TLDs are located along major highways, in surrounding communities, and around the perimeter fences of each major facility, including NRF and ANL-W. The TLDs are placed 3 ft above ground, and the M&O contractor collects and analyzes the TLDs 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, the M&O contractor uses a global positioning radiometric scanner system to conduct gamma radiation surveys. These surveys measure gross gamma radiation and are used to identify general areas of radioactivity, and differ from the in situ soils analysis discussed in Section 4.5.1.1 that are used to identify specific radionuclides and activity levels. Gamma radiation surveys are used for detecting soils that have become contaminated with gamma-emitting nuclides, as well as detecting penetrating radiation exposures outside the fenced areas from a variety of possible sources inside the facility. The global positioning radiometric scanner is mounted on a four-wheel drive vehicle; two plastic scintillation detectors identify contaminated areas, and both global positioning system and radiometric data are recorded. Annual gamma radiation surveys are conducted along major INEEL roads for radiation contamination and around the perimeter of selected INEEL facilities on a 3-year schedule to document penetrating radiation fields. Annual surveys are conducted to detect gross gamma radiation at the RWMC SDA because the SDA is the only low-level waste disposal facility at the INEEL that is required to be monitored to comply with DOE Order 435.1. Because these surveys involve all roads and facility perimeters, these monitoring locations are not displayed on Figures 4-12 or 4-13.

External radiation monitoring is performed by the M&O contractor as described in the "Environmental Surveillance Program Plan" (PLN-720, 2003) and associated procedures.

4.8.2 Argonne National Laboratory-West

ANL-W operates four monitoring stations around the perimeter of the ANL-W boundary. These stations have high-pressure ion chambers capable of detecting low-level ionizing gamma radiation. The stations are equipped with radio telemetry and are placed according to prevailing wind patterns and provide ongoing surveillance of gamma radiation.

In addition to the four monitoring stations around the perimeter of the ANL-W boundary, radiation samples are taken from inside and along the perimeter of the Radioactive Scrap and Waste Facility and along the Industrial Waste Ditch and pond sediments. The penetrating radiation surveys of the Industrial Waste Ditch and pond sediments are conducted for beta and gamma radioactivity at varying locations from year to year and are not shown on Figures 4-12 or 4-13.

Sampling is conducted as described in Chapter 3 of the *ANL-W Environmental Monitoring Program Plan* (ANL-W 2003) and associated procedures.

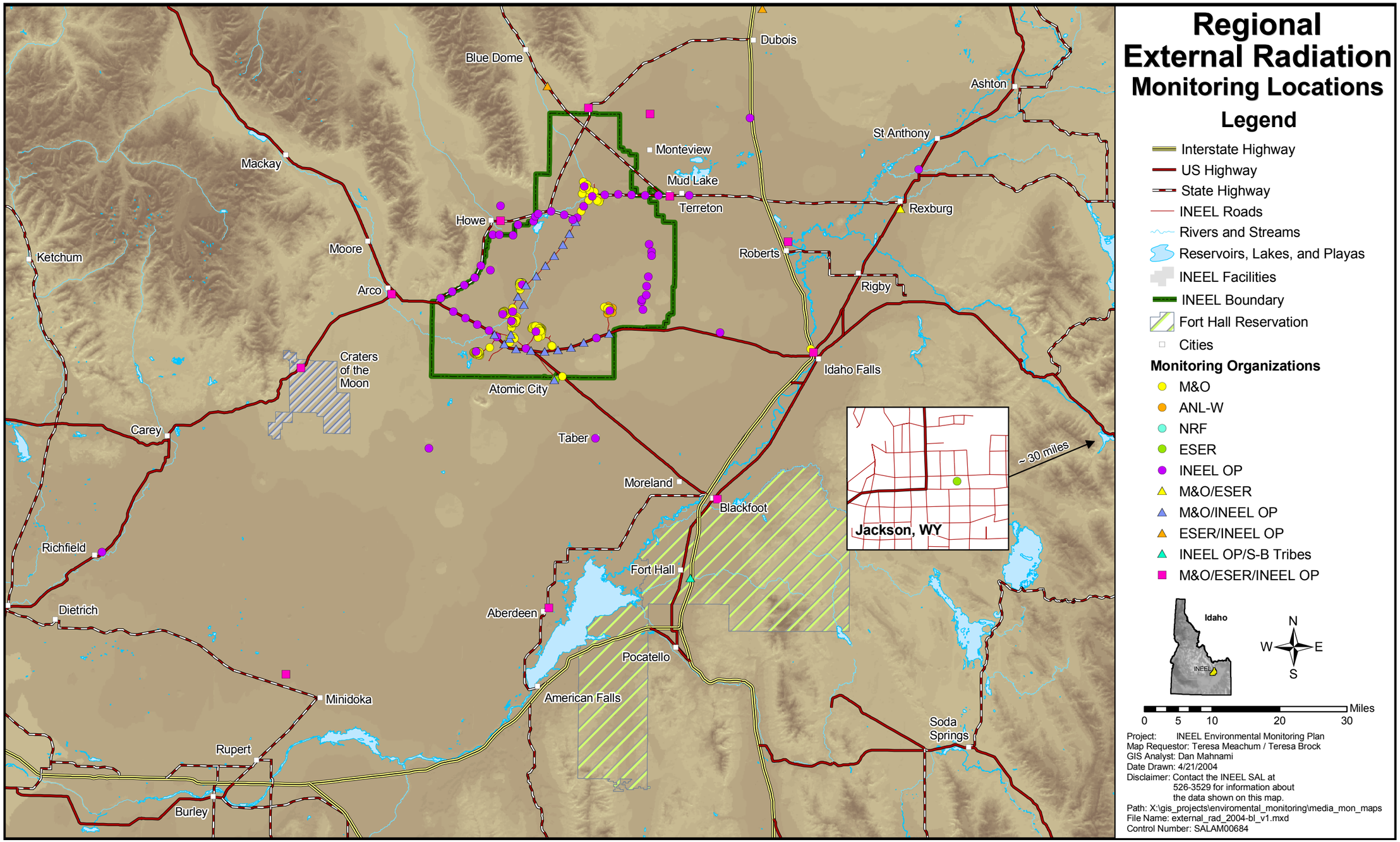

Figure 4-12. Regional external radiation monitoring locations.

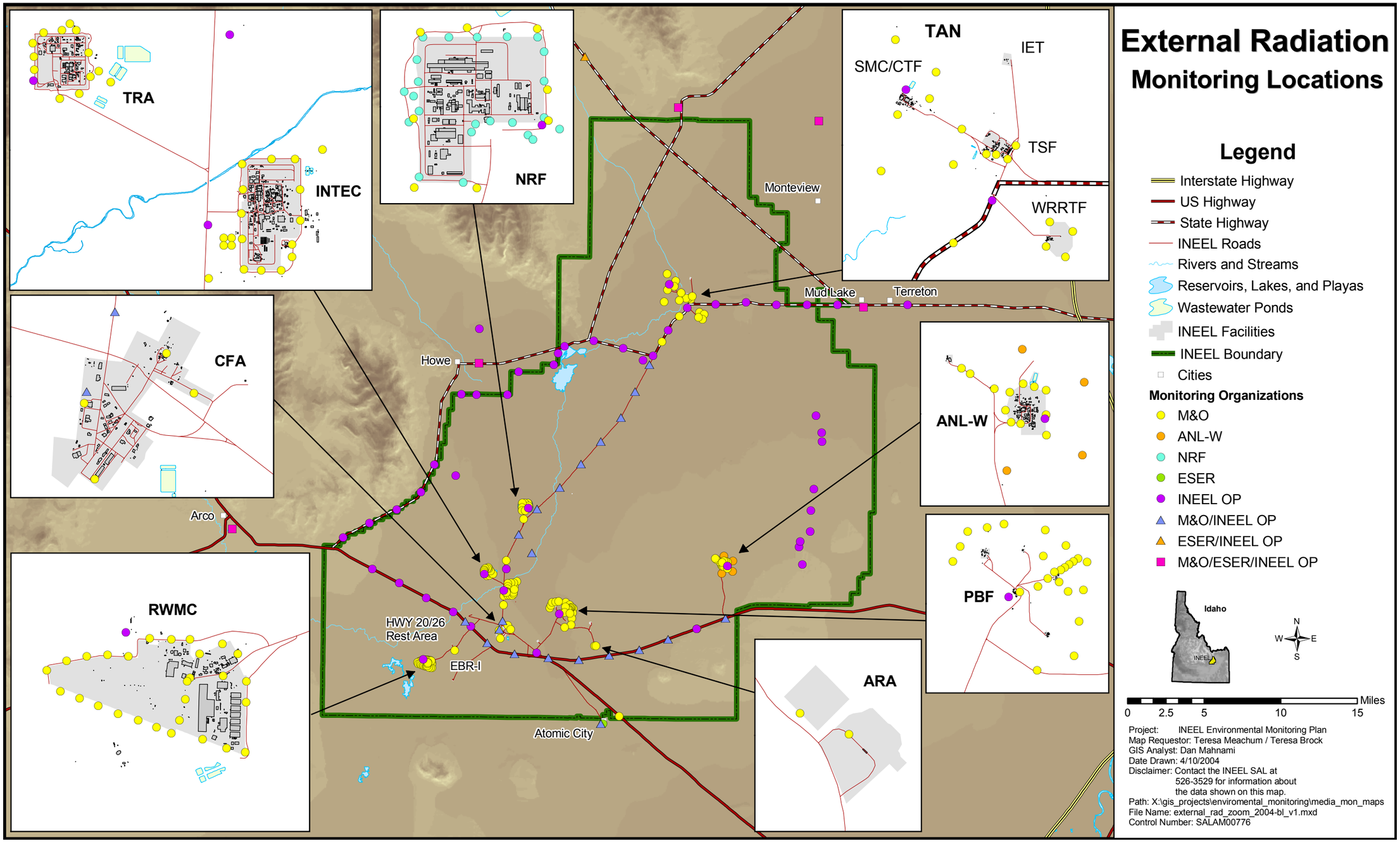

Figure 4-13. Detailed onsite external radiation monitoring locations.

4.8.3 Naval Reactors Facility

Direct measurement of radiation along the NRF security fence is performed independently by NRF and the M&O contractor. NRF monitors direct radiation to verify that NRF operations do not increase radiation exposure to the general public. The NRF radiation monitoring program involves measuring ionizing radiation levels using TLDs at 17 locations along the facility security fence and 8 other locations within the NRF property boundary. NRF monitors 15 additional locations throughout the INEEL varying from 5 to 10 mi from the NRF to determine radiation background levels. These locations are not depicted on Figures 4-12 or 4-13.

More detailed information on the environmental monitoring performed by NRF can be found in the *Naval Reactors Facility Environmental Monitoring Report Calendar Year 2002* (NRF 2003b) and in the *Naval Reactors Facility Environmental Summary Report* (NRF 2002).

4.8.4 Environmental Surveillance, Education and Research Program

The ESER Program determines the contribution of the INEEL to background radiation exposure using TLDs placed at selected locations on the Site perimeter and at more distant locations. If Site operations were contributing significantly to the external radiation dose, the dosimeters at the Site perimeter would show a higher dose than those at the more distant locations. TLDs are collected and analyzed in May and November of each year. The ESER and the M&O contractor maintain adjacent sets of dosimeters at most of the distant locations to coordinate data and confirm measurements.

Details on the external radiation sampling performed by the ESER Program are specified in the ESER Program Description (ESER 2002a).

4.8.5 State of Idaho INEEL Oversight Program

The state of Idaho INEEL OP has deployed environmental dosimeters (i.e., electret ion chambers) to measure cumulative exposures to penetrating radiation at many of the same locations as the TLDs monitored by the M&O contractor and ESER Program. HPICs continuously measure the gamma radiation exposure rate. Exposure rates are measured every 5 seconds using the HPICs, and then averaged over 5-minute intervals by the data logger. Sampling locations and methodologies are outlined in the *Environmental Monitoring Plan* (State of Idaho 2003).

4.8.6 Shoshone-Bannock Tribes

The Shoshone-Bannock Tribes operate a HPIC at Fort Hall. The state of Idaho INEEL OP assists in the collection and reporting of data from this location. Sampling location and methodology are included in the INEEL OP's *Environmental Monitoring Plan* (State of Idaho 2003).

5. METEOROLOGICAL MONITORING

The INEEL meteorological monitoring program supports Site-wide environmental monitoring and surveillance activities, as well as emergency response. Short- and long-term weather conditions have a substantial effect on the INEEL environment, particularly with respect to the movement of contaminants in air and the groundwater system. Meteorological monitoring is performed to record weather conditions (wind speed and direction, temperature, precipitation, etc.) 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, INEEL performs 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 evaluation modeling).

Figure 5-1 shows the meteorological monitoring locations.

5.1 National Oceanic and Atmospheric Administration

Meteorological services and supporting research are provided to the INEEL by the Air Resources Laboratory Field Research Division (ARLFRD) of the National Oceanic and Atmospheric Administration (NOAA). ARLFRD provides real-time meteorological data, climatological data, weather predictions, and dispersion calculations for routine operations and emergency response.

ARLFRD operates a large meteorological monitoring network to characterize the meteorology and climatology of the INEEL Site. The network consists of 33 meteorological towers both on and around the INEEL. It covers an area of approximately 15,000 mi^2. Most of the towers are 50 ft tall and take wind speeds and direction measurements at 50 ft, temperature at 6 and 50 ft, and relative humidity at 6 ft. Three taller towers range from 150 ft to 250 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. These radiological measurements are transmitted and archived with the meteorological data.

In addition to the meteorological towers, ARLFRD operates a 915-MHz radar wind profiler and a Radio Acoustic Sounding System at a site just north of INTEC. These systems provide wind speed and direction profiles up to about 2.5 mi above ground level and temperature profiles up to about 0.6 mi above ground level and provide crucial information about winds and temperatures aloft.

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 INEEL. It is widely used to support Site operations, and is a major part of ARLFRD's support to the INEEL Emergency Operations Center.

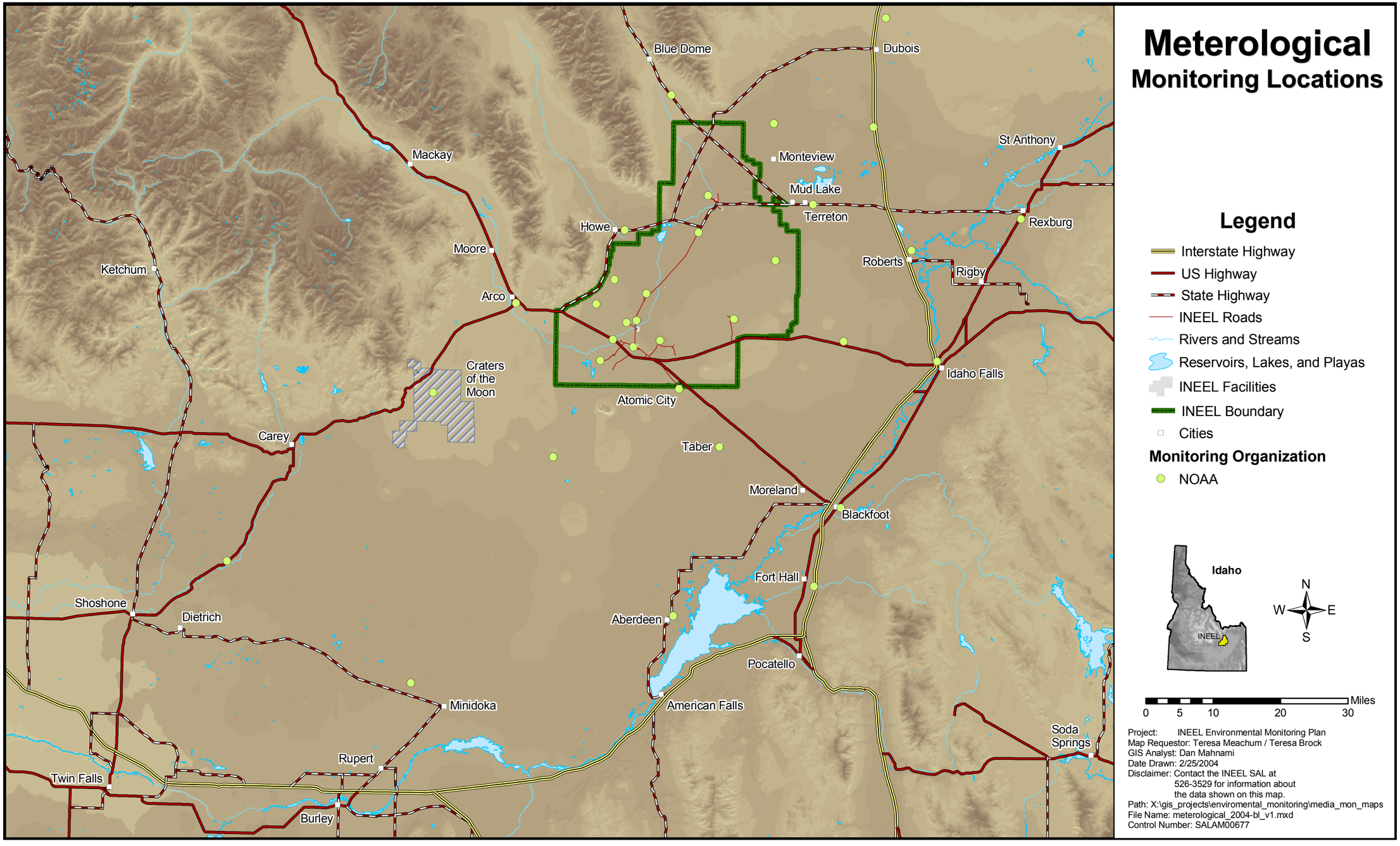

Figure 5-1. Meterological monitoring locations.

6. ENVIRONMENTAL EVENT MONITORING

Environmental event monitoring is an essential part of safe INEEL operations because of the potential impacts of an environmental release of radioactive or regulated materials from INEEL facilities, either from unplanned/accidental operational events or natural events. Environmental events can be widespread across the INEEL (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). Event-specific monitoring data are used to evaluate the potential impact of an event to INEEL personnel, the environment, and the public. Responses to environmental events vary depending on the severity of the event.

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 comprehensive "INEEL Emergency Plan/RCRA Contingency Plan" (PLN-114, 2003) provides the overall process to respond to and mitigate consequences of emergencies that might arise at the INEEL, and individual contractors all have procedures to respond to environmental events. Emergency plans for the INEEL consolidate all emergency planning requirements for federal, state, and local agencies. Mutual aid agreements are in place between the INEEL and state and local agencies to respond to emergencies. One such agreement allows local fire departments to respond to fires on the INEEL and allows the INEEL Fire Department to respond to fires offsite.

6.1.1 Management and Operating Contractor

The M&O contractor has an extensive program to identify chemical/radioactive hazards, evaluate associated risks, prevent accidental releases, and to respond appropriately in the event of a release. The INEEL Emergency Preparedness Program is addressed in the "INEEL Emergency Plan/RCRA Contingency Plan" (PLN-114, 2003). It is used by the Emergency Response Organization and other trained personnel in the event of an emergency. The INEEL Site Monitoring Team collects field data if an unplanned radioactive release or an event such as a wildland fire occurs at the INEEL. Data collected include readings of penetrating radiation levels, airborne and surface contamination levels, and radiation surveys outside of facility fences. The INEEL Site Monitoring Team reports the field data results to the Emergency Response Organization.

The "INEEL Emergency Plan/RCRA Contingency Plan" includes spill prevention and response requirements for each facility. Spills and releases are reported to the INEEL Spill Notification Team. The INEEL Spill Notification Team determines if the spill or release is reportable and makes appropriate release notifications.

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 an INEEL facility or by redistribution of anthropogenic or natural radioactivity contained in soil and vegetation by fire or winds. Three types of air samples are necessary during environmental events that are declared operational emergencies or that involve soil contamination areas:

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

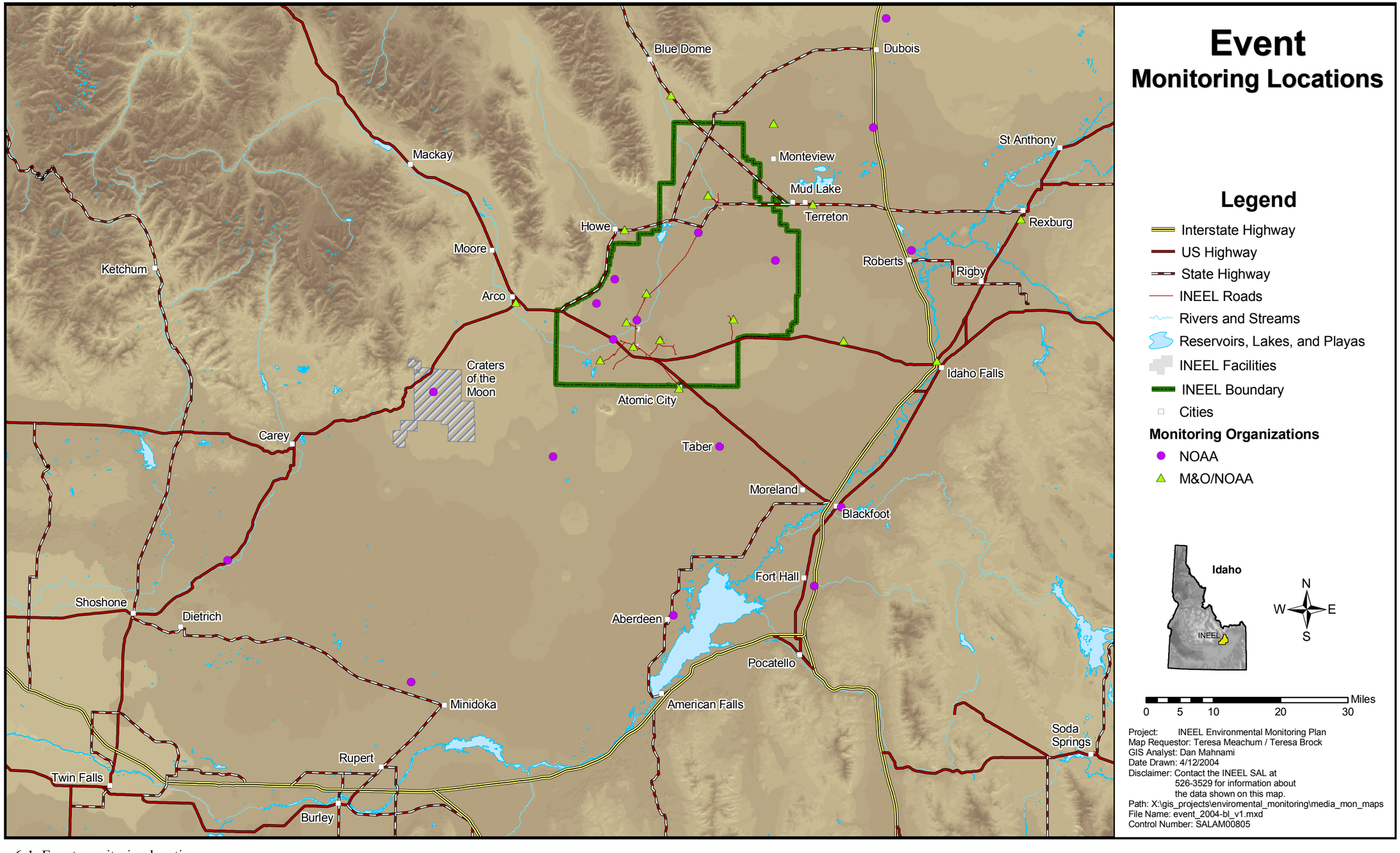

Figure 6-1. Event monitoring locations.

Short-term "grab" samples are taken in the field by the INEEL Site Monitoring Team 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 Operating Center 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 (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 they are collected.

Event-specific monitoring provides data to evaluate potential radiological doses associated with events resulting in accidental or unplanned radiological releases from INEEL 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 such that they effectively surround the Site, are located near facilities, and account for the direction of the prevailing winds. They can be activated remotely, which allow for focused sampling without endangering Site workers. Because most events are short term, ambient air is sampled for 24 hours in order to obtain the airflow through the samplers required to obtain the desired detection levels for specific radionuclide measurements. Because these samplers are not weather-hardened, they are used only during the wildland fire season from May through September. These samplers will be upgraded in the future so that they can be used year-round.

The M&O 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 INEEL.

6.1.2 Argonne National Laboratory-West

ANL-W has an Emergency Management Plan as part of their Environmental Monitoring Program Plan (ANL-W 2003), which addresses emergency, spill, and injury notification and response. Spills or releases greater than a preset reportable quantity are reported to ANL-W management and to DOE via the Occurrence Reporting Process System. Small-scale spills can be handled by personnel directly involved only if the spills can safely be contained at the site, the personnel are trained to respond, and responding to the spill would not put the personnel in danger.

In the event of a radioactive release, ANL-W would use the external radiation monitors located at the four corners of the facility and additional M&O contractor radiation monitors to evaluate potential radiation doses.

6.1.3 British Nuclear Fuels Limited, Inc.

Spills or releases greater than a preset reportable quantity are reported to the INEEL Spill Notification Team. In addition, BNFL, Inc. has a *Spill Response Procedure* (BNFL, Inc. 2003) and an *AMWTP Emergency Plan/RCRA Contingency Plan* (BNFL, Inc. 2002b).

BNFL, Inc. has installed ANSI N13.1-1999-compliant monitors with alarms on two stacks at the Advanced Mixed Waste Treatment Facility. If the stack monitors alarm, BNFL, Inc. will respond using a graded approach to minimize the release by switching filter banks and/or shutting down the processes.

6.1.4 Naval Reactors Facility

NRF has an *Emergency Planning Manual* (NRF 1012) that addresses emergency, spill, and injury notification and response.

6.1.5 State of Idaho INEEL Oversight Program

The state of Idaho INEEL OP has high-volume air sampling equipment available to supplement routine monitoring data and provide timely insight to the quantity of radioactive materials released to the environment from an unplanned release. The INEEL OP has different air samplers available for the collection of particulate matter and gaseous radioactive iodine that may be released to the atmosphere during upset conditions.

Data from electret ion chambers and high-pressure ion chambers operated by the INEEL OP can be used to support emergency management decisions during upset or emergency conditions at INEEL facilities. Additionally, the INEEL OP has radiological survey instrumentation that can be used to assess radiological concerns of the public.

The INEEL OP may deploy field teams to obtain environmental samples used to verify computer dose projections and to evaluate EPA Protective Action Guidelines for the offsite public.

6.1.6 National Oceanic and Atmospheric Administration

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 each of the 33 ARLFRD tower locations operated by NOAA. These samplers are intended for use in the event of a radiological accident at the INEEL, and are therefore not used for routine environmental monitoring. They can be turned on and off remotely upon request from DOE Idaho by an operator stationed in Idaho Falls at ARLFRD.

6.2 Response to an Exceedence

The M&O contractor, ANL-W, BNFL, Inc., and NRF all maintain their own plans or procedures to ensure that appropriate and timely notifications and corrective actions are taken in the event that monitoring results exceed a regulatory limit or, in some cases, a preset trigger level. These plans or procedures are summarized in Table 6-1. For monitoring data taken in support of compliance objectives, specific actions to be taken if validated monitoring results are above certain trigger levels are identified in the applicable permits and regulations (e.g., RCRA, WLAP, SDWA). 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 DOE Order 231.1A, which establishes reporting requirements and categorizes releases of radionuclide and hazardous substances or regulated pollutants. General steps to be taken for responding to an environmental data exceedance in

Table 6-1. Summary of existing plans and procedures for responding to monitoring data exceedences.

	Effluent			Surveillance						
Organization	Airborne	Liquid	Storm Water	Ambient Air	Drinking Water	Ground Water	Surface Water	Soil	Biota	External Radiation
M&O contractor[a]	Title V Permit Application (INEEL 2001a)	INEEL Liquid Effluent Monitoring Program Plan (PLN-729, 2003)	INEEL Storm Water Monitoring Program Plan (PLN-731, 2003)	Environmental Surveillance Program Plan (PLN-720, 2003)	INEEL Drinking Water Program Plan (PLN-730, 2004)	INEEL Groundwater Monitoring Program Plan (PLN-1305, 2003)	Environmental Surveillance Program Plan (PLN-720, 2003)	Environmental Surveillance Program Plan (PLN-720, 2003)	Environmental Surveillance Program Plan (PLN-720, 2003)	Environmental Surveillance Program Plan (PLN-720, 2003)
ANL-W	Title V Permit Application (INEEL 2001a)	Chapter 2, Media Protection Plans, of ANL-W Environmental Monitoring Program Plan (ANL-W 2003)			Chapter 2, Media Protection Plans, of ANL-W Environmental Monitoring Program Plan (ANL-W 2003)	Chapter 2, Media Protection Plans, of ANL-W Environmental Monitoring Program Plan (ANL-W 2003)		Chapter 2, Media Protection Plans, of ANL-W Environmental Monitoring Program Plan (ANL-W 2003)	Chapter 2, Media Protection Plans, of ANL-W Environmental Monitoring Program Plan (ANL-W 2003)	Chapter 2, Media Protection Plans, of ANL-W Environmental Monitoring Program Plan (ANL-W 2003)
BNFL, Inc.	Conduct of Operations Occurrence Reporting, BNFL-5232-MP-COPS-9.6									
NRF	Title V Permit Application (INEEL 2001a)	NRF Environmental Monitoring Program Manual (NRF 2003a)			NRF Environmental Monitoring Program Manual (NRF 2003a)	NRF Environmental Monitoring Program Manual (NRF 2003a)		NRF Environmental Monitoring Program Manual (NRF 2003a)	NRF Environmental Monitoring Program Manual (NRF 2003a)	NRF Environmental Monitoring Program Manual (NRF 2003a)

a. Does not include CERCLA-related plans or procedures.

order to ensure that coordinated actions are taken and INEEL stakeholders are notified in a timely manner include:

- Discover, confirm, and make initial notification
- Categorize environmental data exceedance
- Determine and initiate appropriate response
- Complete necessary reporting and notification.

7. REPORTS

General reporting requirements for effluent monitoring and environmental surveillance activities at the INEEL are outlined in DOE Order 231.1A, "Environment, Safety and Health Reporting," and DOE Order 5400.5, "Radiation Protection of the Public and the Environment." 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.

The principal objectives of DOE's reporting system, as stated in *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* (DOE/EH-0173T), are to:

- Alert DOE management to occurrences for the purpose of investigation and evaluation of 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 the improvement of 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.

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. Table 7-1 lists the INEEL effluent monitoring and environmental surveillance publications and includes a summary description and report frequency for each publication.

7.1 Reporting Requirements

Reporting requirements for each monitoring organization are briefly summarized in the following subsections.

7.1.1 Management and Operating Contractor

The current prime INEEL M&O contractor is responsible for reporting requirements associated with:

- Site-wide air permits required for compliance with the Clean Air Act (Public Law 91-604) and with "Rules for the Control of Air Pollution in Idaho" (IDAPA 58.01.01)
- Permits required for compliance with city of Idaho Falls Sewer Ordinance (City Order 1994)
- Permits required for compliance with "Water Quality Standards and Waste Water Treatment Requirements" (IDAPA 58.01.02)

Table 7-1. Effluent monitoring and environmental surveillance reports at the INEEL.

Report Title	Frequency	Summary Description
Annual Site Environmental Report	Annual	Summarizes DOE, USGS, and contractor data from environmental surveillance activities and data from effluent monitoring programs. Includes a yearly environmental compliance summary for INEEL.
National Emissions Standard for Hazardous Air Pollutants – INEEL Report for Radionuclides	Annual	Summarizes INEEL radioactive airborne emissions and provides a calculated estimate of the maximum individual dose to a member of the public.
INEEL Offsite Environmental Surveillance Program Reports	Quarterly	Reports results of offsite surveillance under the ESER Program, including air, agricultural, external radiation, soil, water, and wildlife sampling.
State of Idaho INEEL Oversight Program Environmental Surveillance Program Reports	Quarterly	Presents quarterly environmental data results and associated quality assurance data.
	Annual	Summarizes trends in environmental data and compares data collected by the INEEL Oversight Program, contractors, and the USGS for selected sample locations.
Injection Well Monitoring Reports	As required	Provides the analytical results from monitoring of storm water runoff discharged to injection wells.
NRF Environmental Monitoring Report	Annual	Describes the NRF environmental monitoring practices and results for each calendar year.
NRF Environmental Summary Report	Every 3 years	Provides background information, such as past and present operations, the geologic and hydrologic nature of the NRF, and assesses environmental impacts of NRF operations.
Semi-Annual Report for the RCRA Post Closure Permit for the Waste Calcining Facility at INTEC	Semiannual	Summarizes the analytical results from RCRA groundwater monitoring conducted for the Waste Calcining Facility Post Closure Permit.
Fiscal Year Environmental Monitoring Report for the RWMC	Annual	Summarizes monitoring data from the air, waste zone, vadose zone, and aquifer in and around the RWMC.
USGS Open-File and Water-Resources Investigations Reports	Every 3 years	Summarizes USGS data, describes hydrologic conditions and distribution of selected constituents in groundwater and surface water in and around the INEEL.
Wastewater Land Application Site Performance Reports for the INEEL	Annual	Reports required information for each permitted Wastewater Land Application Permit facility to include (a) all permit monitoring data (b) status of any permit special compliance conditions, (c) interpretive discussions of monitoring data with particular respect to environmental impacts by the facility.
Monthly and Semiannual Liquid Effluent Reports to city of Idaho Falls	Monthly and Semiannual	Monthly pH logs and semiannual monitoring reports from the IRC effluent to the city of Idaho Falls sewer system.
Storm Water Discharge Monitoring Reports	As required	Reports storm characteristic information and all analytical results from NPDES permit monitoring.
CERCLA 5-Year Review Reports	Every 5 years	Reports overall effectiveness of remedial actions covered by a CERCLA ROD.
CERCLA Post-Record of Decision Monitoring Reports	As specified in ROD	Summarizes data collected in support of remedial actions and long-term monitoring.

- National Pollutant Discharge Elimination System (NPDES)-required Storm Water Multi-Sector General Permit for Industrial Activities (63 FR 189)

- Permits required for compliance with "Rules for the Construction and Use of Injection Wells" (IDAPA 37.03.03)

- Site-wide permits and records required under the Resource Conservation and Recovery Act, Toxic Substance Control Act, Emergency Planning and Community Right-to-Know Act, and Federal Insecticide, Fungicide, and Rodenticide Act

- CERCLA-required environmental monitoring.

Surveillance and effluent monitoring data and environmental compliance activities are summarized in the Annual Site Environmental Report. Monitoring results are also available electronically at http://cleanup.inel.gov/monitoring.

7.1.2 Argonne National Laboratory-West

Radioactive airborne emissions are documented in the annual INEEL-wide NESHAP report. Groundwater monitoring data are reported in accordance with the WAG 9 OU 9-04 ROD. Surveillance and effluent monitoring data and environmental compliance activities are summarized in the Annual Site Environmental Report.

7.1.3 British Nuclear Fuels Limited, Inc.

Airborne effluent emissions from AMWTP activities are reported in the annual INEEL-wide NESHAP report. Airborne effluent monitoring data and environmental compliance activities are summarized in the Annual Site Environmental Report.

7.1.4 Naval Reactors Facility

Results of the NRF radiological and nonradiological environmental monitoring programs are reported in an NRF Environmental Monitoring Report and an NRF Environmental Summary Report. The monitoring report is published annually, and the summary report is published every 3 years. Both are available to the public at the INEEL Public Reading Room in Idaho Falls. The annual monitoring reports contain a conservative assessment of radiation exposure to the general public as a result of NRF operations. The 3-year summary reports provide background information, such as past and present operations, the geologic and hydrologic nature of the NRF, and assess environmental impacts of NRF operations.

Radioactive airborne emissions are documented in the annual INEEL-wide NESHAP report. Groundwater and soil gas monitoring are reported in accordance with the WAG 8 ROD. Surveillance and effluent monitoring data and environmental compliance activities are summarized in the Annual Site Environmental Report.

7.1.5 Environmental Surveillance, Education and Research Program

The ESER Program prepares the Annual Site Environmental Report, with input from the various organizations performing environmental monitoring on and around the INEEL. The annual report is available electronically and summarizes data from effluent monitoring programs and from

environmental surveillance activities, and includes a yearly environmental compliance summary for the INEEL.

The ESER Program prepares quarterly reports summarizing offsite surveillance results and distributes them electronically. Other topical reports summarizing trends in data for a particular medium or dealing with other environmental surveillance subjects are produced periodically.

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

7.1.6 United States Geological Survey

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

7.1.7 State of Idaho INEEL Oversight Program

Monitoring results are summarized in quarterly data reports and in an annual Environmental Surveillance Report. The quarterly reports include the most recent data collected. The annual report presents a summary of environmental data, including trends and results of data comparisons between the state of Idaho INEEL OP, contractors, and the USGS. These reports are available on the Internet at http://www.oversight.state.id.us/about/index.htm.

7.1.8 National Oceanic and Atmospheric Administration

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. These data receive nearly continuous surveillance 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 (DOE/EH-0173T).

Specific climatological data from the Idaho Environmental Monitoring Program are available in real time to the public electronically (http://www.noaa.inel.gov/projects/iemp). ARLFRD data specific to the INEEL are available in near real time electronically at http://www.noaa.inel.gov/windvector/.

Results of past work are summarized in *Climatography of the Idaho National Engineering Laboratory* (Clawson, Start, and Ricks 1989), and *Idaho National Engineering Laboratory Historical Dose Evaluation* (DOE-ID 1991b).

7.1.9 Shoshone-Bannock Tribes

Data from the air monitoring station operated by the Shoshone-Bannock Tribes at Fort Hall are reported in the state of Idaho INEEL OP quarterly environmental surveillance data reports.

8. QUALITY ASSURANCE

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

The primary policy, requirements, and responsibilities for the establishment and maintenance of plans and actions that ensure quality assurance in DOE activities are provided in DOE Order 414.1A, "Quality Assurance," and 10 CFR 830.120, "Quality Assurance Requirements." The "Quality Assurance Requirements for Nuclear Facility Applications" (ASME NQA-1-2004) is the preferred standard for activities at nuclear facilities. Additionally, a quality assurance program in accordance with 40 CFR 61, Appendix B, Method 114 is required for all radiological air emission sources continuously monitored for compliance with NESHAP.

EPA policy on QA plans is based on the national consensus standard "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs" (ANSI/ASQC E4-1994). 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 needs of the data users and the purpose for which the data are generated. *EPA Requirements for Quality Assurance Project Plans* (EPA 2001) 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 Quality Assurance Requirements

The following subsections describe how each monitoring organization implements the above quality assurance requirements.

8.1.1 Management and Operating Contractor

The M&O contractor integrates applicable requirements from the *Quality and Requirements Management Program Documents* (INEEL QA Dept. 2003) into the implementing monitoring program plans and procedures for non-CERCLA monitoring activities. The program plans address the QA elements of EPA QA/R-5 (EPA 2001) to ensure that the required standards of data quality are met.

All CERCLA monitoring activities at the INEEL are conducted in accordance with the *Quality Assurance Project Plan for Waste Area Groups 1, 2, 3, 4, 5, 6, 7, 10 and Deactivation, Decontamination, and Decommissioning,* (QAPjP; DOE-ID 2004). The QAPjP includes procedures designed to ensure sample integrity, precision, and accuracy in the analytical results and to ensure representativeness and completeness of environmental data. The QAPjP was written to meet the requirements of *EPA*

Requirements for Quality Management Plans (EPA 2001) and *EPA Guidance for Quality Assurance Project Plans* (EPA 1998).

Quality control activities for the field and the laboratory include, but are not limited to, the use of blanks, duplicates, performance evaluation samples, and laboratory control samples. The Sample and Analysis Management Program oversees audits of laboratories that analyze environmental monitoring samples taken by the M&O contractor.

8.1.2 Argonne National Laboratory-West

The ANL-W Quality Assurance Program Plan (Chapter 5, ANL-W 2003) establishes a QA program for all the elements of their environmental monitoring program and describes quality assurance and quality control actions performed to ensure monitoring and protection activities are of sufficient quality to meet applicable regulations and requirements. The ANL-W Quality Assurance Program Plan is structured to address the 10 quality management system criteria of 10 CFR 830 and DOE Order 414.1A.

8.1.3 British Nuclear Fuels Limited, Inc.

BNFL, Inc. maintains a quality assurance program in accordance with 40 CFR 61, Appendix B, Method 114, as required of all radiological air emission sources continuously monitored for compliance with NESHAPs. The QA requirements are documented in *Quality Assurance Project Plan for the WMF 676 NESHAPs Stack Monitoring System* (BNFL, Inc. 2004).

8.1.4 Naval Reactors Facility

The NRF environmental monitoring program has an extensive quality assurance program plan, which provides a detailed outline for data quality objectives, program organization, data and sample management, analytical procedures, program training and safety, audits, and data validation (NRF 2003a). The NRF Chemistry Laboratory performs radiological measurements of soil, vegetation, water, sediment, and air samples. This laboratory participates in the DOE Environmental Measurements Laboratory Quality Assessment Program.

8.1.5 Environmental Surveillance, Education and Research Program

The ESER Program maintains a quality assurance program consistent with the requirements of 10 CFR 830 and DOE Order 414.1A that is implemented through the *Quality Management Plan for the Environmental Surveillance, Education and Research Program* (ESER 2001). The *Quality Assurance Project Plan for the INEEL Offsite Environmental Surveillance Program* (ESER 2002b) provides additional quality assurance requirements for surveillance activities. Analytical laboratories used by the ESER Program maintain their own quality assurance programs consistent with DOE requirements.

8.1.6 United States Geological Survey

The USGS *Field Methods and Quality Assurance Plan for Quality-of-Water Activities* (USGS 2003) 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 of the water-quality data
- Compatibility of the data with data collected by other organizations at the INEEL

- That data meet the programmatic needs of the DOE and its contractors and the scientific and regulatory communities.

The USGS conducts performance audits of the analytical laboratories that analyze their environmental monitoring samples.

8.1.7 State of Idaho INEEL Oversight Program

The state of Idaho INEEL OP's "Quality Assurance Program Plan" is part of the state's *Environmental Monitoring Plan* (State of Idaho 2003). It is intended to ensure the quality of data collected by the INEEL OP is suitable for drawing accurate conclusions. The plan was designed based on the format given as guidance by the EPA (EPA Order 5360) and the Department of Environmental Quality's *Quality Management Plan* (State of Idaho 2001).

All laboratories that analyze environmental samples for the INEEL OP must submit a quality assurance plan for review and approval. In addition, the INEEL OP uses an independent laboratory for radiological analysis.

8.1.8 National Oceanic and Atmospheric Administration

A quality assurance plan (NOAA-ARLFRD 1993) addresses the requirements of DOE Order 414.1A, "Quality Assurance," and is consistent with ASME NQA-1-2004. 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 INEEL Meteorological Monitoring Network meets the elements of DOE/EH-0173T.

All the meteorological sensors in the ARLFRD tower network are inspected, serviced, and calibrated semiannually as recommended by American Nuclear Society guidelines (ANSI/ANS-3.11-2000). 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 M&O contractor, NRF, and ANL-W are audited by the Department of Energy's Environmental Management Consolidated Audit Program. This program utilizes trained and certified personnel to perform in-depth audits of subcontract laboratories to review the following:

- 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 posted on the Environmental Management Consolidated Audit Program Web site. Laboratories are required to provide corrective action plans for audit findings.

9. RADIOLOGICAL DOSE EVALUATION

Potential radiological doses to the public from INEEL operations are evaluated to determine compliance with pertinent regulations and limits. Two different computer codes are used to estimate doses. The effective dose equivalent (EDE) for a maximally exposed individual to INEEL airborne releases of radionuclides is calculated annually and documented in an annual INEEL-wide NESHAP report. The annual dose to the public for the maximally exposed individual and the collective 80-kilometer (50-mile) population, and the biota dose are estimated annually and documented in an Annual Site Environmental Report.

9.1 Maximum Individual Dose—Airborne Emissions Pathway

The total EDE to an individual member of the public is calculated from airborne emission sources across the INEEL to demonstrate compliance with Subpart H of 40 CFR 61, DOE Order 450.1, and DOE Order 5400.5. 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 in any year an EDE of 10 millirem per year. 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 impacted by DOE operations and by which DOE 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 INEEL remain too small to be measured by available monitoring techniques, the dose to the public from INEEL operations is calculated using the reported amounts of radionuclides released from the INEEL facilities and EPA-approved air dispersion codes. Compliance to Subpart H of 40 CFR 61 is demonstrated primarily through the use of the CAP-88 computer code (EPA 1990). The mesoscale diffusion (MDIFF) air dispersion model (Sagendorf, Carter, and Clawson 2001) was developed by NOAA to evaluate dispersion of pollutants in arid environments such as those at the INEEL and is used to comply with DOE Order 450.1.

9.1.1 CAP-88 Dose Evaluation

Use of the CAP-88 computer code is required by the EPA to demonstrate compliance with the Clean Air Act (Public Law 91-604). Using the CAP-88 code and information on the reported amounts of radionuclides released from the INEEL facilities, the EDE to the maximally exposed individual is estimated. CAP-88 uses dose and risk tables developed by the EPA and does not include shielding by housing materials, but it 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 INEEL. 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 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 MDIFF Dose Evaluation

ARLFRD developed and maintains a puff dispersion model called MDIFF to estimate radiological pollutant emissions from the INEEL. Results of the MDIFF evaluations for the maximally exposed individual are used to show compliance with DOE Order 450.1 because they offer a more realistic dose estimate for the INEEL than that from the CAP-88 code. The dispersion algorithms within the code are

derived in part from field data collected at the INEEL, and the puff transport is driven by the wind data from the ARLFRD tower network. MDIFF is capable of estimating radiological doses, and it 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 INEEL.

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 INEEL. It is widely used to support Site operations and is a major part of ARLFRD's support to the INEEL Emergency Operations Center.

9.2 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 INEEL is determined from the MDIFF evaluations and information on the population within 50 mi of an INEEL facility. Results of the MDIFF population dose evaluations are used to show compliance with DOE Order 450.1. 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 maximally exposed individual 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 of the isotopes is not calculated during transport over distances greater than that to the maximally exposed individual. 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 occasional ingestion of meat from game animals take into account that waterfowl may reside briefly at the various waste disposal ponds on the INEEL and that game birds and other game animals may reside on or migrate across the INEEL. Based on the highest concentrations of radionuclides in waterfowl or game animals sampled from the INEEL, the potential dose is estimated.

A graded approach is used to evaluate the potential dose to aquatic and terrestrial biota from contaminated soil and water (DOE-STD-1153-2002). 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. Guidance for applying the graded approach at the INEEL on a Site-wide level has been developed (Morris 2003).

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