DOE/ID-10783
Revision 2
March 2003

U.S. Department of Energy
Idaho Operations Office

Long-Term Monitoring Plan for Operable Unit 3-13, Group 5, Snake River Plain Aquifer

INEEL
Home of Science and Engineering Solutions
Idaho National Engineering and Environmental Laboratory

DOE/ID-10783
Revision 2

Long-Term Monitoring Plan for Operable Unit 3-13, Group 5, Snake River Plain Aquifer

March 2003

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

ABSTRACT

This plan, along with the *Quality Assurance Project Plan for Waste Area Group 1, 2, 3, 4, 5, 6, 7, 10, and Inactive Sites*, DOE/ID-10587, comprise the Groundwater Monitoring Plan for the Operable Unit 3-13, Group 5, Snake River Plain Aquifer. The sampling and monitoring activities discussed include groundwater sampling (both above and below the HI interbed) and monitoring of groundwater elevations. The data are being collected to determine the effectiveness of the Operable Unit 3-13, Group 5, Snake River Plain Aquifer remedial action.

CONTENTS

FIGURES

TABLES

ACRONYMS

BBWI	Bechtel BWXT Idaho, LLC
bgs	below ground surface
BLR	Big Lost River
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
COC	contaminant of concern
DOE	Department of Energy
DOE-ID	Department of Energy Idaho Operations Office
DOT	Department of Transportation
DQO	data quality objective
DS	decision statement
EPA	Environmental Protection Agency
ER	environmental restoration
ERIS	Environmental Restoration Information System
ES&H	environment, safety, and health
ES&H/QA	environment, safety, and health/quality assurance
FFA/CO	Federal Facility Agreement and Consent Order
FSP	Field Sampling Plan
FTL	field team leader
FUM	facilities, utilities, and maintenance
HASP	Health and Safety Plan
HDR	Hydrogeologic Data Repository
HSO	health and safety officer
ICPP	Idaho Chemical Processing Plant
ID	identification

IDHW	Idaho Department of Health and Welfare
IEDMS	Integrated Environmental Data Management System
IH	industrial hygienist
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
JRC	job requirements checklist
JSS	job site supervisor
LAV	limitation and validation
LTMP	Long-Term Monitoring Plan
M&O	management and operation
MCL	maximum contaminant level
MSIP	Monitoring System and Installation Plan
MW	monitoring well
NEPA	National Environmental Policy Act
OSHA	Occupational Safety and Health Administration
OU	operable unit
PM	project manager
PPE	personal protective equipment
PRD	program requirements directives
PSQ	principal study question
PW	perched water
QA	quality assurance
QAPjP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
QC	quality control
RAO	remedial action objective

RCT	radiological control technician
RD/RA	remedial design/remedial action
RG	remedial goals
RI/BRA	remedial investigation/baseline risk assessment
RI/FS	remedial investigation/feasibility study
RML	Radiation Measurements Laboratory
ROD	Record of Decision
SAD	site area director
SAM	Sample and Analysis Management
SAP	Sample and Analysis Plan
SC	safety coordinator
SDG	sample delivery group
SH&QA	safety, health, and quality assurance
SNF	spent nuclear fuel
SOW	Statement of Work
SRPA	Snake River Plain Aquifer
STL	sample team lead
TRA	Test Reactor Area
USGS	United States Geological Survey
WAG	waste area group
WGS	Waste Generator Services
WMP	Waste Management Plan

Long-Term Monitoring Plan for Operable Unit 3-13, Group 5, Snake River Plain Aquifer

1. INTRODUCTION

The Idaho National Engineering and Environmental Laboratory (INEEL) is divided into 10 waste area groups (WAGs) to manage environmental operations mandated under the Federal Facilities Agreement and Consent Order (FFA/CO) (DOE-ID 1991). The Idaho Nuclear Technology and Engineering Center (INTEC), formerly the Idaho Chemical Processing Plant (ICPP), is designated as WAG 3. Operable Unit (OU) 3-13 encompasses the entire INTEC facility.

The OU 3-13 was investigated to identify potential contaminant releases and exposure pathways to the environment from individual sites as well as the cumulative effects of related sites. Ninety-nine release sites were identified in the OU 3-13 Remedial Investigation/Feasibility Study (RI/FS), of which 46 were shown to have a potential risk to human health or the environment (DOE-ID 1997a). A new OU, OU 3-14, was created to specifically address activities at the tank farm area where special actions will be required. The 46 sites were divided into seven groups based on similar media, contaminants of concern (COCs), accessibility, or geographic proximity. The OU 3-13 Record of Decision (ROD) (DOE-ID 1999) identifies remedial design/remedial action (RD/RA) objectives for each of the seven groups. The seven groups are

Group 1	Tank Farm Soils
Group 2	Soils Under Buildings and Structures
Group 3	Other Surface Soils
Group 4	Perched Water
Group 5	Snake River Plain Aquifer
Group 6	Buried Gas Cylinders
Group 7	SFE-20 Hot Waste Tank System.

The final ROD for OU 3-13 was signed in October 1999 (DOE-ID 1999). This comprehensive ROD presents the selected remedial actions for the above groups and specifically provides for Group 5 groundwater monitoring to assess contaminant flux into the Snake River Plain Aquifer (SRPA) from within the INTEC facility.

1.1 Purpose

The purpose of this Long-Term Monitoring Plan (LTMP) is to guide the collection and analysis of groundwater samples and data to support the Group 5 OU 3-13 SRPA monitoring at the INTEC and downgradient of the INTEC. Development of the LTMP was based on the data requirements identified in the OU 3-13 ROD.

This LTMP, combined with the Quality Assurance Project Plan (QAPjP) (DOE-ID 2002a), form the Sampling and Analysis Plan (SAP). They are two of the documents that comprise the Monitoring System Implementation Plan (MSIP) (DOE-ID 2002b). The MSIP contains additional Group 5 project documentation, including the Plume Field Sample Plan (FSP) (DOE-ID 2002c), the Waste Management Plan (WMP) (DOE-ID 2003), the Health and Safety Plan (HASP) (INEEL 2003), the Data Management Plan (DOE-ID 2000) as well as other documentation including the Quality Level Designation (DOE-ID 2002b, Appendix I), the Spill Prevention/Response Plan (DOE-ID 2002b, Appendix K), and the Storm Water Pollution Prevention Plan (DOE-ID 2002b, Appendix M).

1.2 Scope

The WAG 3 ROD establishes two remediation goals for the aquifer: (1) "preventing current onsite workers and nonworkers during the institutional control period from ingesting contaminated drinking water above the applicable State of Idaho groundwater standards or risk-based groundwater concentrations," and (2) "in 2095 and beyond, ensure that SRPA groundwater does not exceed a cumulative carcinogenic risk of 1×10^{-4} a total hazard index of 1; or applicable State of Idaho groundwater quality standards" (ROD, Sec. 8, p 8-3) (DOE-ID 1999). The first remediation goal will be met by maintaining institutional control over the area of the identified SRPA contaminant plume south of the current INTEC security fence for as long as contaminant levels remain above groundwater standards or risk-based groundwater concentrations. The second remediation goal will be met by long-term monitoring unless remedial action is found to be necessary.

The purpose of this LTMP and the related project is to collect data for use in determining if the WAG 3 ROD goal for aquifer water quality in the year 2095 will be met. The investigation will (1) conduct long-term monitoring of the INTEC groundwater plume outside the INTEC fence line, (2) monitor the COC flux migrating from INTEC to outside the INTEC fence, (3) determine if the sediment and/or sludge that may exist in the vicinity of the former INTEC injection well is acting as a source of COC flux to the aquifer, and (4) provide the above data to update the OU 3-13 aquifer numerical model, which will provide more accurate COC concentration predictions for the year 2095. The data will be used in a three-step decision process to determine actions under the OU 3-13 ROD (DOE-ID 1999).

A logic diagram showing the scope of activities associated with Group 5 is presented in Figure 1-1.

1.3 Regulatory Background

In October 1999, the ROD was issued for OU 3-13, which includes the INTEC perched and groundwater systems (DOE-ID 1999). The remedial actions chosen in the ROD are in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980 as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986. In addition, remedies comply with the National Oil and Hazardous Substances Pollution Contingency Plan (EPA 1990) and are intended to satisfy the requirements of the FFA/CO.

The Department of Energy Idaho Operations Office (DOE-ID) is the lead agency for remedy decisions. The Environmental Protection Agency (EPA) Region 10 and the Idaho Department of Health and Welfare (IDHW) approve these decisions.

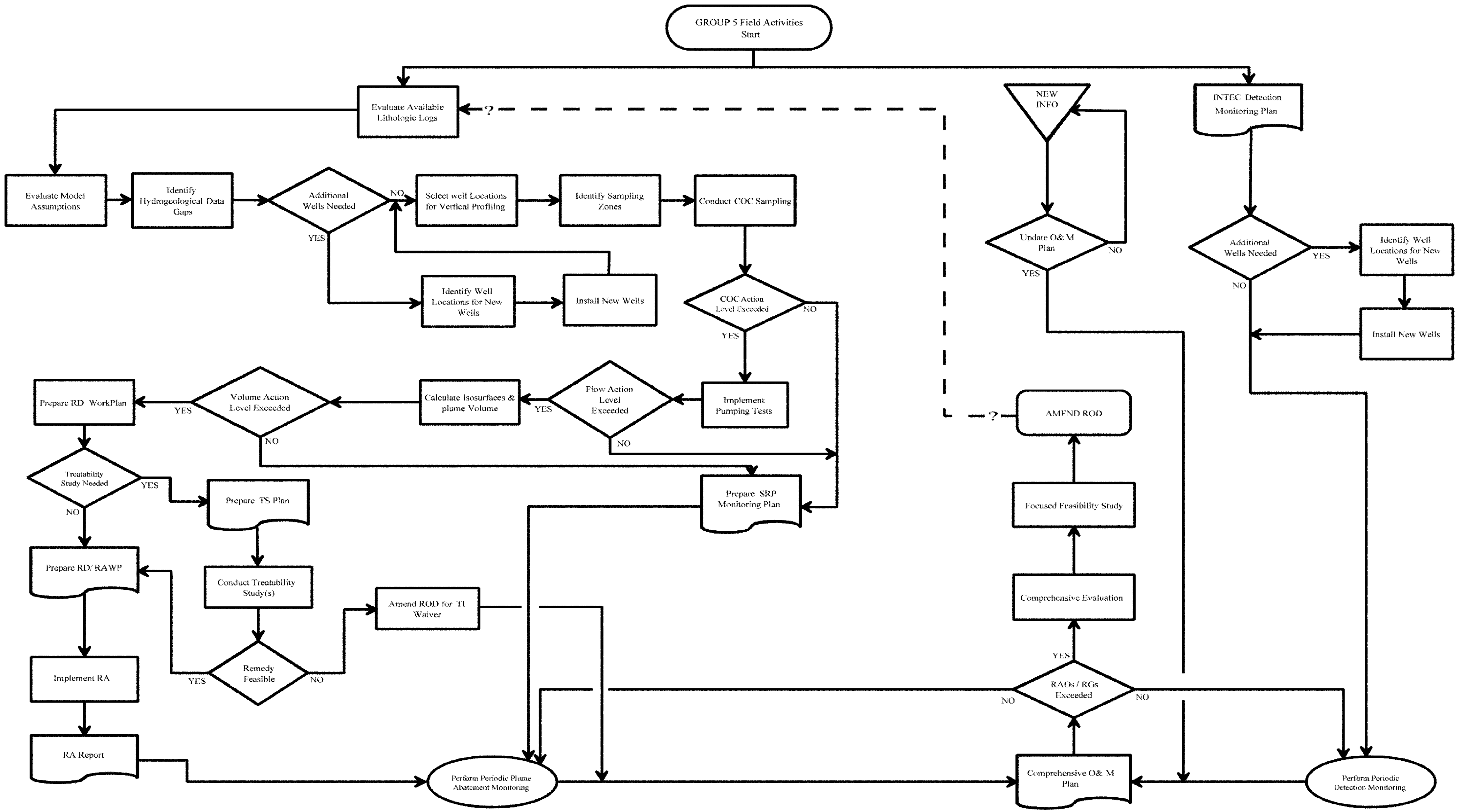

Figure 1-1. Logic diagram for Group 5 field activities.

1.4 Document Organization

The LTMP is organized to facilitate understanding and maximize its usefulness to the field sampling team. The organization is as follows:

- Site description and background
- Group 5 DQOs
- Discussion of types of sampling to be conducted, including groundwater monitoring, groundwater level measurements, and the types of analyses to be performed and determination of sample locations and frequency on the basis of available data (such as, well construction/completion, historical water level data, historical water quality data, and other relevant considerations)
- Description of all sampling and monitoring procedures and equipment to be used
- Sample control considerations
- Quality assurance (QA) requirements
- Data management, analysis, and unusual occurrences
- Project organization and responsibilities
- Waste management considerations
- Health and safety requirements
- Document management.

2. SITE DESCRIPTION AND BACKGROUND

The INEEL is a government-owned facility managed by the United States Department of Energy (DOE). The eastern boundary of the INEEL is located 52 km (32 mi) west of Idaho Falls, Idaho. The INEEL site occupies approximately 2,305 km^2 (890 mi^2) of the northwestern portion of the Eastern Snake River Plain in southeast Idaho. The INTEC facility covers an area of approximately 0.39 km^2 (0.15 mi^2), and is located approximately 72.5 km (45 mi) from Idaho Falls, in the south-central area of the INEEL as shown in Figure 2-1.

The INTEC has been in operation since 1952. The plant's original mission was to reprocess uranium from defense related projects and to research and store spent nuclear fuel (SNF). The DOE phased out the reprocessing operations in 1992 and redirected the plant's mission to (1) receipt and temporary storage of SNF and other radioactive wastes for future disposition, (2) management of current and past wastes, and (3) performance of remedial actions.

The liquid waste generated from the past reprocessing activities is stored in an underground tank farm. The INTEC tank farm consists of eleven 1,135,624-L (300,000-gal) tanks, four 113,562-L (30,000-gal) tanks, four 68,137-L (18,000-gal) tanks, and associated equipment for the monitoring and control of waste transfers and tank parameters. One of the 1,135,624-L (300,000-gal) tanks is empty and serves as a spare tank in the event of an emergency. The majority of wastes stored in the tank farm are raffinates generated during the first-, second-, and third-cycle fuel extraction processes. These wastes include high-level wastes that are composed of first-cycle raffinates and intermediate-level wastes that are composed of second- and third-cycle raffinates blended with concentrated bottoms from the process equipment waste evaporator. This liquid waste continues to be treated by a calcining process to convert the waste into a more stable form and reduce the waste volume.

Numerous CERCLA sites are located in the area of the tank farm and adjacent to the process equipment waste evaporator. Contaminants found in the interstitial soils of the tank farm are the result of accidental releases and leaks from process piping, valve boxes, sumps, and cross-contamination from operations and maintenance excavations. No evidence has been found to indicate that the waste tanks themselves have leaked. The contaminated soils at the tank farm comprise about 95% of the known contaminant inventory at INTEC. The final comprehensive RI/FS for OU 3-13 (DOE-ID 1997a, 1997b, and 1998) contains a complete discussion of the nature and extent of contamination.

The SRPA underlies the eastern Snake River Plain and has been designated by the EPA as a sole source aquifer for the region. The basalts and sedimentary interbeds underlying INTEC, where continually saturated, are part of the SRPA. The aquifer lies at a depth of about 137 m (450 ft) beneath the site. Regional groundwater flow is southwest at average estimated velocities of 1.5 m/day (5 ft/day). The average groundwater flow velocity at the INTEC is estimated at 3 m/day (10 ft/day) due to local hydraulic conditions. Hydraulic characteristics of the aquifer differ considerably from place to place depending on the saturated thickness and the characteristics of the basalts and sedimentary interbeds.

The source of contamination in the SRPA originates primarily from the injection well (CPP-23). However, contaminated soils and perched water are predicted to contribute to future SRPA contamination. The iodine-129 (I-129), strontium-90 (Sr-90), and plutonium isotopes were determined to be the only contaminants that pose an unacceptable risk to a hypothetical future resident beyond the year 2095. The primary I-129 source was the former injection well. The primary Sr-90 source(s) were the former injection well and the tank farm soils. The primary source of plutonium isotopes is the tank farm. The major human health threat posed by contaminated SRPA groundwater is exposure to radionuclides via ingestion by future groundwater users.

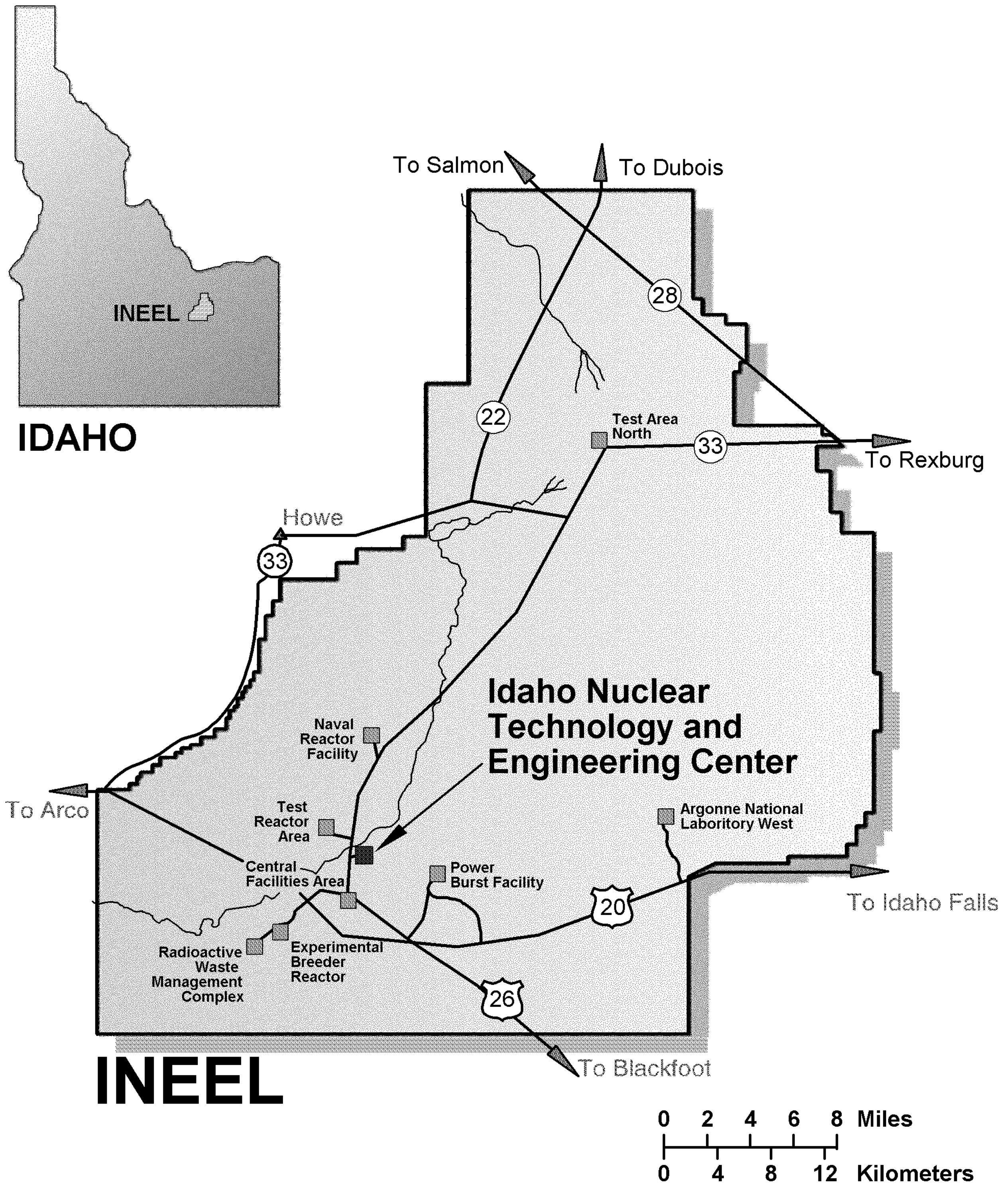

Figure 2-1. Map showing location of the INTEC at the INEEL.

Due to the uncertainty associated with the contaminant source estimates and potential releases from the tank farm soils, the remedial measures taken for the SRPA under OU 3-13 are designated as an interim action. The actions selected for the SRPA outside the current INTEC security fence are final actions. The evaluation and remedy selection for the SRPA inside the current INTEC security fence will occur under OU 3-14.

2.1 Conceptual Model

2.1.1 Geological and Hydrologic Setting

The INTEC northwest corner is approximately 46 m (150 ft) southeast of the Big Lost River (BLR) channel, which flows along the northwest border of the INTEC facility boundary. As with much of the BLR on the INEEL, the channel is typically dry at INTEC; however, the BLR flowed during most of 1997 and 1998. At land surface, as much as 18.2 m (60 ft) of surficial alluvium is composed of gravelly, medium- to coarse-grained sediment. This alluviual material overlies a series of basalt/sediment units where the basalt is very transmissive, and the sediment units are relatively thin, much less transmissive, and laterally discontinuous, as shown on Figure 2-2. Below a depth of roughly 137 m (450 ft), the basalts are more massive, with one primary sedimentary interbed (HI interbed) below the water table which occurs at a depth approximately 168 m (550 ft) beneath INTEC. These deeper units comprise the SRPA under and southwest of INTEC. Regional groundwater flow in the area of INTEC is affected by local recharge as well as by locally high permeability basalts. The average groundwater flow velocity beneath INTEC is about 3 m/day (10 ft/day). See Sections 2.3 and 2.4 for detailed discussions of the hydrogeologic and geologic settings of the vadose and saturated zones.

2.1.2 Recharge Sources

As an operating facility, there are several sources of aquifer recharge at INTEC that include natural sources such as precipitation, infiltration, and intermittent flows of the BLR, as well as anthropogenic water sources including the INTEC percolation ponds, sewage treatment ponds, lawn irrigation, and other miscellaneous sources. As this water infiltrates downward through the alluvium and the underlying transmissive basalts it is impeded by lenses of low permeability sediments and potentially by low permability basalt flows, creating local areas of higher water saturation or moisture content. In some instances, enough water is present in or on top of the sedimentary interbeds to form local perched water bodies (see Section 2.3).

The percolation ponds and the BLR are the primary sources of recharge to perched water, comprising about 91% of the total perched water recharge at the INTEC. The percolation ponds contribute about 70% of the total perched water recharge. Percolation Ponds 1 and 2 are located outside the INTEC southern security fence, southeast of CPP-603. The percolation ponds are unlined wastewater disposal ponds that were excavated in the surficial alluvium in 1982 and 1985. The BLR contributes about 21% of the total perched water recharge.

2.1.3 Contaminant Distribution and Transport

The SRPA has been contaminated by historical INTEC operational waste disposal activities. Release site CPP-23 (OU 3-02) consists of the former INTEC injection well, which was the primary means to dispose of service wastewater from 1952 to 1984 and is the primary source of contamination in the SRPA at INTEC (Fromm et al. 1994).

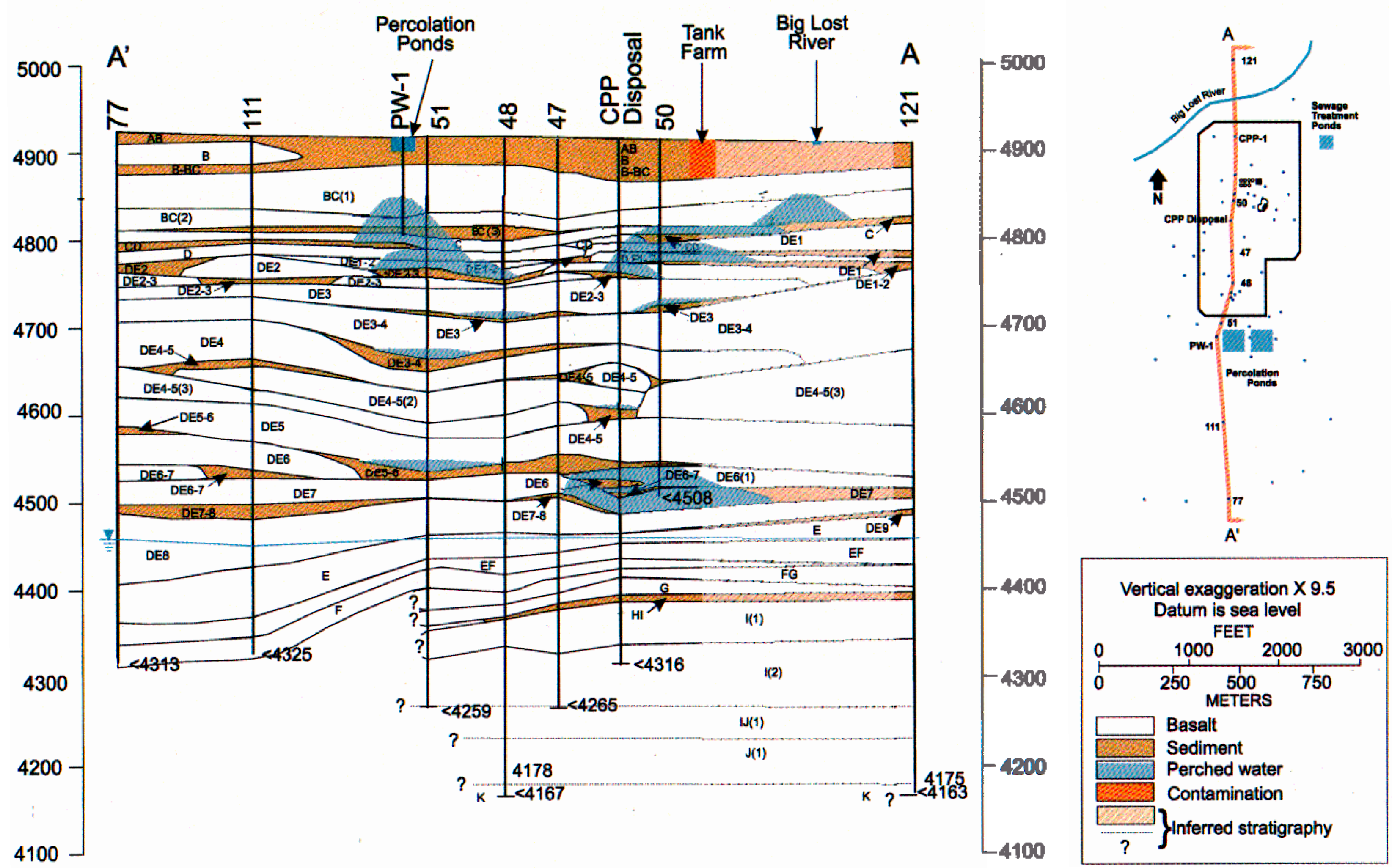

Figure 2-2. North-south cross-section through INTEC illustrating the perched water bodies, lithology, and water table of the SRPA.

In 1984, the well was removed from routine service and wastewater was subsequently discharged to the percolation ponds. After 1984, the well was used for emergency purposes in 1986 and was permanently sealed in 1989. In addition to the direct disposal of wastewater to the aquifer from the injection well, a second contaminant pathway to the SRPA is through the infiltration ponds at the surface through the vadose zone.

Radionuclides that were introduced into the aquifer from the former INTEC injection well include Pu-238, Pu-239, Pu-240, Sr-90, I-129, and tritium. Of these, tritium was the most common, comprising about 96% of the contaminant activity. At the time of injection, the radionuclides were generally below federally regulated levels. The injected wastewater also contained other (nonradioactive) chemicals including arsenic, chromium, mercury, and nitrates at concentrations below federal and state groundwater quality standards. Mercury, however, is estimated to exceed groundwater quality standards in the aquifer in the immediate vicinity of the former injection well but has not been detected in downgradient wells.

Contaminants are transported between contaminated surface soils and the SRPA by water infiltrating from the surface. Contaminants present in the recharge water and perched water in the upper portion of the vadose zone are primarily Sr-90 and tritium. Contamination in the lower portion of the vadose zone is different in composition and concentration than the upper zone. The lower vadose zone perched water was influenced and partially contaminated as a result of two events during which the INTEC injection well (CPP-23) collapsed and service wastewater was released into the vadose zone above the lower sediment units. Additional contamination in the lower perched water zone is the result of the transport of contaminants from the alluvial soils and upper perched water contamination. The lower vadose zone contamination includes Cs-137, Sr-90, I-129, plutonium, and mercury. Although contaminants are locally present in perched water, they are generally not available for consumption because of limited availability of that water. There are no water supply wells in the perched zone. Wells installed in the perched zone would not be capable of sustaining the pumping rates needed for future domestic water supplies, and as such, the perched water does not pose a direct human health threat, but impacts aquifer groundwater quality because it is a contaminant transport pathway between the contaminated surface soils and the SRPA.

Subsequent migration of these contaminants has produced several overlapping groundwater contaminant plumes, containing tritium, Sr-90, and I-129 currently occurring in groundwater beneath INTEC and extending downgradient for several miles. Short-lived (<30 year half-life) radionuclides, such as tritium, do not pose a long-term risk. Strontium is predicted to persist in the aquifer beyond 2095 at levels above the maximum contaminant level (MCL) if no action is taken. Iodine-129 has a very long half-life and is predicted in the WAG 3 RI/FS modeling to persist in the aquifer at concentrations exceeding MCLs.

2.2 Perched Water

Perched water bodies are significant because they increase the opportunity for contaminants to move both laterally and vertically in the vadose zone. This lateral water and contaminant movement in the vadose zone results in vertical migration rates that are spatially nonuniform beneath INTEC. Infiltration from the surface is assumed to move vertically through the basalt to an interbed. Because the interbeds are sloped, the water and contaminants migrate along the interbed and accumulate at interbed low points. This results in greater than average vertical water and contaminant fluxes in water accumulation areas and less than average vertical water and contaminant fluxes in the elevated portions of the interbed. Perched water bodies increase the complexity of flow and transport through the vadose zone.

Several zones of perched water have developed in the vadose zone as a result of site operations and natural recharge sources. The perched water bodies have been found in the following three zones in the subsurface:

1. The interface between the surface alluvium and the shallowest basalt flow.

2. An upper zone associated with the CD and DE3 interbeds at depths between 34 and 53 m (113 ft and 170 ft) below ground surface (bgs). This shallow zone is further subdivided into an upper shallow zone and a lower shallow zone.

3. A lower zone associated with the DE6 and DE8 interbeds at a depth of about 97 to 128 m (320 to 420 ft) bgs.

Figure 2-2 shows a geologic cross-section running from north to south through INTEC. The names of the basalt flows and interbeds are shown in the figure. Also depicted are locations where perched water is thought to exist. The perched water has varying degrees of radionuclide concentrations, with the northern upper perched zone showing the highest concentration levels.

2.2.1 Perched Water in Surficial Alluvium

In places with a concentrated source of surface recharge, a perched water zone can develop in the surficial alluvium on top of the first basalt flow. Perched water has been identified in the alluvium beneath the INTEC surface disposal ponds (the percolation ponds and the sewage treatment pond). A small perched water table in alluvium was encountered west of CPP-603. The source for the perched water west of CPP-603 was assumed to be wastewater that was discharged to a shallow seepage pit (Robertson et al. 1974).

Perched water in the surficial alluvium requires a concentrated source of recharge that exceeds the normal recharge provided by precipitation. Perched water has not been widely measured at the sediment-basalt interface beneath INTEC and is not believed to be present there.

2.2.2 Upper Perched Water Zone

The upper perched water zone occurs as several distinct water bodies, perching on several different sedimentary interbeds (see Figure 2-2). The upper portion of the shallow upper perched water body is above the CD and D interbeds. The lower portion of the upper perched water body is on the DE3 interbed. The CD interbed occurs at depths between 34 and 36 m (113 and 119 ft) bgs, the D interbed occurs at depths between 39 and 41 m (128 and 135 ft) bgs, and the DE3 interbed occurs at depths between 50 and 52 m (163 and 170 ft) bgs.

The upper perched water zone is frequently considered to be divided into northern and southern zones because it appears to be two discrete water bodies. Because the perched water boundaries are not well defined, the actual extent of the perched water bodies could be quite different than assumed. Even within the upper zones, the zones appear to occur as fragmented rather than continuous perched water bodies. The connections between the perched water bodies are not well understood. Based on the upper perched water configuration, it appears that multiple water sources are providing recharge to the upper perched water body in the northern portion of INTEC. These sources may include recharge from the BLR, the waste water treatment lagoons, and operational releases.

2.2.3 Lower Perched Water Zone

A deep perched water zone has been identified in the basalt between 98 and 128 m (320 and 420 ft) bgs. This was first discovered in 1956 when perched groundwater was encountered at a depth of 106 m (348 ft) while drilling well United States Geological Survey (USGS) -40 (Robertson et al. 1974) (see Figure 2-3). Since then, perched water has been encountered in this zone during the drilling of several INTEC facility wells.

Only four monitoring wells are completed in the deep perched water zone. Wells MON-P-001, MON-P-018, and USGS-50 are completed in the northern portion of the facility, and water has been encountered at approximately 85, 107.5, and 101 m (322, 407, and 383 ft) bgs, respectively. In the southern portion of the INTEC facility, only Well MON-P-017 is completed in the lower perched water zone in which water is encountered at a depth of approximately 96 m (364 ft) bgs.

Similar to the upper perched water zone, it is thought that the lower perched water zone is formed by decreased permeability associated with sedimentary interbed layers. It appears that the lower perched water has formed primarily on the DE7 interbed (see Figure 2-2). The top of this interbed occurs beneath the INTEC at depths ranging from 101 to 112.5 m (383 to 426 ft) bgs in the western portion of the INTEC facility. However, the DE6 interbed is also responsible for creating perched water, which is associated with Wells USGS-40 and USGS-43. The lower perched water zone is not continuous beneath the entire facility and may actually consist of several individual perched water bodies. Recharge to the southern perched water body is from service wastewater discharged to the percolation ponds. The source of recharge to the western portion of the northern perched water body is unknown, though the BLR and facility water leaks are likely contributors.

2.3 Snake River Plain Aquifer

This section explains the regional hydrogeology and the SRPA beneath INTEC.

2.3.1 Regional Hydrogeology

The SRPA is about 322 km (200 mi) long and 89 to 113 km (55 to 70 mi) wide. It extends from Ashton and the Big Bend Ridge on the northeast to Hagerman on the southwest and covers about 25,900 km^2 (10,000 mi^2). The aquifer consists of a series of basalt flows with interbedded sedimentary deposits and pyroclastic materials. The boundaries are formed by the contacts of the aquifer with less permeable rock at the margins of the plain (Mundorff et al. 1964). Robertson et al. (1974) estimated that as much as 2 billion acre-ft of water may be in storage in the aquifer, of which about 500 million acre-ft are recoverable.

Groundwater in the SRPA generally occurs under unconfined conditions, but locally may be quasi-artesian or artesian (Nace et al. 1959). The quasi-artesian or artesian conditions are caused by layers of dense, massive basalt or sediments with relatively low permeability. Nace et al. (1959) described quasi-artesian as the situation in which the groundwater level is first recognized in a borehole during drilling at a depth below the regional water table, and then the level rises significantly (1.5 to 15.2 m [5 to 50 ft]) to the level of the water table. This rise of the water level simulates artesian pressure, but the conditions are not truly artesian. Nace et al. (1959) also noted water levels in some wells in the SRPA respond to fluctuations in barometric pressure similar to wells in confined aquifers, indicating that tight zones in the basalt may impede pressure equalization. True artesian or flowing artesian conditions in the SRPA were identified at Rupert, in parts of the Mud Lake Basin, and north of the American Falls Reservoir (Nace et al. 1959).

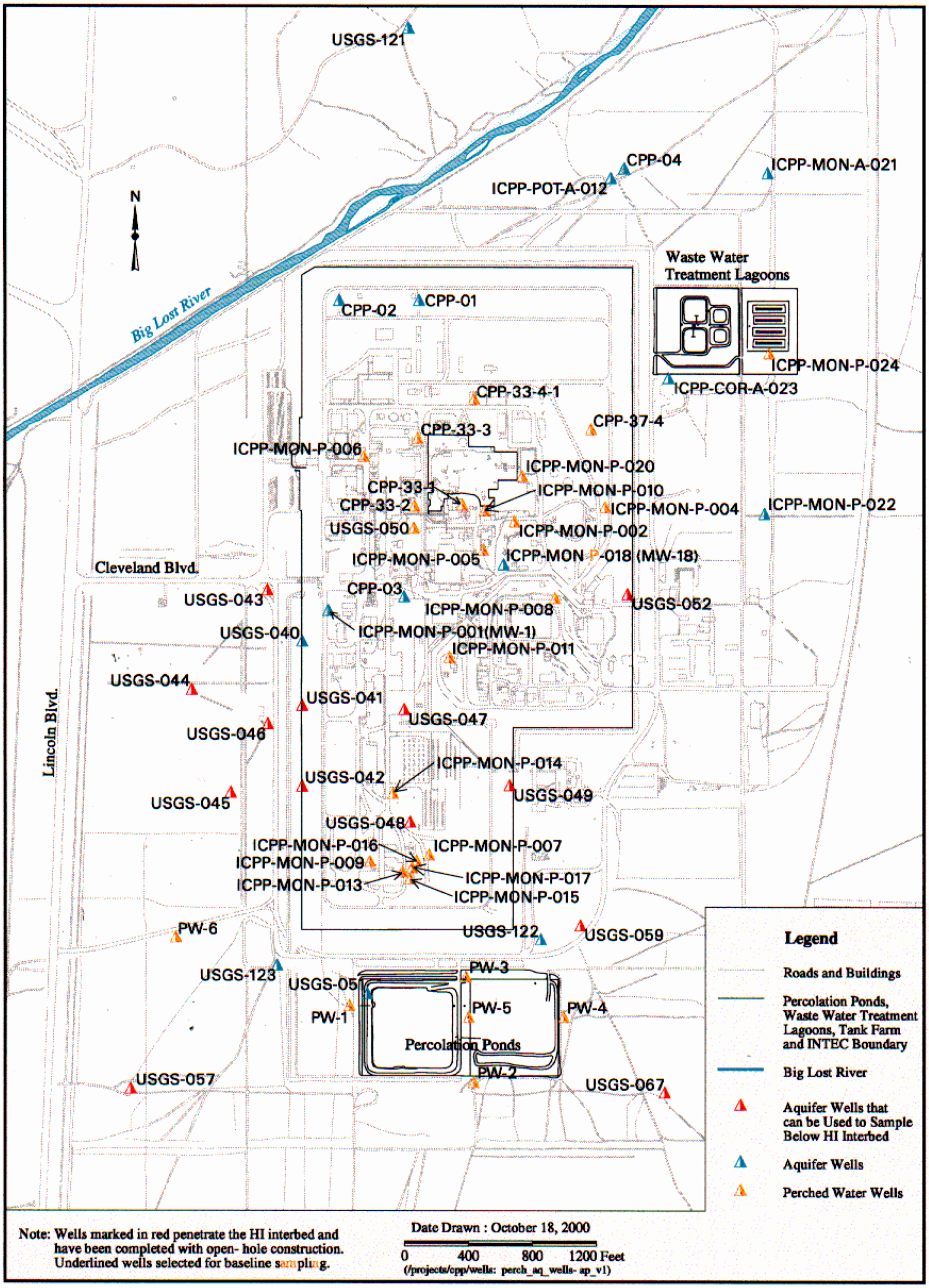

Figure 2-3. Locations of wells completed in the perched and groundwater zones.

Recharge to the aquifer is primarily by valley underflow from the mountains to the north and northeast of the plain and from infiltration of irrigation water. A small amount of recharge occurs directly from precipitation. Recharge to the aquifer within INEEL boundaries is primarily by underflow from the northeastern part of the plain and the BLR (Bennett 1990). Significant amounts of recharge from the BLR have caused water levels in some wells at the INEEL to rise as much as 1.8 m (6 ft) within in a few months after high flows in the river (Barraclough et al. 1982). Locally, the direction of groundwater flow is temporarily changed by recharge from the BLR (Bennett 1990).

Estimates of the effective thickness of the SRPA at the INEEL vary. A 3,159-m (10,365-ft) deep geothermal test well (INEL-1) was drilled about 7.2-km (4.5-mi) north of the INTEC in 1979. Subsurface geologic information from INEL-1 indicates at least 610 m (2,000 ft) of basalt underlie the INEEL (Prestwich and Bowman 1980). Hydrological data from INEL-1 were interpreted by Mann (1986) to indicate the effective base of the aquifer is 259 to 372 m (850 to 1,220 ft) bgs. The depth to water at INEL-1 is about 122 m (400 ft) bgs, which suggests an effective aquifer thickness of 137 to 250 m (450 to 820 ft). In earlier studies by Robertson et al. (1974), the effective portion of the SRPA at the Test Reactor Area (TRA) was assumed to be the upper 76 m (250 ft) of the saturated zone based on lithology and water quality. The aquifer thickness varies at different areas, and the aquifer becomes less productive with depth due to decreasing hydraulic conductivity (Hull 1989). Hydraulic conductivity of the basalt in the upper 244 m (800 ft) of the aquifer generally is 0.3 to 30.5 m/day (1 to 100 ft/day); whereas, the hydraulic conductivity of underlying rocks is several orders of magnitude smaller (Orr and Cecil 1991). Fracture filling from sediments and secondary mineralization is the principal reason for the decreased hydraulic conductivity.

Water level elevations generally range from 1,399 m (4,590 ft) above median sea level in the northern part of the INEEL to about 1,347 m (4,420 ft) above median sea level south of the INEEL with the depth to the water table varying from about 61.0 m (200 ft) bgs in the northern part of the INEEL to about 274 m (900 ft) bgs in the southern part. The general direction of groundwater flow is to the south-southwest, and the average gradient is about 0.8 m/km (4 ft/mi) (Orr and Cecil 1991). Locally, however, the hydraulic gradient varies significantly and ranges from about 0.2 m/km (1 ft/mi) in the northern part of the INEEL to a maximum of 2.8 m/km (15 ft/mi). The elevation of the water table and direction of groundwater flow are affected by recharge, groundwater withdrawal, and variations in aquifer transmissivity. The effects of groundwater withdrawal are often localized in contrast to recharge and transmissivity variations that have regional impacts. From July 1985 to July 1988, Orr and Cecil (1991) reported water level changes in INEEL wells ranging from a 7.9-m (26-ft) decline near the Radioactive Waste Management Complex to a 1.2-m (4-ft) rise north of Test Area North. Water levels generally declined in the southern two-thirds of the INEEL during that time and rose in the northern one-third.

Hydraulic properties of the SRPA have been determined by pumping tests. Robertson et al. (1974) reported transmissivities ranging from 1.24×10^4 to 1.24×10^6 m^2/day (1.34×10^5 to 1.3×10^7 ft^2/day) with 6.2×10^4 m^2/day (6.7×10^5 ft^2/day) considered normal. By calculating the geometric mean of transmissivity values, Hull (1989) estimated regional aquifer transmissivity for the southern INEEL to be 27,000 m^2/day (294,000 ft^2/day). Estimates of the storage coefficients range from 0.01 to 0.06 and effective porosity from 5 to 15%, with 10% being historically the most accepted value (Robertson et al. 1974), though more recent information indicates that a lower value may be appropriate.

2.3.2 INTEC Hydrogeology

Sixty-eight wells have been installed at the INTEC to monitor perched water bodies and the SRPA. This monitoring well network consists of 32 wells completed in the perched water zones and 36 wells completed in the SRPA. Several of the perched water monitoring wells are completed in multiple water bearing zones. The locations of wells completed in the perched and groundwater zones are shown in Figure 2-3, with the construction specifications provided in Appendix A.

Water level elevations indicate two separate sources of local recharge to the SRPA. One source for recharge is apparently from the percolation ponds as indicated by elevated water levels measured in Wells USGS-51, -112, -113, -114, -115, and -116. Water level response to recharge from these ponds is indicated by a 0.6 m (2 ft) rise in Well USGS-113 and a 0.3 m (1 ft) rise in Well USGS-51. The water table in the SRPA downgradient from the percolation ponds has a bimodal shape, indicating a preferred flow direction toward the southwest with a secondary flow component to the southeast.

Directly south of the ponds, water levels in Wells USGS-77 and USGS-111 are significantly lower than what would be expected based on the water levels in the adjacent wells. The reason(s) for the anomalously low water levels in these two wells is attributed to local variations in the water-bearing characteristics of the SRPA (see Section 2 of the remedial investigation/baseline risk assessment (RI/BRA) report [DOE-ID 1997a]). A second possible source of recharge to the SRPA may be indicated by anomalously high water levels measured in Well USGS-47. The water levels measured in Well USGS-47 are consistently 0.3 to 0.6 m (1 to 2 ft) higher than corresponding water levels measured from the surrounding wells. The possible causes of the anomalously high water levels include local recharge, local pumping, vertical hydraulic gradient (i.e., increasing hydraulic head with depth), and well completion characteristics.

The local groundwater flow appears complex and is apparently affected by local recharge, variations in hydraulic conductivity, local pumping, and possibly vertical hydraulic gradients. Groundwater directly beneath INTEC generally flows to the southwest and southeast, with a minor flow component to the south. The local flow pattern likely results from local recharge (i.e., percolation ponds and sewage ponds) that creates the mounding in the water table, and possibly from pumping the production wells. As the groundwater progresses beyond the influence of INTEC, it flows toward the southwest. The local hydraulic gradient is low, only 0.2 m/km (1.2 ft/mi) compared to the regional gradient of 0.8 m/km (4 ft/mi).

2.3.2.1 Local Flow Velocity. Tritium from INTEC wastes has been used extensively in tracing groundwater flow velocities and directions (Morris et al. 1964; Hawkins and Schmalz 1965; and Barraclough et al. 1967). Peaks of high tritium discharge to the disposal well have been particularly useful in determining the local flow characteristics in the SRPA. One of the most studied peak discharges of tritium occurred in December 1961 because it was preceded and followed by relatively long periods of low tritium discharge.

The concentration of the tritium peak as it passed each observation well provides an indication of the amount of dispersion the slug has undergone. The tritium concentration distribution indicates two preferred flow paths from the disposal well probably exist: (1) the predominant path to the southwest and (2) a less clearly defined path to the southeast. Some of the explanation for this phenomenon is provided in the plot of the transmissivity values for INTEC where a zone of low transmissivity is located directly to the south. This zone of low transmissivity to the south apparently acts as a barrier to impede the local groundwater flow.

2.3.2.2 Groundwater Pumping Effects. The INTEC facility uses approximately 7.9 million L (2.1 million gal) of water per day. This water is supplied by two raw water wells (CPP-1 and CPP-2) and two potable water wells (CPP-4 and new well) located in the northern portion of the facility. As part of the WAG 3 remedial investigation, the effect of pumping groundwater from these wells upon the local water table was investigated during July and August 1995. This investigation involved continuous water level monitoring of several aquifer wells completed in the northern section of INTEC while metering the pump usage in Production Well CPP-2.

Water level fluctuations in six aquifer wells (MW-18, USGS-40, -43, -47, -52, and -121) were monitored at 5-minute intervals using pressure transducers and data loggers. The National Oceanic and

Atmospheric Administration recorded barometric pressure changes at 5-minute intervals at the Central Facilities Area weather station, which is located approximately 5 km (3 mi) from the test site. Pump usage for Well CPP-2 was continuously monitored based on amperage requirements. During the 11 days of the test, the production well pump turned on 17 times with each pump cycle lasting for approximately 9 hours.

The water levels in all aquifer wells exhibited a similar response. Daily fluctuations, generally less than 3 cm (1 in.), were observed in all aquifer wells corresponding with pump usage of the production well. In almost all pump cycles, the corresponding water levels in the aquifer wells decreased by an average of 1.9 cm (0.75 in.). Only Pump Cycle #11 demonstrated an increase in water levels throughout the pump duration for all wells except Well USGS-40. This water level increase during this pump cycle may be the result of a local or regional trend and not related to pumping groundwater. Other than Pump Cycle #11, the water levels decreased during the pump cycle in Wells MW-18, USGS-40, -43, and -52 throughout the test.

As shown by this test, water levels in the SRPA are affected by pumping groundwater from the production well. Minimal responses (<2.5 cm [<1 in.]) were observed in these six monitoring wells; however, the wells are located approximately 610 m (2,000 ft) from the production well. Increased drawdown would be expected closer to the production well that could affect the local groundwater flow direction in the northern sections of INTEC.

2.3.2.3 Hydraulic Conductivity. The hydraulic conductivity of the SRPA in the vicinity of INTEC was estimated using the transmissivity values reported by Ackerman (1991) and the saturated thickness of the open interval of the well (Table 2-1). The estimation of hydraulic conductivity assumes the wells fully penetrate the saturated thickness of the aquifer. Hydraulic conductivities range five orders of magnitude with a maximum hydraulic conductivity of 3.0×10^{3} m/day (1.0×10^{4} ft/day) at Well CPP-3 and a minimum hydraulic conductivity of 3.0×10^{-2} m/day (1.0×10^{-1} ft/day) at Well USGS-114. The average hydraulic conductivity within the immediate vicinity of INTEC is $4.0 \times 10^{2} \pm 7.9 \times 10^{2}$ m/day ($1.3 \times 10^{3} \pm 2.6 \times 10^{3}$ ft/day). Using the average hydraulic conductivity, a hydraulic gradient of 1.2 m/km (6.3 ft/mi) (Orr and Cecil 1991), and an effective porosity of 10%, the calculated seepage velocity in the vicinity of the INTEC is approximately 3 m/day (10 ft/day).

2.4 Contaminants of Concern

The water quality in the SRPA at and downgradient from INTEC has been adversely impacted due to past facility operations. The SRPA (Group 5) is identified as containing low-level threat wastes. The COCs identified in the OU 3-13 baseline risk assessment are primarily radionuclides and include Sr-90, tritium, Cs-137, I-129, plutonium isotopes (Pu-238, -239, -240, and -241), uranium isotopes (U-234, -235, and -238), Np-237, Am-241, and Tc-99. In addition, mercury was identified as a COC.

It has been estimated a total of 22,000 Ci of radioactive contaminants have been released in 4.2×10^{10} L (1.1×10^{10} gal) of water (DOE-ID 1997a). The vast majority of this radioactivity is attributed to tritium (approximately 96%) with minor components of Am-241, Tc-99, Sr-90, Cs-137, Co-60, I-129, and plutonium. In May and June 1995, groundwater samples were collected from the aquifer wells located near and downgradient from the INTEC. The results from this sampling effort are provided in Table 2-2.

Table 2-1. Transmissivities in the SRPA near the INTEC (Ackerman 1991) and estimates of hydraulic conductivity.

Well Identifier	Transmissivity (ft^2/day)	Saturated Thickness [a] (ft)	Hydraulic Conductivity (ft/day)
CPP-1	7.3×10^4	150	4.9×10^2
CPP-2	1.6×10^5	75	2.1×10^3
CPP-3	7.6×10^5	74	1.0×10^4
CPP-4	2.5×10^2	255	9.8×10^{-1}
USGS-37	1.6×10^4	65	2.5×10^2
USGS-40	8.7×10^4	27	3.2×10^3
USGS-43	8.0×10^4	225	3.6×10^2
USGS-51	2.9×10^3	184	1.6×10^1
USGS-57	2.8×10^4	255	1.1×10^2
USGS-82	5.6×10^4	100	5.6×10^2
USGS-111	2.2×10^1	137	1.6×10^{-1}
USGS-112	6.4×10^4	96	6.7×10^2
USGS-113	1.9×10^5	97	2.0×10^3
USGS-114	1.0×10^1	100	1.0×10^{-1}
USGS-115	3.2×10^1	123	2.6×10^{-1}
USGS-116	1.5×10^2	127	1.2×10^0
Maximum	7.6×10^5		1.0×10^4
Minimum	1.0×10^1		1.0×10^{-1}
Average ± standard deviation	9.5×10^4 $\pm 1.9 \times 10^5$		1.3×10^3 $\pm 2.6 \times 10^3$

a. Saturated thickness values are the total saturated portion of the open well interval.

Table 2-2. Summary sampling results statistics for contaminants in the SRPA Wells (May-June 1995).[a]

	Water Concentration, mg/L or pCi/L					
Contaminants	Minimum	Maximum	PRG[b]	Number of Samples	Number of Detects	Frequency of Detection
Ag	6.30E-04 BNJ	8.80E-04 BNJ	1E-01[c]	38	3	8%
As	3.10E-03 B	1.08E-02 B	5E-02	42	3	7%
Ba	5.00E-02 B	2.05E-01	2E+00	42	42	100%
Cd	4.80E-04 B	3.00E-03 B	5E-03	42	4	10%
Co	5.20E-04 B	1.40E-03 B	NA	42	8	19%
Cr	1.80E-03 B	3.88E-02	1E-01	42	31	74%
Cu	1.60E-03 BJ	3.20E-03 B	1.3E+00	42	7	17%
Hg	1.00E-04 B	4.40E-04	2E-03	42	7	17%
Mn	8.40E-04 B	6.28E-02	5E-02[c]	42	10	24%
Ni	4.30E-03 B	2.06E-01	NA	42	6	14%
Pb	2.30E-03 BWJ	3.77E-02	1.5E-02	42	10	24%
Sb	1.90E-03 B	4.60E-03 B	6E-03	42	3	7%
Se	1.40E-03 B	3.70E-03 B	5E-02	42	7	17%
V	2.30E-03 B	9.90E-03 B	NA	42	24	57%
Zn	2.60E-03 B	4.54E-01 IJ	5E+00[c]	42	27	64%
Am-241	5.40E-01	5.40E-01	<1.5E+01[d]	49	1	2%
I-129[e]	9E-07	3.82E+00	1E+00[d]	33	32	94%
Sr-90	7.00E-01	8.40E+01	8E+00	70	49	70%
Tc-99	1.10E+00	4.48E+02	9E+02[d]	70	57	81%
Tritium	5.81E+02	3.07E+04	2E+04	49	45	92%
U-234	7.00E-01	2.60E+00	1.5E+01[f]	49	7	14%

Table 2-2. (continued).

	Water Concentration, mg/L or pCi/L					
Contaminants	Minimum	Maximum	PRG[b]	Number of Samples	Number of Detects	Frequency of Detection
U-238	8.00E-01	1.10E+00	1.5E+01[f]	49	4	8%
Gross alpha	2.30E+00	1.00E+01	1.5E+01[g]	49	20	41%
Gross beta	2.40E+00	4.69E+02	4mrem/yr[h]	49	49	100%

a. NOTE: Duplicate and QC sample results were not included in the statistical analysis. Analytical results are from groundwater samples collected from the SRPA during May and June 1995 as part of the OU 3-13 RI. Results are provided in Table 4-4 of the OU 3-13 RI/FS Part A (DOE-ID 1997a) and the ERIS Database. Samples were analyzed for TAL inorganics and radionuclides. Only those constituents that were identified above detection limits in the samples are shown in the table except for the following constituents which were detected but are not considered to be present at hazardous concentrations: Ca, Fe, Mg, K, and Na. Samples rejected because of an unacceptable quality control parameter were not included in the table.

b. The PRG concentrations are from the Primary Constituent Standards table in IDAPA 58.01.11.200(a) unless otherwise footnoted.

c. The PRG concentrations for manganese, silver, and zinc are from the Secondary Constituent Standards in IDAPA 58.01.11.200(b).

d. The PRG concentrations for Am-241, I-129, were Tc-99 are calculated values based on the National Interim Primary Drinking Water Regulations (EPA 1976).

e. Summary sampling data for I-129 was taken from data collected during the 1990-91 USGS sampling event (DOE-ID 1994). The data shown in the table are only from those wells sampled both during the 1990-91 USGS sampling event and the WAG 3 RI/FS, May–June 1995, sampling event.

f. The PRG concentrations for U-234 and U-238 are from Section 8, Table 8-2 of the ROD (DOE-ID 1999).

g. The PRG concentration for gross alpha includes radium-226 but excludes radon and uranium.

h. The PRG concentration for gross beta (combined beta/photon emitters) is 4 mrem/yr effective dose equivalent.

3. GROUNDWATER SAMPLING AND MONITORING DATA QUALITY OBJECTIVES

The objective of this LTMP is to outline the sample collection and monitoring activities to be conducted to monitor the contaminants in the SRPA outside the INTEC fence and to monitor the flux of contaminants in the aquifer across the INTEC security fence. The groundwater monitoring will be performed to meet the SRPA monitoring requirements as stated in the OU 3-13 ROD (DOE-ID 1999). In general, the results from the monitoring will be used to

- Monitor the flux of contaminants in the aquifer across the INTEC security fence in the Group 5
- Validate and/or update the OU 3-13 aquifer numerical model
- Evaluate whether the INTEC groundwater plume in the SRPA outside of the INTEC fence line will meet the Group 5 remedial action objective (RAO) of achieving Idaho groundwater quality standards or risk-based concentrations in the SRPA by 2095.

3.1 Data Quality Objectives

To help with defensible decision-making, the EPA has developed the DQO process, which is a systematic planning tool based on the scientific method for establishing criteria for data quality and for developing data collection designs (EPA 1994). DQOs have been developed to guide monitoring and sampling of the SRPA. The process consists of seven iterative steps that yield a set of principal study questions (PSQs) and decision statements (DSs) that must be answered to address a primary problem statement. The seven steps comprising the DQO process are listed below:

Step 1: State the problem

Step 2: Identify the decision

Step 3: Identify the inputs to the decision

Step 4: Define the study boundaries

Step 5: Develop decision rules

Step 6: Specify limits on the decision

Step 7: Optimize the design for obtaining data.

The DQOs that govern the Group 5 groundwater sampling and monitoring are presented in the following sections and summarized in Table 3-1. These objectives were negotiated with and have the concurrence of the Agencies.

3.1.1 State the Problem

The WAG 3 ROD requires monitoring activities to determine whether present contaminants in Group 5 or the flux of contaminants originating from within the INTEC security fence will affect the aquifer such that Idaho groundwater quality standards or risk-based concentrations will not be met in Group 5 in 2095.

Table 3-1. Data quality objectives for OU 3-13, Group 5, groundwater.

1: State the Problem	2: Identify the Decision			3: Identify Inputs to the Decision	4: Define the Study Boundaries
Monitor the flux of contaminants in the aquifer across the INTEC security fence and the contaminants in the plume downgradient of the INTEC facility to determine if the Group 5 RAO of achieving Idaho groundwater quality standards or risk-based concentrations by 2095 will be affected by contamination within the INTEC facility. The OU 3-13 Group 5 is defined as that portion of the SPRA outside of the INTEC security fence where concentrations of COCs exceed current MCLs or risk based concentrations. The remediation goal for OU 3-13, Group 5 is "Achieving the applicable State of Idaho groundwater standards or risk-based groundwater concentrations in the SRPA plume south of the INTEC security fence by the year 2095" (ROD, Sec. 8.1.5, pg 8-10). To determine if this goal will be met the input of contaminants to Group 5 from the contaminated aquifer within the INTEC security fence must be determined.	**Principal Study Questions:** PSQ-1: Is the COC flux in the SRPA from the contaminated media in the vadose zone beneath the INTEC facility of sufficient magnitude to prevent achieving the Group 5 remediation goals.	**Alternative Actions:** No alternative actions required for monitoring program.	**Decision Statement:** DS-1: Determine whether or not the flux of contaminants in the SRPA which originate in the vadose zone within the INTEC security fence line is of sufficient magnitude to exceed the Group 5 remediation goals in 2095.	The inputs to PSQ-1 are Sampling of selected wells upgradient of, near the boundary of, and within the INTEC security fence line and analysis for COCs. Selected wells will be sampled in the upper 50 ft of the SRPA. Measurement of water table elevations for evaluation of groundwater elevation contours and flow direction. Periodic incorporation of new data and update of the OU 3-13 aquifer numerical model for prediction of COC concentrations in the SRPA at 2095 and beyond	This study will focus on the SRPA beneath the INTEC facility and near the boundary of the facility. The area of focus along the INTEC boundary is the south and west boundaries given the south-southwest direction of groundwater flow in this region. The primary sources of contaminants to the aquifer include both the perched water/vadose zone above SRPA and the former injection well which penetrates the aquifer and HI interbed. Two principal study questions have been identified to evaluate these sources separately.
	PSQ-2: Is the COC flux in the SRPA from the contaminated sediments/sludges remaining in the former ICPP injection well (CPP-3) and immediate vicinity of sufficient magnitude to prevent achieving the Group 5 remediation goals.	No alternative actions required for monitoring program.	DS-2: Determine whether or not the flux of contaminants in the SRPA from the former INTEC injection well is of sufficient magnitude to exceed the Group 5 remediation goals in 2095.	The inputs to PSQ-2 are Borehole geophysical and fluid logging of selected wells which penetrate the HI interbed for selection of wells and sampling zones below the HI interbed downgradient of the former injection well. Isolation through packers or other method(s), sampling, and analysis for COCs of selected well zones below the HI interbed downgradient of the former injection well. Measurement of water table elevations for evaluation of groundwater elevation contours and flow direction, and possibly head gradient between aquifer above and below the HI interbed. Periodic incorporation of new data and update of the OU 3-13 aquifer numerical model for prediction of COC concentrations in the SRPA at 2095 and beyond. NOTE: Isolation of sampling zone(s) beneath the HI interbed depth from selected wells should also not preclude sampling of zone(s) above the HI interbed from the same well to supply inputs for PSQ-1.	The portion of the aquifer that is likely to be affected by contaminants transported through the vadose zone is the upper 50 ft of the aquifer above the HI interbed. Because the former injection well penetrated the HI interbed, the portion of the aquifer potentially affected by the injection well includes both the upper zone from the water table to the HI interbed and the lower zone beneath the HI interbed. The total depth of the former injection well was 598 ft. Accordingly, the base of the study boundary should correspond to the total depth of injection, or approximately 600 ft below land surface.
	PSQ-3: Are the COC concentrations in the SRPA outside the INTEC facility at sufficient magnitude to prevent achieving the Group 5 remediation goals.	No alternative actions required for monitoring program.	DS-3: Determine whether or not the COCs in the SRPA outside the INTEC facility will exceed the Group 5 remediation goals in 2095.	The inputs to PSQ-3 are Sampling of selected wells downgradient of the INTEC security fence and analysis for COCs. Selected wells will monitor the contaminants above the MCLs and monitor the downgradient plume area above the MCLs. Measurement of water elevations for evaluation of groundwater elevation contours and flow direction. Periodic incorporation of new data into the OU 3-13 aquifer numerical model for the prediction of COC concentrations in the SRPA in 2095 and beyond.	Monitoring the concentrations of COCs above and below the HI interbed and as far downgradient as indicated by the detections of COCs above MCLs. Because the remediation goal is established in the year 2095, this study will continue through the institutional control period to at least 2095.

Table 3.1 (continued).

5: Develop a Decision Rule	6: Specify Tolerable Limits on Decision Errors	7: Optimize the Design
If the monitoring activities and model predictions generated for this study indicate that Group 5 RAOs/remedial goals will be exceeded due to the flux of contaminants in the SRPA beneath or downgradient of the INTEC facility, a comprehensive evaluation, focused feasibility study, and ROD amendment will be performed to address the risks posed by groundwater contaminants beneath INTEC and/or downgradient of INTEC. If it is determined that the RAOs/remedial goals will be met, monitoring will continue until 2095 or until the Agencies determine that no unacceptable risk exists from Group 5. NOTE: The decision is based upon model predictions using data obtained from an observational well network to model evolution of the plume.	In this case the decisions will be made by comparing data to computer predictions, the accuracy of the computer predictions will be dependent on the accuracy of the OU 3-13 model.	A flow chart presenting the conceptual design of the WAG 3 Group 5 field activities entitled "Logic diagram for Group 5 field activities," is shown in Section 1, Figure 1-1. The flow chart details the steps to be taken to both arrive at a contingent remedy decision and to perform the SRPA interim monitoring. The two separate flow paths are identified on the chart. The following paragraphs describe and present the rationale for the design of field activities related to the contingent remedy decision. Thirty six wells are available in the vicinity of INTEC suitable for groundwater monitoring. From that set of wells, eleven are selected for the INTEC facility monitoring program to support PSQ-1, monitoring of the contaminant input from the vadose zone to the SRPA. The PSQ-1 INTEC facility monitoring shall consist of groundwater sample collection from wells located upgradient of, within, and adjacent to the INTEC facility. The wells selected for monitoring include MW-18, USGS 40, USGS 42, USGS 47 through 49, USGS 51, USGS 52, and USGS 122 through USGS 123 and the tank farm well set aquifer well ICPP-MON-A-230 (see Section 4, Figure 4-1). One well, USGS 121, was selected upgradient of the contaminant source areas at INTEC to provide background groundwater quality data. Though this well is not directly upgradient of the INTEC facility, it is located nearer to the groundwater flow paths from potential sources of upgradient contamination (TRA or NRF) than other wells and is, in that respect, well suited for providing upgradient water quality data. Several wells were selected inside the INTEC facility (MW-18, USGS 47, USGS 48, USGS 49, and USGS 52) to help distinguish between the possible sources of groundwater contaminants located throughout the INTEC facility. Wells USGS 40, USGS 42, USGS 51, USGS 122, and USGS 123 were selected because they are located along the southern and western boundaries of INTEC. The general direction of groundwater flow beneath INTEC is interpreted to be to the south-southwest. The selected wells considered adequate for the INTEC facility monitoring and no new wells are considered necessary at this time. However, additional wells are currently planned for various other monitoring programs at INTEC. As these wells become available, they will be considered for inclusion into the INTEC facility monitoring program. The three wells selected for monitoring in support of PSQ-2, former injection well monitoring, are USGS-41, USGS-48, and USGS-59 based upon an evaluation of their suitability for monitoring the aquifer below the HI interbed. There are 12 USGS wells in the vicinity of INTEC and the former injection well that penetrate the HI interbed and remain as open boreholes in the aquifer, potentially suitable for long term monitoring of the aquifer beneath the HI interbed (excluding INTEC production wells which are required for facility support and cannot be modified to sample below the HI interbed). The wells are USGS-40 through 49, USGS 51, USGS 52, and USGS 59. These wells are located either cross-gradient or downgradient of the former injection well. An evaluation of available data from and additional geophysical and borehole fluid logging of these wells will be performed to determine if they are suitable for deep sampling and to identify potential zones for sampling. It should be noted that an upgradient monitoring well which penetrates the HI interbed is not available within the existing monitoring well network at INTEC. Well USGS-121 does not penetrate the HI interbed. Production wells CPP-1, CPP-2, and CPP-4 have been drilled through the HI interbed and have perforated well casing both above and below the HI interbed but are of limited use as monitoring wells based upon their required support of INTEC operations. The need for an upgradient monitoring well in this zone will be evaluated after the monitoring program is initiated. If the data obtained from the facility monitoring program indicate that the injection well secondary source may cause or contribute to not meeting the Group 5 RAO/ remediation goals, an upgradient well will be installed for sampling beneath the HI interbed to ensure that an upgradient source is not present. It should also be noted that current plans for OU 3-14 investigation include the installation of monitoring well in the immediate vicinity of the former injection well. As these well(s) become available, they will be incorporated into the INTEC facility monitoring well program to provide additional data in the vicinity of the injection well secondary source. In addition to the above monitoring, one sampling round will be conducted using the entire INTEC monitoring network at the onset of the activities outlined in the LTMP. This sampling event will provide a "snapshot" of the current state of the contamination of the SRPA in the vicinity of the INTEC facility and provide a data set to compare the COC flux monitoring data. In addition, these data will be used to update the OU 3-13 numerical aquifer model. In support of Group 4 activities, groundwater samples collected during the baseline sampling event from USGS-40, -42, -47, -48, -51, -52, -121, -122, -123, and MW-18 will be analyzed for stable isotopes including oxygen, hydrogen, and nitrogen. In addition to the analytes listed below, metals and anions will be included in the semiannual sampling conducted after the baseline sampling. Six wells have been selected for long-term monitoring of the INTEC plume beyond the facility boundary in support of PSQ-3. The wells selected for long-term monitoring are USGS-57, USGS-67, USGS-112, USGS-85, LF2-08, and LF3-08. These wells were selected based on a review of the historical data for I-129. However, most of the data used to select these wells for long-term monitoring are from 1990–1991; therefore, the baseline groundwater sampling data will be used to optimize the well locations and the total number of wells for long-term monitoring. Analytes of interest include COCs which currently exist in the SRPA at concentrations exceeding either MCLs or risk based concentrations as well as COCs derived from the modeling which are predicted to potentially cause a future unacceptable risk to the SRPA. Contaminants that currently exceed MCLs or risk based concentrations and will be included in the INTEC facility monitoring program are I-129, H-3, and Sr-90. Contaminants that are predicted by the WAG 3 RI/FS modeling to exceed MCLs or risk based concentrations at a future date and are included in the INTEC facility monitoring program are plutonium and uranium isotopes, Np-237, Am-241, and mercury. Chromium, while listed as a COC, is excluded because it is specifically related to groundwater contamination at TRA. Also, because Tc-99 is a contributor to total beta emitting radionuclides limit and present at significant concentrations in the aquifer beneath INTEC, it is included in the list of analytes for INTEC facility monitoring. To evaluate additional radionuclides that may be present but not accounted for in the modeling, gross-alpha and gross-beta analyses will also be performed. Finally, the list of analytes will be updated through either the exclusion of some analytes or inclusion of additional analytes as analytical data is accumulated or new information regarding contaminant sources is identified. The detection limits for I-129, Sr-90, and tritium required to make the decisions needed concerning the contingent remedy are 0.1 pCi/L, 0.8 pCi/L and 2000 pCi/L, respectively. Sampling and analyses will occur at the following frequency: Year 1 — Semi-annual (twice per year) — Gross-alpha/beta, Hg, tritium, Tc-99, I-129, Sr-90, plutonium isotopes (Pu-238, -239, -240, and -241), uranium isotopes (U-234, -235, and -238), Am-241, Nd-237, Cs-137 Years 2–7 — Annual — Gross-alpha/beta, Hg, tritium, Tc-99, I-129, Sr-90, plutonium isotopes (Pu-238, -239, -240, and -241), uranium isotopes (U-234, -235, and -238), Am-241, Nd-237, Cs-137 Years 8–16 — Biannual (once every two years) — Review and adjust as required Years 17–100 — Once every 5 years — Review and adjust as required Following each sampling event and prior to each CERCLA 5 year review, the new groundwater sampling results will be compared against the OU 3-13 aquifer model predictions to determine if concentrations are above, at, or below the model predicted trends. If the new data indicate the model must be updated, the model will be updated generating new COC concentration predictions. These predictions will be compared against the Group 5 RAO/ remediation goals to determine if they will be exceeded or not. If the data trends exceed model predicted trends and indicate a potential exceedance of the Group 5 RAO/remediation goals, the sampling frequency will revert to annual sampling and progress in a manner similar to the schedule above.

The possibility of COC flux in the SRPA originating from sources within INTEC, either in the vadose zone or in the vicinity of the former INTEC injection well, must be quantified. The concentration of contaminants downgradient of INTEC also needs to be monitored. These data can be used to update and refine the OU 3-13 numerical groundwater model to better predict the state of the aquifer in 2095.

3.1.2 Identify the Decision

This step of the DQO process lays out the principal study questions, alternative actions, and corresponding decision statements that must be answered to effectively address the problem stated above. The remediation goal for OU 3-13, Group 5 is "Achieving the applicable State of Idaho groundwater standards or risk-based groundwater concentrations in the SRPA plume south of the INTEC security fence by the year 2095" (ROD, Sec. 8.1.5, p 8-10). To determine if this goal will be met, the input of contaminants to Group 5 from the contaminated aquifer within the INTEC security fence and the distribution of contaminants in the aquifer outside the INTEC security fence must be determined. To further assist in this evaluation, the groundwater modeling conducted as part of the OU 3-13 RI/FS will be utilized and refined with data collected under this LTMP.

3.1.2.1 Principal Study Questions. The purpose of the PSQ is to identify key unknown conditions or unresolved issues that, when answered, provide a solution to the problem being investigated. The PSQs for this project are

PSQ-1: Is the COC flux in the SRPA from the contaminated media in the vadose zone within the INTEC security fence of sufficient magnitude to prevent achieving the Group 5 remediation goals?

PSQ-2: Is the COC flux in the SRPA from the contaminated sediments/sludges remaining in the former ICPP injection well (CPP-3) and immediate vicinity of sufficient magnitude to prevent achieving the Group 5 remediation goals?

PSQ-3: Are the COC concentrations in the SRPA outside the INTEC facility of sufficient magnitude to prevent achieving the Group 5 remediation goals?

3.1.2.2 Alternative Actions. Alternative actions are those actions resulting from resolution of the above PSQs. The types of actions considered will depend on the answers to the PSQs.

3.1.2.3 Decision Statements. The DSs combine the PSQs and alternative actions into a concise statement of action. The DSs are

DS-1: Determine whether the flux of contaminants in the SRPA that originate in the vadose zone within the INTEC security fence is of sufficient magnitude to exceed the Group 5 remediation goals in 2095.

DS-2: Determine whether the flux of contaminants in the SRPA from the former INTEC injection well is of sufficient magnitude to exceed the Group 5 remediation goals in 2095.

DS-3: Determine whether the COCs in the SRPA outside the INTEC facility will exceed the Group 5 remediation goals in 2095.

It is important to realize that the installation of an updated monitoring system and collection of new types of data during the SRPA monitoring might modify the site conceptual model for vadose zone flow and transport beneath WAG 3. If the conceptual model is significantly changed, DS-1 and DS-2 may need to be reevaluated accordingly.

3.1.3 Identify Inputs to the Decision

This step of the DQO process identifies the informational inputs that are required to answer the DSs made above.

3.1.3.1 Inputs for PSQ-1. PSQ-1 will be answered by collecting data on the COC flux originating in the vadose zone within the INTEC security fence, updating the OU 3-13 aquifer numerical model, and evaluating the predictions of the updated aquifer numerical model for COC concentrations in 2095.

Inputs to PSQ-1 are

1. Samples of selected wells upgradient of, near the boundary of, and within the INTEC security fence line, and analysis for COCs. Selected wells will penetrate the upper 15 m (50 ft) of the SRPA.

2. Measurements of water table elevations for evaluation of groundwater elevation contours and flow direction.

3. Periodic incorporation of new data and update of the OU 3-13 aquifer numerical model for prediction of COC concentrations in the SRPA at 2095 and beyond.

3.1.3.2 Inputs for PSQ-2. PSQ-2 will be answered by collecting measurements of COC flux originating from the former injection well within the INTEC security fence, updating the OU 3-13 aquifer numerical model, and evaluating the predictions of the updated aquifer numerical model for COC concentrations in 2095.

Inputs to PSQ-2 are

1. Borehole geophysical and fluid logging of selected wells which penetrate the HI interbed for selection of wells and sampling zones below the HI interbed downgradient of the former injection well

2. Isolation through packers or other method(s), sampling, and analysis for COCs of selected well zones below the HI interbed downgradient of the former injection well

3. Measurements of water table elevations to contour of groundwater elevations and to determine flow direction, and possibly head gradient between the aquifer above and below the HI interbed

4. Periodic incorporation of new data and update of the OU 3-13 aquifer numerical model for prediction of COC concentrations in the SRPA in 2095 and beyond.

Isolation of sampling zone(s) beneath the HI interbed depth from selected wells should not preclude the sampling of zone(s) above the HI interbed from the same well to supply inputs for PSQ-2.

3.1.3.3 Inputs for PSQ-3. PSQ-3 will be answered by collecting measurements of COCs in the aquifer beyond the INTEC security fence line and by updating the OU 3-13 aquifer numerical model. The inputs to PSQ-3 are

1. Sampling selected wells downgradient of the INTEC security fence and analysis for COCs. Selected wells will monitor the contaminants above MCLs and monitor the downgradient plume area above MCLs.

2. Measuring water elevations for evaluation of groundwater elevation contours and flow direction.

3. Periodic incorporation of new data into the OU 3-13 aquifer numerical model for the prediction of COC concentrations in the SRPA in 2095 and beyond.

3.1.4 Define the Boundaries of the Study

This study will focus on the SRPA beneath INTEC, near the boundary of the facility and downgradient of the facility. The area of focus is the south and west boundaries because of the south-southwest direction of groundwater flow in this region.

The primary sources of contaminants to the aquifer include both the perched water/vadose zone above SRPA and the former injection well that penetrates the aquifer and HI interbed. Two PSQs have been identified to evaluate these sources separately.

The portion of the aquifer that is likely to be affected by contaminants transported through the vadose zone is the upper 15 m (50 ft) of the aquifer above the HI interbed.

Because the former injection well penetrated the HI interbed, the portion of the aquifer potentially affected by the injection well includes both the upper zone from the water table to the HI interbed and the lower zone beneath the HI interbed. The total depth of the former injection well was 182 m (598 ft). Accordingly, the base of the study boundary should correspond to the total depth of injection, or approximately 600 ft bgs.

The third PSQ addresses monitoring the contaminants already present in Group 5 downgradient of INTEC. The long-term plume monitoring will monitor the concentrations of COCs as far downgradient of the INTEC facility as indicated by the detection of COCs above MCLs.

Because the remediation goal is established in the year 2095, this study will continue through the institutional control period to at least 2095.

3.1.5 Develop a Decision Rule

This step of the DQO process brings together the outputs from Steps 1 through 4 into a single statement describing the basis for choosing among the listed alternatives. If the monitoring activities and model predictions generated for this study indicate that Group 5 RAOs/remediation goals (RGs) will be exceeded due to the flux of contaminants in the SRPA beneath INTEC, then a comprehensive evaluation, focused feasibility study and ROD amendment will be prepared to address the risks posed by groundwater contaminants beneath INTEC. If it is determined that the RAOs/RGs will be met, monitoring will continue until 2095, or until the Agencies determine that no unacceptable risk exists from Group 5.

The decision is based upon model predictions using data obtained from an observational well network to model evolution of the plume.

3.1.6 Specify Tolerable Limits on Decision Errors

This step of the DQO process specifies acceptable limits on decision error. These limits are used to establish performance goals for the data collection design. In this case, the decisions will be made by evaluating computer predictions, and thus, the accuracy of the computer predictions will bound the tolerable limits on the decision errors.

3.1.7 Optimize the Design

A flow chart presenting the conceptual design of the Group 5 field activities is provided in Section 1, Figure 1-1. The flow chart details the steps to be taken to both arrive at a contingent remedy decision and to perform the SRPA interim monitoring. The two separate flow paths are identified on the chart. The following paragraphs describe and present the rationale for the design of field activities related to the contingent remedy decision.

There are thirty-six wells that are available in the vicinity of INTEC suitable for groundwater monitoring. From that set of wells, 12 are selected for the INTEC facility-monitoring program to support PSQ-1, monitoring of the contaminant input from the vadose zone to the SRPA. The PSQ-1 INTEC facility monitoring will consist of groundwater sample collection from wells located upgradient of, within, and adjacent to INTEC. The wells selected for monitoring include MW-18, USGS-40, USGS-42, USGS-47 through USGS-49, USGS-51, USGS-52, and USGS-122 through USGS-123 and ICPP-MON-A-230 (see Section 2, Figure 2-3). One well, USGS-121, was selected upgradient of the contaminant source areas at INTEC to provide background groundwater quality data. Though this well is not directly upgradient of the INTEC facility, it is located nearer to the groundwater flow paths from potential sources of upgradient contamination (TRA or Naval Reactors Facility) than other wells and is, in that respect, well suited for providing upgradient water quality data. Several wells were selected inside INTEC (ICPP-MON-A-230, MW-18, USGS-47, USGS-48, USGS-49, and USGS-52) to help distinguish between the possible sources of groundwater contaminants. Wells USGS-40, USGS-42, USGS-51, USGS-122, and USGS-123 were selected because they are located along the southern and western boundaries of INTEC. The general direction of groundwater flow beneath INTEC is interpreted to be to the south-southwest. The selected wells are considered adequate for the INTEC facility monitoring and no new wells are considered necessary at this time. However, additional wells are currently planned for various other monitoring programs at INTEC. As these wells become available, they will be considered for inclusion into the INTEC facility-monitoring program.

The three wells selected for monitoring in support of PSQ-2, former injection well monitoring, are USGS-41, USGS-48, and USGS-59, based upon an evaluation of their suitability for monitoring the aquifer below the HI interbed. There are 12 USGS wells in the vicinity of INTEC and the former injection well that penetrate the HI interbed and remain as open boreholes in the aquifer, potentially suitable for long term monitoring of the aquifer beneath the HI interbed (excluding INTEC production wells that are required for facility support and cannot be modified to sample below the HI interbed). The wells are USGS-40 through USGS-49, USGS-51, USGS-52, and USGS-59. These wells are located either cross-gradient or downgradient of the former injection well. An evaluation of available data from, and additional geophysical and borehole fluid logging of, these wells will be performed to determine if the selected wells are suitable for deep sampling and to identify potential zones for sampling. (NOTE: because these wells are completed with an open borehole, there is a significant possibility that the deeper portions of one or more of these may be obstructed, requiring the selection of an alternate well from the 12 wells identified above.) It should be noted that an upgradient monitoring well that penetrates the HI interbed is not available within the existing monitoring well network at INTEC. Well USGS-121 does not penetrate the HI interbed. Production wells CPP-1, CPP-2, and CPP-4 have been drilled through the HI interbed and have perforated well casing both above and below the HI interbed but are of limited use as monitoring wells based upon their required support of INTEC operations. The need for an upgradient monitoring well in this zone will be evaluated after the monitoring program is initiated. If the data obtained from the facility monitoring program indicate that the injection well may cause or contribute to not meeting the Group 5 RAO/RGs, an upgradient well will be installed for sampling beneath the HI interbed to ensure that there is no upgradient contaminant source present. Also, current plans for OU 3-14 investigation include the installation of a monitoring well in the immediate vicinity of the former injection well. As the additional well(s) become available, they will be incorporated into the INTEC facility monitoring well program to provide additional data in the vicinity of the injection well.

In addition to the above monitoring, one sampling round will be conducted using the entire INTEC monitoring network at the onset of the activities outlined in this LTMP. This baseline sampling event will provide information on the current state of the contamination of the SRPA in the vicinity of INTEC and provide a data set to compare the COC flux monitoring data. These data will be used to update the OU 3-13 numerical aquifer model. In support of Group 4 activities, groundwater samples collected during the baseline sampling event from USGS-40, -42, -47, -48, -51, -52, -121, -122, -123, and MW-18 will be analyzed for stable isotopes including oxygen, hydrogen, and nitrogen.

Six wells have been selected for long-term monitoring of the INTEC plume beyond the facility boundary in support of PSQ-3. The wells selected for long-term monitoring are USGS-57, USGS-67, USGS-112, USGS-85, LF2-08, and LF3-08. These wells were selected based on a review of the historical data for I-129. However, most of the data used to select these wells for long-term monitoring is from 1990–1991; therefore, the baseline groundwater sampling data will be used to optimize the well locations and the total number of wells for long-term monitoring.

Analytes of interest include COCs that currently exist in the SRPA at concentrations exceeding either MCLs or risk-based concentrations, as well as COCs derived from the modeling, which are predicted to potentially cause a future unacceptable risk to the SRPA. Contaminants that currently exceed MCLs or risk-based concentrations and will be included in the INTEC facility monitoring program are I-129, Sr-90, and tritium. Contaminants that are predicted by the WAG 3 RI/FS modeling to exceed MCLs or risk-based concentrations at a future date, and are included in the INTEC facility monitoring program, are plutonium and uranium isotopes, Np-237, Am-241, and mercury. Chromium, while listed as a COC, is excluded here because it is specifically related to groundwater contamination at TRA. Because Tc-99 is a contributor to the total beta-emitting radionuclide limit and is present at significant concentrations in the aquifer beneath INTEC, it is included in the list of analytes for INTEC facility monitoring. To evaluate additional radionuclides that may be present but not accounted for in the modeling, gross-alpha, and gross-beta analyses will also be performed. Finally, the list of analytes will be updated through either the exclusion of some analytes or inclusion of additional analytes as analytical data are accumulated or new information regarding contaminant sources is identified. The detection limits for I-129, Sr-90, and tritium required to make the decisions needed concerning the contingent remedy are 0.1 pCi/L, 0.8 pCi/L, and 2,000 pCi/L, respectively.

Sampling and analyses will occur at the following frequency:

Year 1	Baseline 47 wells semiannual 20 wells	Tritium, Tc-99, I-129, Sr-90, plutonium isotopes, uranium isotopes (U-234, -235, and -238), Am-241, Np-237, Cs-137, gross-alpha/beta, and mercury;
Years 2–7	Annual 20 wells	Tritium, Tc-99, I-129, Sr-90, plutonium isotopes, uranium isotopes (U-234, -235, and -238), Am-241, Np-237, Cs-137, gross-alpha/beta, and mercury
Years 8–16	Biannual	Review and adjust as required
Years 17–100	Once every 5 years	Review and adjust as required

Following each sampling event and prior to each CERCLA 5-year review, the new groundwater sampling results will be compared against the OU 3-13 aquifer model predictions to determine how concentrations compare to the model predicted trends. If the new data indicate the necessity, the model will be updated, generating new COC concentration predictions. These predictions will be compared against the Group 5 RAO/RGs to determine if they will be exceeded. If the data trends exceed model predicted trends and indicate a potential to exceed the Group 5 RAO/RGs, the sampling frequency will revert to annual sampling and progress in a manner similar to the schedule above.

3.1.8 DQO Summary

A summary of the DQOs is presented in Table 3-1.

3.2 Sampling Objectives

The purpose of the groundwater monitoring and sampling is to collect data to determine if the remediation goal for OU 3-13, Group 5 of "Achieving the applicable State of Idaho groundwater standards or risk-based groundwater concentrations in the SRPA plume south of the INTEC security fence by the year 2095" (ROD, Sec. 8.1.5, p 8-10) will be met. The monitoring and sampling will quantify the input of contaminants to Group 5 from the contaminated aquifer within the INTEC security fence.

In addition to investigating the Group 5 RAOs, a comprehensive round of groundwater samples will be collected from the INTEC monitoring well network to provide a "snapshot" of the present state of contamination within the SRPA in and around the INTEC facility. These data will be used for several purposes, including a comprehensive review/update of the aquifer conceptual model and numerical model predictions.

3.3 Data Reporting

Data will be collected and validated per procedures identified in the QAPjP (DOE-ID 2002a). Analysis reports will be prepared and issued according to the schedule presented in Table 3-2.

Table 3-2. Reports that are projected to be generated.

Report Type	Contents
Annual report	Groundwater chemistry Water level trend data
Monitoring report decision summary	Groundwater chemistry Water level trend data Recharge Contaminant flux to SRPA estimations Update groundwater modeling if necessary
CERCLA 5-yr review	Data summary Evaluation of data to determine if RAO/RGs will be met Update groundwater modeling if necessary

4. FIELD ACTIVITIES

The following sections describe the field activities and procedures to be used to meet the DQOs described in Section 3. Prior to commencing any sampling activities, a prejob briefing will be held with all work-site personnel to review the requirements of the LTMP, HASP, and other work control documentation, and to verify that all supporting documentation has been completed. Additionally, following sampling, a postjob review will be conducted.

The OU 3-13 Group 5 groundwater monitoring and sampling will include collection of several types of data, including water levels, water samples, and geophysical logs of selected wells.

4.1 Sampling and Monitoring Well Network

Group 5 groundwater monitoring and sampling will include collection of several types of data, including water levels, water samples, and geophysical logs of selected wells. The samples will be collected from a network of existing groundwater wells. The first round of sampling will be considered a baseline sampling round and be nearly inclusive of all groundwater monitoring wells in the vicinity of the INTEC facility and downgradient to the Central Facilities Area landfills. Following this baseline sampling round, monitoring activities will consist of sampling of a selected subset of the INTEC monitoring wells.

In order to monitor COC flux originating from the former INTEC injection well (CPP-23) three wells (USGS-41, USGS-48, and USGS-59) completed through the HI interbed will be sampled below the interbed. This will be accomplished by using inflatable packers to seal the borehole below the HI interbed and then collecting the sample from the interval below the packer. Wells suitable for sampling below the HI interbed must have the following characteristics:

- The HI interbed must be present in the borehole
- The well must be completed as an open borehole through the HI interbed
- The wells must be downgradient from the injection well
- The well must be able to maintain a seal using an inflatable packer.

In order to select appropriate wells for this sampling, lithologic and geophysical logs will be reviewed and a borehole televiewer log will be collected from prospective wells. A preliminary review of the lithologic logs indicates that the wells to be selected for this sampling will come from the following group of wells: USGS-41, USGS-43, USGS-45, USGS-46, USGS-47, USGS-48, USGS-49, USGS-51, USGS-59, and a new well. Based on the review of the geophysical and borehole televiewer logs, the wells chosen to sample below the HI interbed may be revised.

4.2 Sampling and Monitoring Locations

The following discussion includes locations for the groundwater sampling.

4.2.1 Groundwater Sampling Locations

A general discussion of the wells to be included is provided in Section 4.1. The majority of the existing groundwater wells will be included in the baseline sampling network. These wells are listed in

Table 4-1 and shown on Figure 4-1. However, for the long-term monitoring the number of wells will be significantly reduced. These wells are listed in Table 4-2 and shown on Figure 4-2, with the exception of the three wells to be determined to monitor contaminants below the HI interbed. The total number of wells for long-term monitoring is 20 and includes 11 facility monitoring wells, six plume monitoring wells, and three wells to monitor the flux originating from the former INTEC injection well. Possible wells for monitoring the flux from the former injection well below the HI interbed are shown on Figure 4-3.

Table 4-1. The INTEC groundwater wells for baseline sampling.

INEEL Name			
ICPP-MON-A-021	USGS-34	USGS-46	USGS-85
ICPP-MON-A-022	USGS-35	USGS-47	USGS-111
LF2-08	USGS-36	USGS-48	USGS-112
LF2-09	USGS-37	USGS-49	USGS-113
LF2-10	USGS-38	USGS-51	USGS-114
LF2-11	USGS-39	USGS-52	USGS-115
LF2-12	USGS-40	USGS-57	USGS-116
LF3-08	USGS-41	USGS-59	USGS-121
LF3-09	USGS-42	USGS-67	USGS-122
LF3-10	USGS-43	USGS-77	USGS-123
LF3-11	USGS-44	USGS-82	MW-18
USGS-20	USGS-45	USGS-84	

Table 4-2. The INTEC groundwater wells for long-term monitoring.

INEEL Name			
USGS-40	USGS-52	USGS-57	USGS-59 (below HI interbed)
USGS-42	USGS-121	USGS-67	USGS-41 (below HI interbed)
USGS-47	USGS-122	USGS-85	LF2-08
USGS-48	USGS-123	USGS-112	ICPP-MON-A-230
USGS-49	MW-18	LF3-08	
USGS-51		USGS-48 (below HI interbed)	

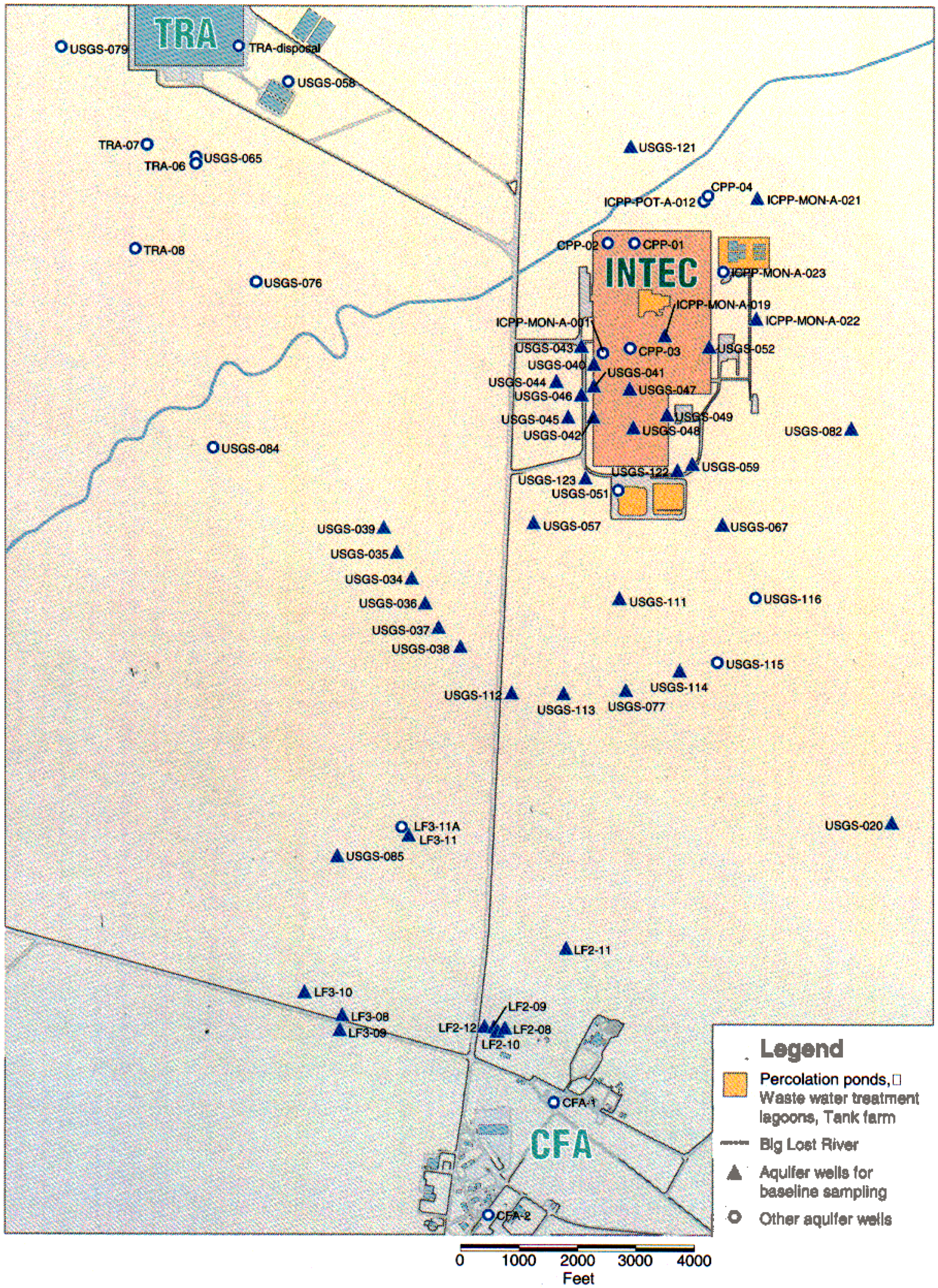

Figure 4-1. The INTEC groundwater wells for baseline sampling and water-level measurement.

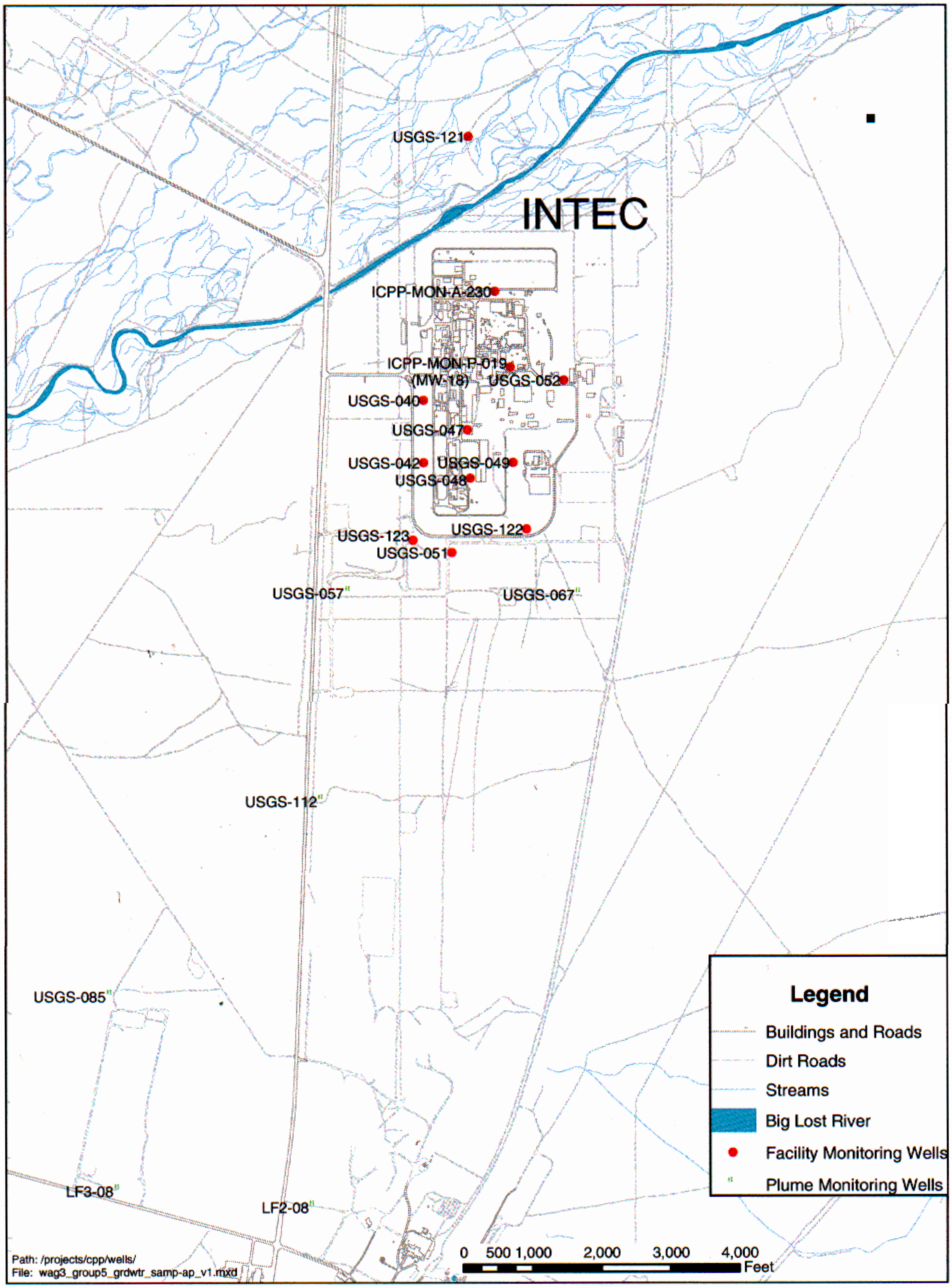

Figure 4-2. INTEC groundwater wells for long-term monitoring.

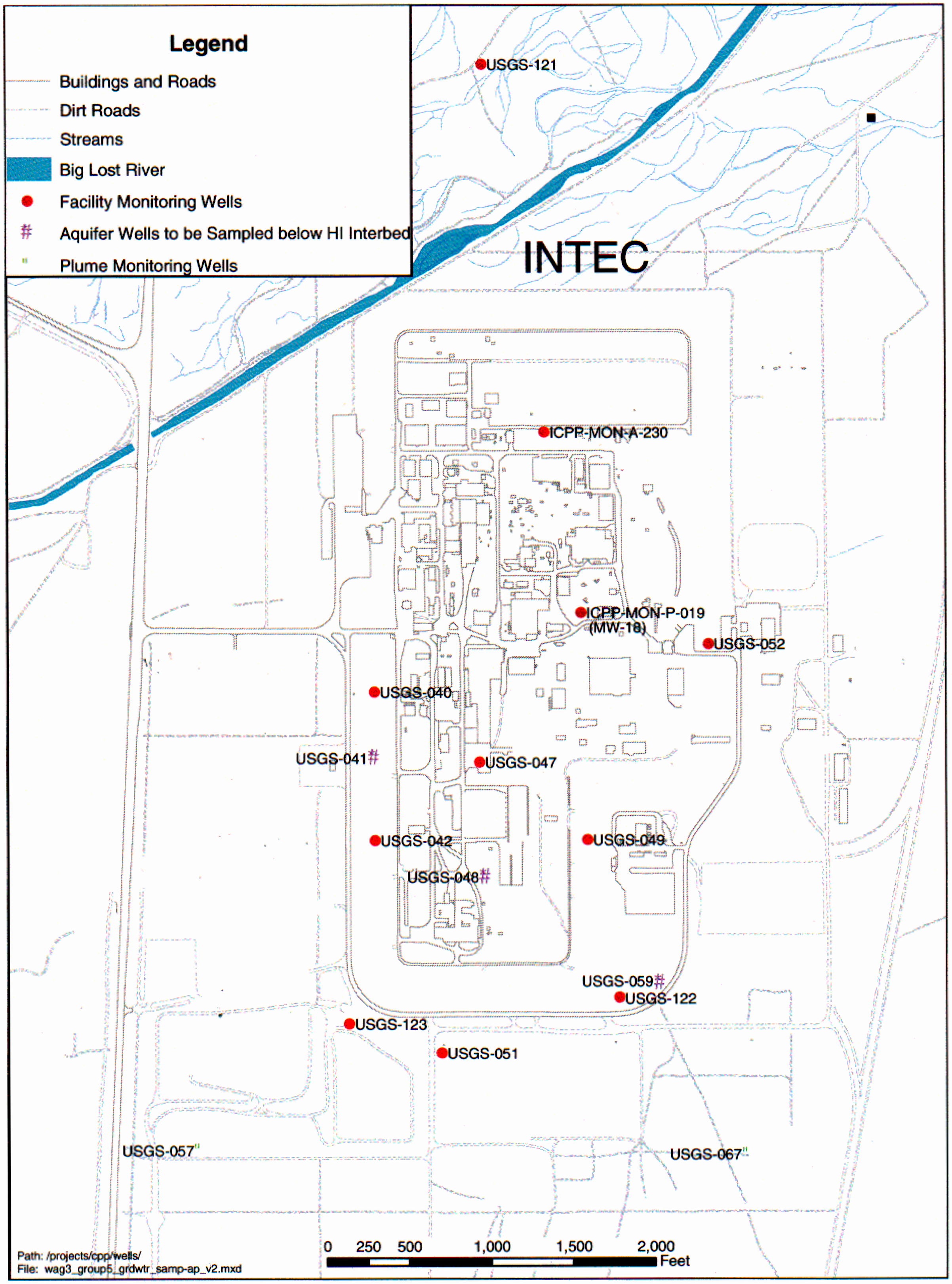

Figure 4-3. INTEC groundwater wells for long-term monitoring of the COC flux from the former injection well below the HI interbed.

All of the selected monitoring wells, with the exception of well MW-18, have dedicated sampling pumps installed.

4.2.2 Groundwater Level Monitoring Locations

With the exception of the production wells, all existing INTEC area groundwater monitoring wells and several wells from surrounding areas will be included in the water level monitoring network. The water level information is essential for the determination of hydraulic gradients in the vicinity of the INTEC facility, to quantify the COC flux across the INTEC fence line, and to refine the site conceptual and OU 3-13 numerical model. The water level information from the surrounding areas will serve to constrain the contouring of the water table along the edges of the area of interest. The wells for the water level monitoring are listed, along with relevant construction information, in Table 4-3 with locations shown on Figure 4-4.

In order to quantify vertical hydraulic gradients across the HI interbed, wells that will be sampled below the HI interbed will also have water level measurements taken above and below the packer after conditions stabilize following installation of the packer.

4.3 Schedule

Table 4-4 lists the sampling and monitoring schedule for Group 5 monitoring under this LTMP.

4.4 Data Types

For groundwater monitoring and sampling, collection of quality assurance/quality control (QA/QC) samples is required. Duplicate samples and field blank samples will be collected at a frequency of 1 per 20 samples or 1 per day, whichever is less. Equipment rinsate samples are required for samples collected from wells that do not have dedicated sampling equipment.

Quality requirements will be satisfied by collecting QA/QC samples (duplicates, field blanks, equipment rinsate, and performance evaluation) during the groundwater sampling according to the schedule presented in Table 4-5.

After the baseline sampling round is completed, sampling will continue as outlined in Table 4-4. The analytes will consist of the COCs identified and hazardous substances. Table 4-6 lists the analytes for the first 7 years of monitoring, after which the analyte list will be reviewed.

Water level measurements will be collected from all existing INTEC facility groundwater monitoring wells.

4.5 Corrective Actions

In the event a discrepancy is discovered by field personnel or auditors, some form of corrective action will be initiated. The level of action taken is related to the level of the discrepancy. Corrective actions can range from field changes caused by unforeseen field conditions to DOE reportable incidents.

Table 4-3. Monitoring wells for the water level monitoring.

INEEL Name				
ICPP-MON-A-021	LF3-11	USGS-42	USGS-57	USGS-112
ICPP-MON-A-022	USGS-20	USGS-43	USGS-59	USGS-113
LF2-08	USGS-34	USGS-44	USGS-65	USGS-114
LF2-09	USGS-35	USGS-45	USGS-67	USGS-115
LF2-10	USGS-36	USGS-46	USGS-76	USGS-116
LF2-11	USGS-37	USGS-47	USGS-77	USGS-121
LF2-12	USGS-38	USGS-48	USGS-82	USGS-122
LF3-08	USGS-39	USGS-49	USGS-84	USGS-123
LF3-09	USGS-40	USGS-51	USGS-85	MW-18
LF3-10	USGS-41	USGS-52	USGS-111	TRA-08

Table 4-4. Groundwater (Group 5) sampling and monitoring frequency.

Sampling or Monitoring Activity	Frequency			
Groundwater sampling	Semiannual for year 1	Annual for years 2 through 7	Biannual for years 8 through 16	Every 5 years for years 17 through 100
Water level measurements	Monthly for year 1	Quarterly for year 2	Semiannual for years 3 through 4	Annual for years 5 through 100

Table 4-5. The QA/QC samples for groundwater sampling.

Activity	Type	Comment
Groundwater sampling	Duplicate	Field duplicates will be collected at a frequency of 1 per 20 samples or 1 per day, whichever is less.
	Field blank	Field blanks will be collected at a frequency of 1 per 20 samples or 1 per day, whichever is less.
	Trip blanks	Trip blanks will be collected when VOC samples are taken at a frequency of 1 per 20 samples or 1 per day, whichever is less.
	Equipment rinsate	Equipment rinsate samples will be collected if the well does not have a dedicated pump. A minimum of 1 rinsate sample will be collected per sampling event, or 1 per day or 1 per 20 samples, whichever is less.
	Performance evaluation	one performance evaluation sample will be submitted for each round of sampling in which radionuclide samples, other than tritium, are collected.

VOC = volatile organic compound

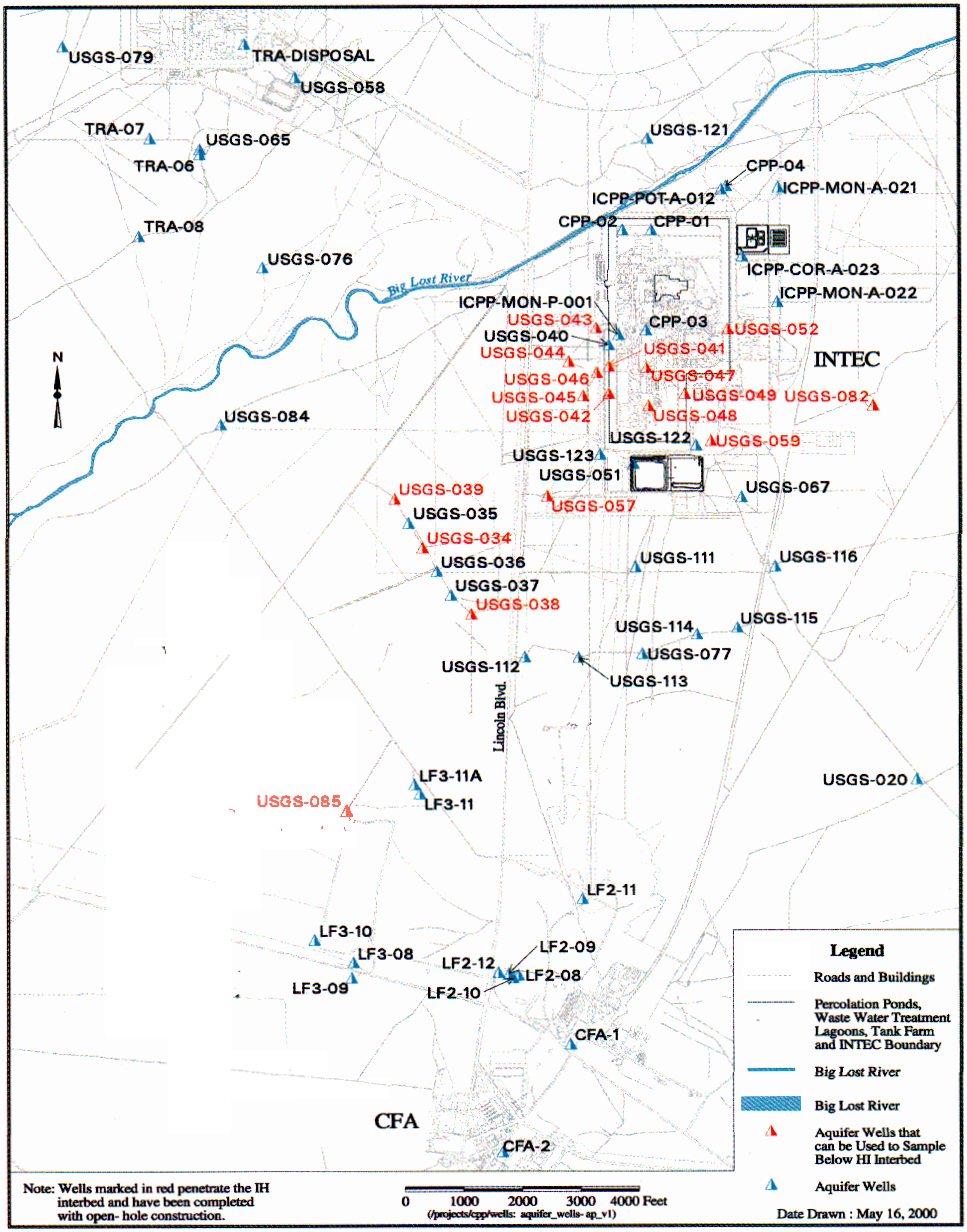

Figure 4-4. INTEC groundwater wells for water levels.

Table 4-6. Group 5 sampling analytes for years 1 through 7.

Field	COCs	Analytical Method[a]	Detection Limits (pCi/L)
Temperature	Gross-alpha	GFP	2
pH	Tritium	LSC	2,000
Alkalinity	Gross-beta	GFP	4
Specific conductance	Technetium-99	LSC or GFP	1
	Iodine-129	MS	0.1
	Strontium-90	GFP	0.8
	Plutonium isotopes (Pu-238, -239, -240, and -241)	ALS	0.05
	Uranium isotopes (U-234, -235, and -238)	ALS	0.05
	Am-241	ALS	0.05
	Np-237	ALS	0.05
	Cs-137	GMS	3
	Mercury	SW7421	0.2 µg/L

a. Methods used for radionuclide analysis are laboratory-specific. The laboratory shall use standard operating procedures based on standard analytical methods provided to the INEEL SAM. The references that may be used to develop the laboratory standard operating procedures are in Wells (1995).

GFP = Gas flow proportional
LSC = Liquid scintillation counting
MS = Mass spectrometry
ALS = Alpha spectometry
GMS = Gamma screen
SW7421 = Cold vapor

5. SAMPLING AND MONITORING PROCEDURES AND EQUIPMENT

This section describes the sampling and monitoring procedures and equipment to be used for the planned groundwater monitoring. Prior to any sampling activities, a presampling meeting will be held to review the requirements of the LTMP and HASP and to ensure all supporting documentation has been completed.

5.1 Groundwater Elevations

Prior to sampling, all groundwater elevations will be measured using either an electronic measuring tape (Solinst brand or equivalent) or a steel-type measure. Measurement of all groundwater levels will be recorded to an accuracy of 0.003 m (0.01 ft).

5.2 Well Purging

All groundwater wells will be purged prior to sample collection. During the purging operation, a Hydrolab (or equivalent) will be used to measure specific conductance, pH, and temperature. A sample for water quality analysis can be collected after a minimum of three well casing volumes of water have been purged from the well and when three consecutive water quality parameters are within the following limits:

pH	$\pm$ 0.1
Temperature	$\pm$ 0.5°C
Specific conductance	$\pm$ 10 µmhos/cm.

5.3 Groundwater Sampling

Prior to sampling, all nondedicated sampling equipment that comes in contact with the water sample will be cleaned. Following sampling, all nondedicated equipment that came in contact with the well water will be decontaminated prior to storage, with the exception that the isopropanol steps for decontamination will be omitted.

Prior to purging, the water level in each well will be measured. The well will then be purged a minimum of three well-casing volumes until the pH, temperature, and specific conductance of the purge water have stabilized, or until a maximum of five well-casing volumes have been removed. A flow-through cell will be used to collect water quality measurements. If the well goes dry prior to purging three well-bore volumes, purging will be considered complete and samples collected thereafter. If parameters are still not stable after five volumes have been removed, samples will be collected and appropriate notations will be recorded in the logbook.

Sample bottles for groundwater samples will be filled to approximately 90 to 95% of capacity to allow for content expansion or preservation. Samples requiring acidification will be acidified to a pH < 2 using ultra-pure nitric acid. The following is the preferred order for sample collection:

1. Temperature, pH, specific conductance, and dissolved oxygen (during purging)
2. Radionuclides (unfiltered)
3. Mercury (unfiltered).

5.4 Personal Protective Equipment

The personal protective equipment (PPE) required for this sampling effort is discussed in the project HASP. Prior to disposal, all PPE will be characterized based on groundwater and field screening results, and a hazardous waste determination shall be made.

5.5 Groundwater Level Monitoring

Water levels will be measured monthly for the first year and quarterly thereafter. All groundwater elevations will be measured using either an electronic measuring tape (Solinst brand or equivalent) or a steel type measure. Measurement of all groundwater levels will be recorded to an accuracy of 0.003 m (0.01 ft).

6. SAMPLING CONTROL

Strict sample control is required on this project. Sample control ensures that unique sample identifiers are used for separate samples. It also ensures that documentation of sample collection information is such that a sampling event may be reconstructed at a later date. The following sections detail unique sample designation, sample handling (including shipping), and radiological screening of samples.

6.1 Sample Identification Code

A systematic 10-character identification (ID) code will be used to uniquely identify all samples. Uniqueness is required to prevent the same ID code from being assigned to more than one sample.

When the first three characters of the code are GWM, this indicates that the sample originated from groundwater monitoring activities. The next three numbers designate the sequential sample number for the project. The seventh and eighth characters represent a two-character set (e.g., 01, 02) for designation of field duplicate samples. The last two characters refer to a particular analysis and bottle type. Refer to the SAP tables in Appendix B for specific bottle code designations.

In this example, a groundwater sample collected in support of the SRPA monitoring might be designated as 5OM09001AB where (from left to right)

- 5OM designates the sample as being collected for Group 5 long-term SRPA groundwater monitoring
- 090 designates the sequential sample number
- 01 designates the type of sample (01 = original, 02 = field duplicate)
- AB designates gross alpha/beta analysis.

A SAP table/database will be used to record all pertinent information (well designation, media, date, etc.) associated with each sample ID code. The SAP tables for the groundwater sampling are presented in Appendix B.

6.2 Sample Designation

6.2.1 General

A SAP table format was developed to simplify the presentation of the sampling scheme for project personnel. The following sections describe the information presented in the SAP table/database (Appendix B).

6.2.2 Sample Description Fields

The sample description fields contain information related to individual sample characteristics.

6.2.2.1 Sampling Activity. The sampling activity field contains the first six characters of the assigned sample number. The sample number in its entirety will be used to link information from other sources (e.g., field data and analytical data) to the information in the SAP table for data reporting, sample tracking, and completeness reporting. The sample number will also be used by the analytical laboratory to track and report analytical results.

6.2.2.2 Sample Type. Data in this field will be selected from the following:

REG	for a regular sample
QC	for a quality control sample.

6.2.2.3 Media. Data in this field will be selected from the following:

GROUNDWATER	for water collected from the groundwater wells
WATER	for other water samples (e.g., rinsates, field blanks, trip blanks).

6.2.2.4 Collection Type. Data in this field will be selected from the following:

GRAB	for grab
COMP	for composite
TBLK	for trip blanks
FBLK	for field blanks
RNST	for equipment rinsates
DUP	for duplicate samples.

6.2.2.5 Planned Date. These data, or event identifier, are related to the planned sample collection start date.

6.2.3 Sample Location Fields

This group of fields pinpoints the exact location for the sample in three-dimensional space, starting with the general AREA, narrowing the focus to an exact location geographically, and then specifying the DEPTH in the depth field. The DEPTH identified in the depth field will correspond to the completion interval of the well.

6.2.3.1 Area. The AREA field identifies the general sample-collection area. This field should contain the standard identifier for the INEEL area being sampled. For this investigation, samples are being collected from INTEC; thus, the area identifier will be “INTEC.”

6.2.3.2 Location. This field may contain geographical coordinates, x-y coordinates, building numbers, or other location-identifying details, as well as program-specific information such as a borehole or well number. Data in this field will normally be subordinated to the AREA. This information is included on the labels generated by the Sample and Analysis Management (SAM) to aid sampling personnel.

6.2.3.3 Type of Location. The type of location field supplies descriptive information concerning the exact sample location. Information in this field may overlap that in the location field, but it is intended to add detail to the location. An example would be “groundwater well.”

6.2.3.4 Depth. The DEPTH of a sample location is the distance in feet from surface level or a range in feet from the surface.

6.2.4 Analysis Types (AT1-AT20)

These fields indicate analysis types (radiological, chemical, hydrological, etc.). Space is provided at the bottom of the form to clearly identify each type. A standard abbreviation should also be provided if possible.

6.3 Sample Handling

Analytical samples for laboratory analyses will be collected in precleaned containers and packaged according to American Society for Testing and Materials or EPA-recommended procedures. The QA samples will be included to satisfy the QA/QC requirements for the program as outlined in the QAPjP and in Section 4. Qualified analytical laboratories (SAM approved) will analyze the samples.

6.3.1 Sample Preservation

Water samples will be preserved as indicated in the analytical laboratory SOW.

6.3.2 Chain-of-Custody Procedures

The chain-of-custody procedures will be followed per applicable procedures, and the QAPjP (DOE-ID 2002a). Sample containers will be stored in a secured area accessible only to the field team members.

6.3.3 Transportation of Samples

Samples will be packaged and shipped in accordance with the regulations issued by the Department of Transportation (DOT) (49 CFR 171 through 49 CFR 178) and EPA sample handling, packaging, and shipping methods (40 CFR 262).

6.3.3.1 Custody Seals. Custody seals will be placed on all shipping containers in such a way as to ensure that tampering or unauthorized opening does not compromise sample integrity. Clear plastic tape will be placed over the seals to ensure that the seals are not damaged during shipment.

6.3.3.2 On-Site and Off-Site Shipping. An on-Site shipment is any transfer of material within the perimeter of the INEEL. Site-specific requirements for transporting samples within INEEL boundaries and those required by the shipping and receiving department will be followed. Shipment within the INEEL boundaries will conform to DOT requirements as stated in 49 CFR Parts 171–178. Off-Site shipment will be coordinated with Packaging and Transportation personnel, as necessary, and will conform to all applicable DOT requirements.

6.4 Radiological Screening

Following sample collection, samples will be surveyed for external contamination, and field screened for radiation levels. If necessary, a gamma-screening sample will be collected and submitted to the Radiation Measurements Laboratory (RML) located at TRA-620 for a 20-minute analysis prior to shipment off-Site. Determination of the need for RML screening will be made by the radiological control technician (RCT) in the field.

If it is determined that the contact readings on the samples exceed 200 mrem/hr beta/gamma, the samples will be held for analysis in the INTEC Remote Analytical Laboratory.

7. QUALITY ASSURANCE/QUALITY CONTROL

A revision to the existing Quality Assurance Project Plan (QAPjP) has been developed for INEEL WAGs 1, 2, 3, 4, 5, 6, 7, 10, and the Inactive Sites Department (DOE-ID 2002a). This plan pertains to all environmental, geotechnical, geophysical, and radiological testing, analysis, and data review. This section details the field elements of the QAPjP to support field operations during the groundwater sampling and monitoring.

7.1 Project Quality Objectives

The QA objectives specify the measurements that must be met to produce acceptable data for a project. The technical and statistical qualities of these measurements must be properly documented. Precision, accuracy, and completeness are quantitative parameters that must be specified for physical/chemical measurements. Comparability and representativeness are qualitative parameters.

The QA objectives for this project will be met through a combination of field and laboratory checks. Field checks will consist of collecting field duplicates, equipment blanks, and field blanks. Laboratory checks consist of initial and continuing calibration samples, laboratory control samples, matrix spikes, and matrix spike duplicates. Laboratory QA is detailed in the QAPjP and is beyond the scope of this LTMP.

7.1.1 Field Precision

Field precision is a measure of the variability not due to laboratory or analytical methods. The three types of field variability or heterogeneity are spatially within a data population, between individual samples, and within an individual sample. Although the heterogeneity between and within samples can be evaluated using duplicate and/or sample splits, overall field precision will be calculated as the relative percent difference between two measurements, or relative standard deviation between three or more measurements. The relative percent difference or relative standard deviation will be calculated as indicated in the QAPjP, for duplicate samples, during the data validation process. Precision goals have been established for inorganic Contract Laboratory Program methods by the EPA (EPA 1993) and for radiological analyses in applicable procedures.

7.1.2 Field Accuracy

Cross-contamination of samples during collection or shipping could yield incorrect analytical results. To assess the occurrence of any cross-contamination events, field blanks will be collected to evaluate any potential impacts. One goal of the sampling program is to eliminate any cross-contamination associated with sample collection or shipping. Duplicate samples to assess precision will be co-located and collected by field personnel at a minimum frequency of one duplicate for every 20 samples or one duplicate sample per day, whichever is less as shown in Table 4-5. These duplicates will be collected for water (blanks). Sample identifications are provided in the SAP tables in Appendix B.

Accuracy of field-instrumentation will be maintained by calibrating all instruments used to collect data and cross-checking with other independently collected data.

7.1.3 Representativeness

Representativeness is evaluated by assessing the accuracy and precision of the sampling program and expressing the degree to which samples represent actual site conditions. In essence, representativeness is a qualitative parameter that addresses whether the sampling program was properly designed to meet the DQOs. The representativeness criterion is best satisfied by confirming that sampling locations are selected properly and a sufficient number of samples are collected to meet the requirements stated in the DQOs (see Section 3.1).

7.1.4 Comparability

Comparability is a qualitative measure of the confidence with which one data set can be compared to another. These data sets include data generated by different laboratories performing this work, data generated by laboratories in previous studies, data generated by the same laboratory over a period of several years, or data obtained using different sampling techniques or analytical protocols. For field aspects of this program, data comparability will be achieved using standard methods of sample collection and handling.

Data collection frequency and long-term trends will ensure comparability of monitoring data.

7.1.5 Completeness

Field completeness will be assessed by comparing the number of samples collected to the number of samples planned. Field sampling completeness is affected by such factors as equipment and instrument malfunctions, and insufficient sample recovery. Completeness can be assessed following data validation and reduction. The completeness goal for this project is 100% for critical activities and 90% for noncritical activities. Well installations (see DOE-ID 2002d) are considered critical activities, while the collection of individual samples are noncritical.

7.2 Field Data Reduction

The reduction of field data is important to ensure that there have been no errors in sample labeling and documentation. This includes cross-referencing the SAP table presented in Appendix B with sample labels, logbooks, and chain-of-custody forms. Prior to sample shipment to the laboratory, field personnel will ensure that all field information is properly documented.

7.3 Data Validation

All laboratory-generated data will be validated to Level B. Data validation will be performed in accordance with applicable procedures. Field-generated data (e.g., matric potential, moisture measurements, and water levels) will be validated through the use of properly calibrated instrumentation, comparing and cross-checking data with independently gathered data, and recording data collection activities in a bound field logbook.

7.4 Quality Assurance Objectives for Measurement

The QA objectives are specifications that the monitoring and sampling measurements identified in the QAPjP must meet to produce acceptable data for the project. The technical and statistical quality of these measurements must be properly documented. Precision, accuracy, method detection limits, and completeness must be specified for hydraulic and chemical measurements. Specific QA objectives are included in DOE-ID 2002a.

8. DATA MANAGEMENT/DATA ANALYSIS AND UNUSUAL OCCURRENCES

Analytical data that results from groundwater sampling will be managed and maintained by the Integrated Environmental Data Management System (IEDMS). The Hydrogeologic Data Repository (HDR) will supply long-term management of the field data. This section discusses the approach to managing the data, analysis of data, and suggested responses to unusual occurrences.

8.1 Data Management

The following discussion presents the various processes associated with managing the data collected in as part of the LTMP. Group 5 data management will follow guidelines specified in the following section.

8.1.1 Laboratory Analytical Data

Analytical data are managed and maintained in the IEDMS. The components that make up IEDMS provide an efficient and accurate means of sample and data tracking.

The IEDMS performs sample tracking throughout all phases of a sampling project, beginning with the assignment of unique sample identification numbers using the SAP application program. The SAP Application produces a SAP table, which contains a list of sample identification numbers, sample demographics (area, location, and depth), and the planned analyses. Once the SAP application database is finalized, it is used to automatically produce sample labels and tags (with or without barcode identification). In addition, sampling guidance forms can be produced for the field sampling team that provide information such as sampling location, requested analysis, container types, and preservative.

When the analytical data package, or sample delivery group (SDG), is received, it is logged into the IEDMS journaling system, an integrated subsystem of the sample tracking system, which tracks the SDG from data receipt to Environmental Restoration Information System (ERIS). Cursory technical reviews on the data packages are performed to assess the completeness and technical compliance with respect to the project's analysis-specific Task Order Statement of Work or SOW. Any deficiencies, resubmittal actions, and special instructions to the validator are recorded on the Cursory Subcontractual Compliance Review form using the Laboratory Performance Indicator Management System. This form is sent to the validator with the data package (when required).

Errors in the data package are resolved among the SAM chemist(s), the originating lab, and the IEDMS staff. Data validity is assured by the validator through the assignment of data validation flags. The validator generates a limitation and validation (LAV) report, which gives detailed information on the assignment of data qualifier flags. A copy of the form 1 accompanies the LAV-report with the validator assigned data qualifier flags and any changes to the data result. The validated data results, along with the data qualifier flags, are entered into the IEDMS database. From this database, a summary table (Result Table) is generated. The Result Table summarizes the sample identification numbers, sample logistics, analytes, and results for each particular type of analysis (such as inorganic, radiological, organic) from the sampling effort. The field sample data from this database is also uploaded to ERIS.

8.1.2 Field Data

Field data includes all data that is non-chemical analytical data generated in support of OU 3-13 Group 5. This data will be managed according to the requirements specified in the *Data Management*

Plan for Operable Unit 3-13, Group 4 and Group 5 Monitoring Well Installation and Monitoring Project (DOE-ID 2000). Final field data will reside in the HDR for long-term management. The HDR will maintain hard copies of the data reports along with electronic copies of the final field data.

8.2 Data Analysis

8.2.1 Laboratory Analytical Data

The validated data will be used in flux calculations to determine if contaminant fluxes to the SRPA from the vadose zone are decreasing as predicted by the OU 3-13 model, as well as determining if the former injection well is acting as a residual source of groundwater contamination in the vicinity of INTEC.

8.2.2 Field Data

Field data will be analyzed using methods that are appropriate for the data types and specific field conditions. Some data sets may be filtered. Analysis will include recognized methods and techniques that are used with the specific data types and may include statistical processes. Field data will be compared to modeled values (as discussed above). This may require that the groundwater be remodeled or, at least, that the model be recalibrated using field-determined values.

8.2.3 Decision Process

The data obtained under this monitoring program will be evaluated and incorporated into an updated OU 3-13 aquifer numerical model to determine if the COC fluxes from within the INTEC facility fence line have been reduced sufficiently to meet the COC concentration limits in the SRPA in 2095.

A summary of the process to update the numerical simulation of the monitoring data follows:

1. Refine the existing conceptual model describing the physical and chemical processes that will be represented in the simulation model.

2. Refine the existing parameterization of the model that meets the conceptual model assumptions. The OU 3-13 RI/FS model parameterization will be the primary source for this initial parameterization.

3. Calibrate the model. The calibration will consist of two parts. The first part will be an evaluation of the model structure that will determine which attributes of the subsurface model have the largest effect on predicted peak concentrations in the aquifer. The second part will consist of adjusting parameter values to improve model agreement to the field data.

4. Summarize the sensitivity and uncertainty analysis and how the results will be used.

5. Summarize the predictive model results and COC concentration predictions at the performance measurement point in 2095.

8.3 Unusual Occurrences

Unusual occurrences are situations that are unforeseen, unanticipated, or unexpected. They may occur in chemical data sets or as field-related data and observations. An example of an unusual occurrence is detection of a COC where previously it was undetected.

The following is meant to provide a process for resolving an unusual occurrence rather than a method for dealing with each specific unusual occurrence. The following steps will be taken to resolve an unusual occurrence:

- Record the unusual occurrence and supporting observations in the field log book.
- Validate unusual occurrence (e.g., reanalyze the sample if any remaining) and report to program manager as soon as possible.
- Determine if the occurrence is a one-time event or is recurring.
- If the unusual occurrence is of a significant nature (significant is anything that can potentially increase contaminant flux to the aquifer with concentration levels above MCLs, e.g., large persistent increases in water levels), it will be reported to the appropriate program managers.
- If the unusual occurrence is not of a significant nature (e.g., malfunctioning instrument that is reporting increases in water levels), it will be resolved by the technical leader and is a nonissue.
- For significant unusual occurrences, take appropriate action, which may include increasing sampling (in network, not just individual well) and/or monitoring frequency, or reviewing the ROD for implementation of a remedial action (for example, curtailing steam condensate discharges to the subsurface).