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**Post Record of Decision
Monitoring Plan for the
Test Reactor Area
Perched Water System
Operable Unit 2-12**



**Idaho
National
Engineering
Laboratory**

*Managed
by the U.S.
Department
of Energy*



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**Post Record of Decision Monitoring Plan
for the Test Reactor Area Perched Water System
Operable Unit 2-12**

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Post Record of Decision Monitoring Plan for the Test Reactor Area Perched Water System Operable Unit 2-12

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ABSTRACT

In 1992, the Record of Decision was issued for Operable Unit 2-12, the Test Reactor Area (TRA) Perched Water System (PWS), at the Idaho National Engineering Laboratory. The selected remedy was no action with groundwater monitoring and a three-year review of the monitoring program. This plan outlines the activities and objectives for the selected remedy. Monitoring activities have been designed for the following objectives: (a) verifying contaminant concentration trends in the Snake River Plain Aquifer (SRPA) predicted by the computer model and (b) evaluating the effect that discontinued discharge to the warm waste pond has on contaminant concentrations in the SRPA and the deep PWS. Groundwater monitoring will be conducted twice a year at a network of SRPA wells located in the vicinity of TRA and quarterly for selected deep PWS wells. Samples collected from these wells will be analyzed for specific contaminants of concern.

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ACRONYMS

ARDC	Administrative Records and Document Control
DQO	data quality objective
EPA	U. S. Environmental Protection Agency
ER&WM	Environmental Restoration and Waste Management
ER	Environmental Restoration
ERIS	Environmental Restoration Information System
FTL	field team leader
HRA	health risk assessment
IEDMS	Integrated Environmental Data Management System
INEL	Idaho National Engineering Laboratory
%RSD	percent relative standard deviation
PARCC	precision, accuracy, representativeness, completeness, and comparability
PM	project manager
PWS	Perched Water System
QPP	Quality Program Plan
RI	remedial investigation
ROD	Record of Decision
RPD	relative percent difference
SMO	Sample Management Office
SOP	standard operating procedure
SOW	statement of work
SRPA	Snake River Plain Aquifer
TAL	target analyte list
TL	tolerance limit
TRA	Test Reactor Area
USGS	U.S. Geological Survey
WAG	Waste Area Group

Post-Record of Decision Monitoring Plan for the Test Reactor Area Perched Water System Operable Unit 2-12

1. INTRODUCTION

The final remedial investigation (RI) for the Test Reactor Area (TRA) Perched Water System (PWS) at the Idaho National Engineering Laboratory (INEL) was finalized in June 1992 (Lewis et al. 1992). The TRA PWS is designated as Operable Unit 2-12 in Waste Area Group (WAG) 2. The proposed plan, issued in June 1992, proposed no action with groundwater monitoring and a three-year review as the preferred alternative for treatment of the PWS [EG&G Idaho, Inc. (EG&G Idaho) 1992a]. The Record of Decision (ROD) for Operable Unit 2-12 was issued in December 1992 (EG&G Idaho 1992b). The selected remedy was consistent with the proposed plan, no action with groundwater monitoring and a three-year review of the monitoring program.

This monitoring plan outlines the activities and objectives that support the groundwater quality monitoring requirement of the ROD. This plan has been prepared to fulfill the requirements stated in all applicable EG&G Idaho, Inc. Environmental Restoration & Waste Management (ER&WM) program directives. Other requirements for this document are stated in the Quality Program Plan (QPP) for Environmental Restoration (ER) [formerly the Environmental Restoration Program], QPP-149 (EG&G Idaho 1991).

This Post-ROD Monitoring Plan has been designed in accordance with ERD Program Directive 5.2, "Preparation of Sampling and Analysis Plans" (EG&G Idaho 1993a). The monitoring plan consists of two elements: a quality assurance project plan and a field sampling plan. Section 2, the quality assurance project plan, is based on the 16 elements prescribed in the U.S. Environmental Protection Agency (EPA) guidance (EPA 1983; EPA 1991). Section 3 of the monitoring plan is the field sampling plan and includes the site background, sampling objectives, sample location and frequency, sample designation, sampling equipment and procedures, sample handling and analysis, and waste management. The format of Section 3 is consistent with EPA guidance on preparing field sampling plans for remedial investigations and feasibility studies (EPA 1988). The health and safety plan, appropriate ER standard operating procedures (SOPs), and laboratory statements of work (SOWs) have been appended to this document.

2. QUALITY ASSURANCE PROJECT PLAN

2.1 Project Description

Because the no remedial action decision of the ROD will result in hazardous substances remaining on-Site above health-based risk levels, post-ROD monitoring of the deep PWS at TRA is required. A three-year review of the no action decision will be conducted by EPA and the Idaho Department of Health and Welfare (referred to as "the Agencies") to ensure that human health and the environment are being protected by the no action response and that the assumptions used for the no action decision are still valid. These assumptions, as stated in the ROD, are as follows:

- Groundwater monitoring will be conducted to verify that contaminant levels decline as predicted by a numerical model. A monitoring program will be developed as a post-ROD document.
- Operations at TRA will continue at least through the year 2016, followed by a minimum estimated 10-year decontamination and decommissioning period. Existing institutional controls, which include land use and property access restrictions, will continue to be maintained during this period.
- The existing warm waste pond, which is the major source of contamination in the perched groundwater, will be replaced by a new lined pond in 1993. The RI assumed that the existing warm waste pond would be removed after the new lined pond becomes operational.

The data collected under this plan will support the three-year review. The data will be reported to EPA and the State of Idaho through quarterly data transmittals and annual technical memoranda (see Section 2.14).

2.1.1 Objectives

Post-ROD monitoring will observe the water quality of the deep PWS and Snake River Plain Aquifer (SRPA) in the vicinity of TRA. As stated in the ROD, the objectives of monitoring are to (a) verify the accuracy of contaminant of concern concentration trends in the SRPA predicted by computer modeling and (b) evaluate the effect that discontinued discharge to the warm waste pond has on contaminant of concern concentrations in the SRPA and the deep PWS. All data generated will be available for use in the WAG 2 comprehensive RI.

2.1.2 Site Background

TRA is located in the southwestern portion of the INEL, north of the Big Lost River and approximately 47 miles west of Idaho Falls (see Figure 1). The area houses high neutron flux nuclear test reactors. Three major reactors have been built at TRA: the Materials Test Reactor, the Engineering Test Reactor, and the Advanced Test Reactor. Only the Advanced Test Reactor

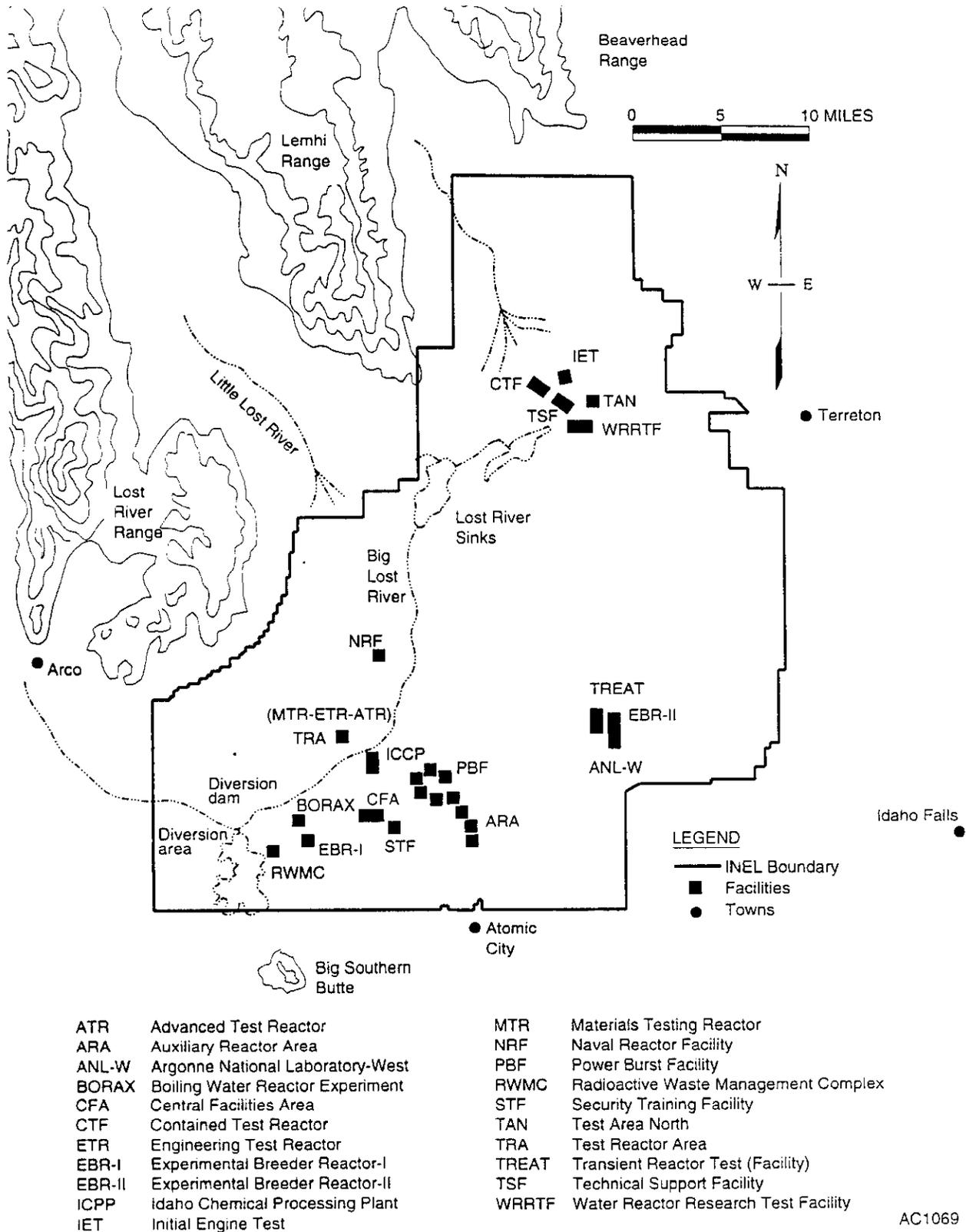


Figure 1. Map of the INEL and surrounding areas.

is operational today. More than 73 buildings and 56 structures have been constructed at TRA, providing four major types of functional support: reactor, laboratory, office, and crafts.

The area around TRA is relatively flat with elevation variations not exceeding 38 ft. Generally, the land surface gently slopes from the west-southwest corner to the east-northeast corner. TRA is in an area measuring 1,900 by 1,700 ft and is surrounded by a double security fence. The buildings and structures are located inside the fence. Located outside the fence are parking areas, a helicopter landing pad, the sewage treatment plant, the Engineering Test Reactor waste gas stack, the North Storage Area, and four unlined waste disposal ponds (see Figure 2). Also located around the perimeter of TRA are unpaved roads, groundwater monitoring wells, and numerous construction rubble piles created as facilities were built at TRA.

Wastewater discharged to unlined surface ponds at TRA percolates downward through the surficial alluvium and the underlying basalt bedrock. A resulting shallow perched water zone has formed at the interface between the surficial sediments and the underlying basalt. Further downward movement of groundwater is again impeded by a low permeability layer of silt, clay, and sand encountered at a depth of approximately 150 ft. The deep perched water zone occurs on top of this low permeability interbed. Figure 3 shows the PWS under TRA. Figure 4 illustrates the configuration of the deep perched groundwater at TRA. Various groundwater investigations in the vicinity of TRA have been conducted since 1949 to characterize the quality of the groundwater. These investigations are summarized in the final RI report (Lewis et al. 1992).

The U. S. Geological Survey (USGS) began monitoring waste migration in the deep perched groundwater zone at TRA in 1960. By 1986, the deep perched groundwater monitoring network had expanded to 22 wells. Four USGS wells monitor the SRPA in the vicinity of the TRA. Other wells used to monitor the SRPA include three test wells, the TRA disposal well, three wells installed for RI purposes, and two of the four TRA production wells. Monitoring parameters in the shallow and deep perched water zones and in the SRPA have included nitrate, chloride, pH, specific conductivity, sodium, hexavalent chromium, total and dissolved chromium, chromium-51, tritium, cobalt-60, cesium-137, and strontium-90.

Groundwater in the PWS was sampled in 1991 for a comprehensive water quality evaluation. The data from this study were used for a health risk assessment (HRA) to evaluate potential risks to human health and the environment, as discussed in the final RI report (Lewis et al. 1992). The purpose of this sampling effort was to extend the scope of the USGS monitoring effort to include additional groundwater quality parameters not routinely monitored by the USGS. Data generated during this sampling effort were obtained from a total of 39 wells (6 shallow perched wells, 22 deep perched wells, and 11 SRPA wells). The samples were collected to provide water quality information and to assess the nature and extent of the chemical and radiological contaminants in the perched water zones and the SRPA from past waste disposal practices at TRA.

Groundwater samples collected from existing TRA monitoring and production wells were analyzed for volatile organics, acrylonitrile, semivolatile organics, metals by atomic absorption and inductively coupled plasma, hexavalent chromium, and radionuclides. In addition, groundwater collected from these wells was analyzed for field parameters of specific conductivity, pH, and temperature; laboratory analyses were performed for the water quality parameters of alkalinity,

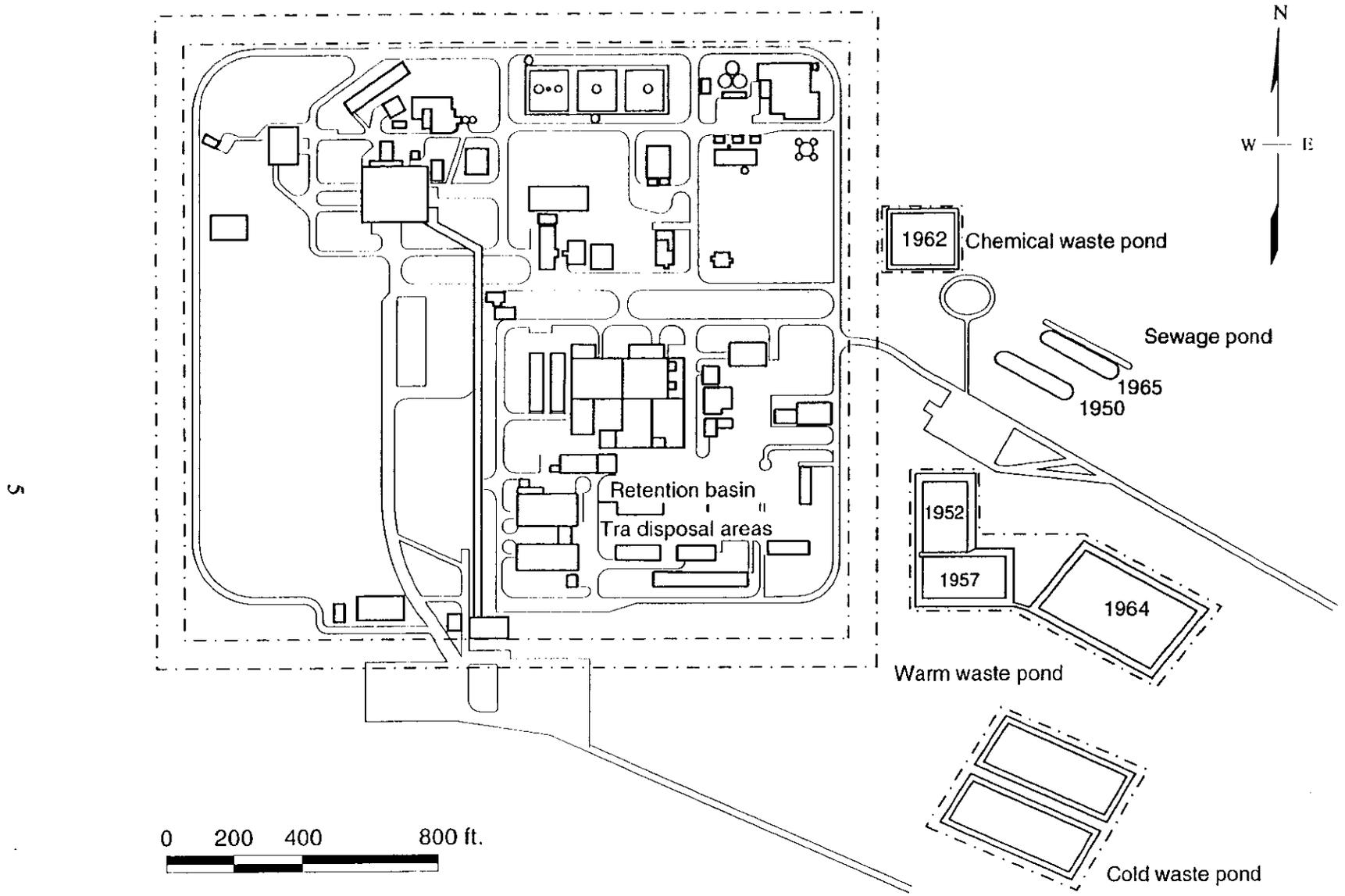
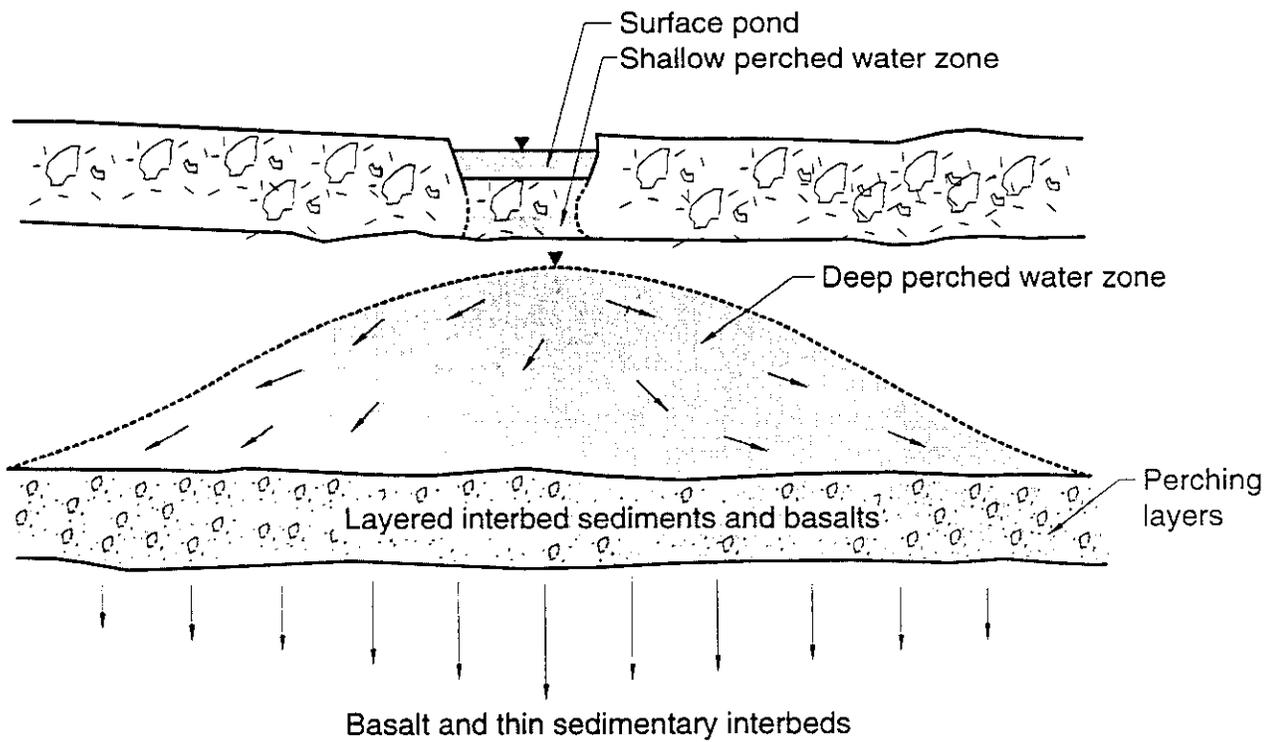


Figure 2. TRA waste disposal areas.



Schematic (not to scale) Snake River Plain Aquifer

Figure 3. Generalized cross section of the perched water zones beneath TRA.

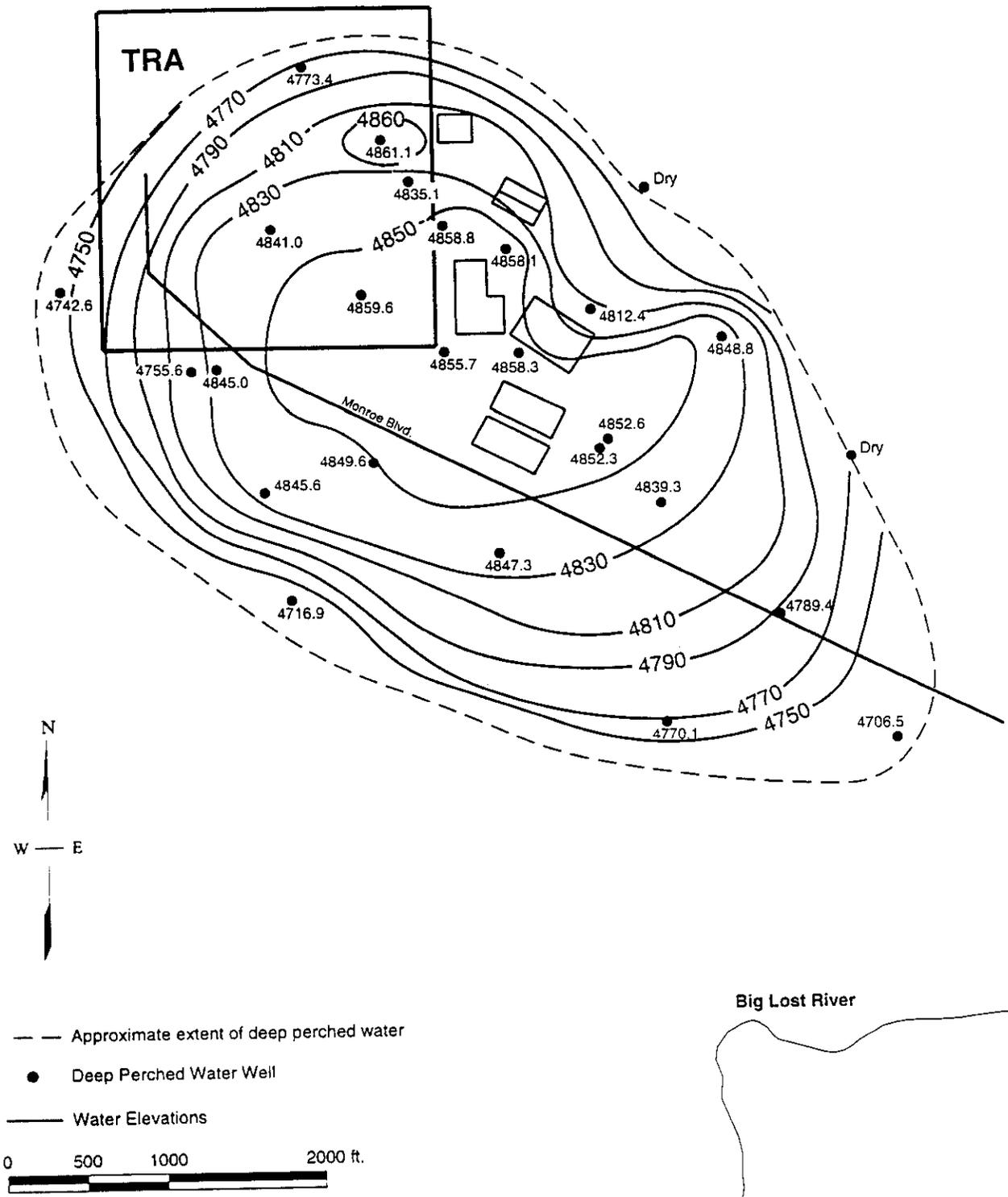


Figure 4. Configuration of the deep perched groundwater at TRA on March 21, 1991.

fluoride, total dissolved solids, nitrate, nitrite, phosphate, chloride, silica, and sulfate. The PWS RI focused on using these data, in conjunction with the historical information, to identify contaminants of concern, assess fate and transport of the contaminants of concern, and conduct the baseline risk assessment. The contaminants of concern for the PWS are fluoride, chromium, hexavalent chromium, cadmium, manganese, cobalt, arsenic, beryllium, lead, tritium, strontium-90, cobalt-60, americium-241, and cesium-137. A summary of the site characterization efforts, the contaminant of concern identification process, and site risks to human health and the environment are documented in the final PWS RI report (Lewis et al. 1992).

2.1.3 Summary of Sampling and Analysis Tasks

The sampling and analysis tasks for the post-ROD monitoring program include groundwater collection and analysis for the contaminants of concern identified in the final RI report (Lewis et al. 1992). Water level measurements and field water quality testing (e.g., pH, conductivity, and temperature) also will be performed.

2.1.3.1 Groundwater Sampling. Deep PWS samples will be collected quarterly for the first year while SRPA groundwater samples will be collected semiannually. This frequency of sampling and the wells to be sampled will be evaluated after one year of monitoring. The wells that will be sampled are listed below (see Figure 5):

- Deep PWS
 - PW-11
 - PW-12
 - USGS-53
 - USGS-54
 - USGS-55
 - USGS-56
- SRPA
 - TRA-7
 - USGS-58
 - USGS-65.

Section 3 discusses the rationale for selecting these wells for monitoring. Wells TRA-03 and TRA-04 are production wells and are considered to represent hydrologically upgradient water quality (i.e., SRPA water unaffected by perched water contamination). These wells will not be sampled as part of the post-ROD monitoring program; however, chemical data from these wells

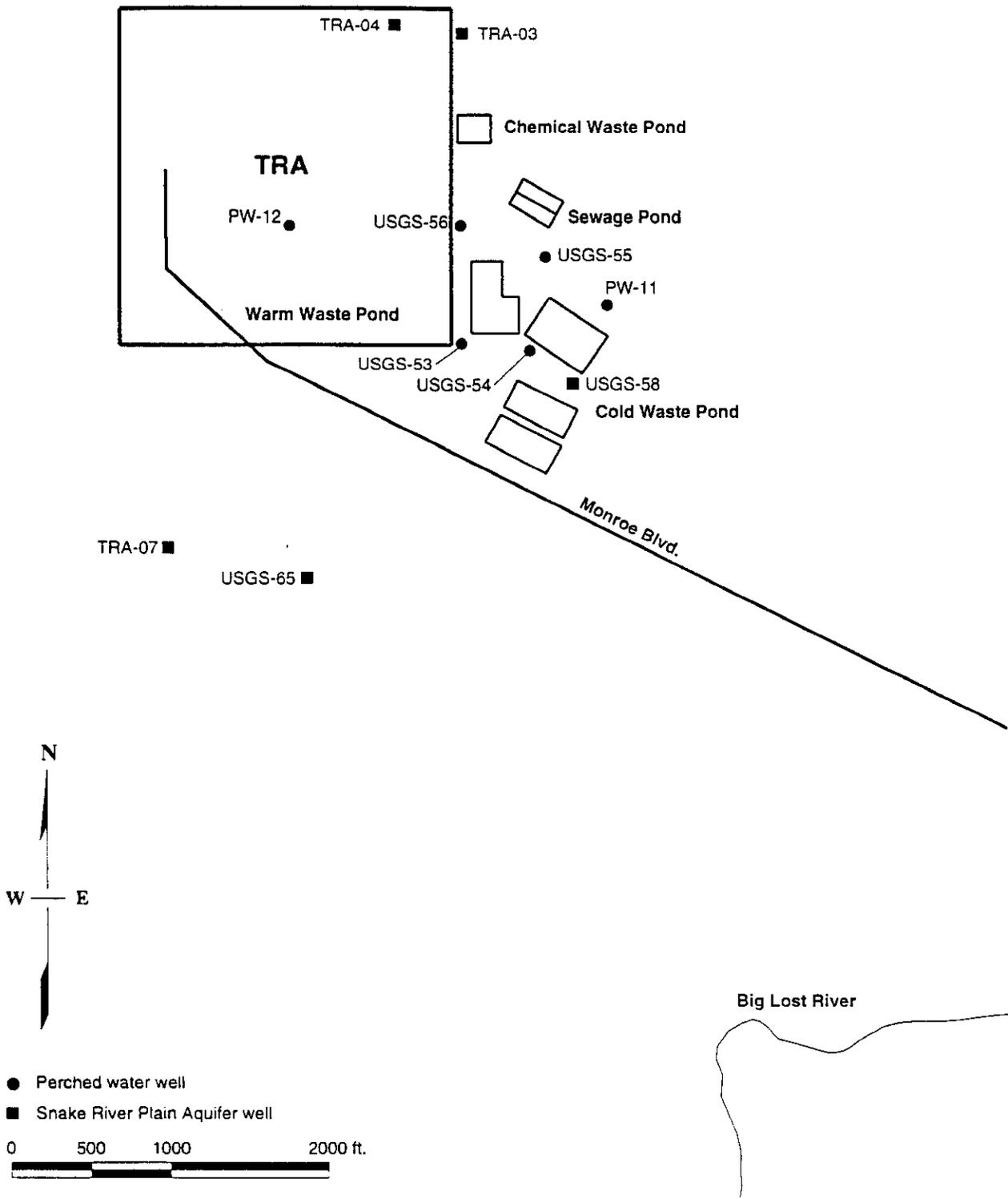


Figure 5. TRA perched water system post-ROD groundwater monitoring well network.

will be obtained from other programs at the same frequency that the SRPA wells are sampled, and will be evaluated as necessary.

Field measurements of pH, temperature, and conductivity will be measured at each sample site. Both filtered and unfiltered groundwater samples will be collected from the SRPA wells; filtered groundwater samples will be collected in the deep PWS wells. The water samples will be analyzed for the nonradiological contaminants of concern identified in the RI for OU 2-12 (Lewis et al. 1992):

- Arsenic
- Beryllium
- Cadmium
- Chromium (trivalent and hexavalent)
- Cobalt
- Lead
- Manganese.

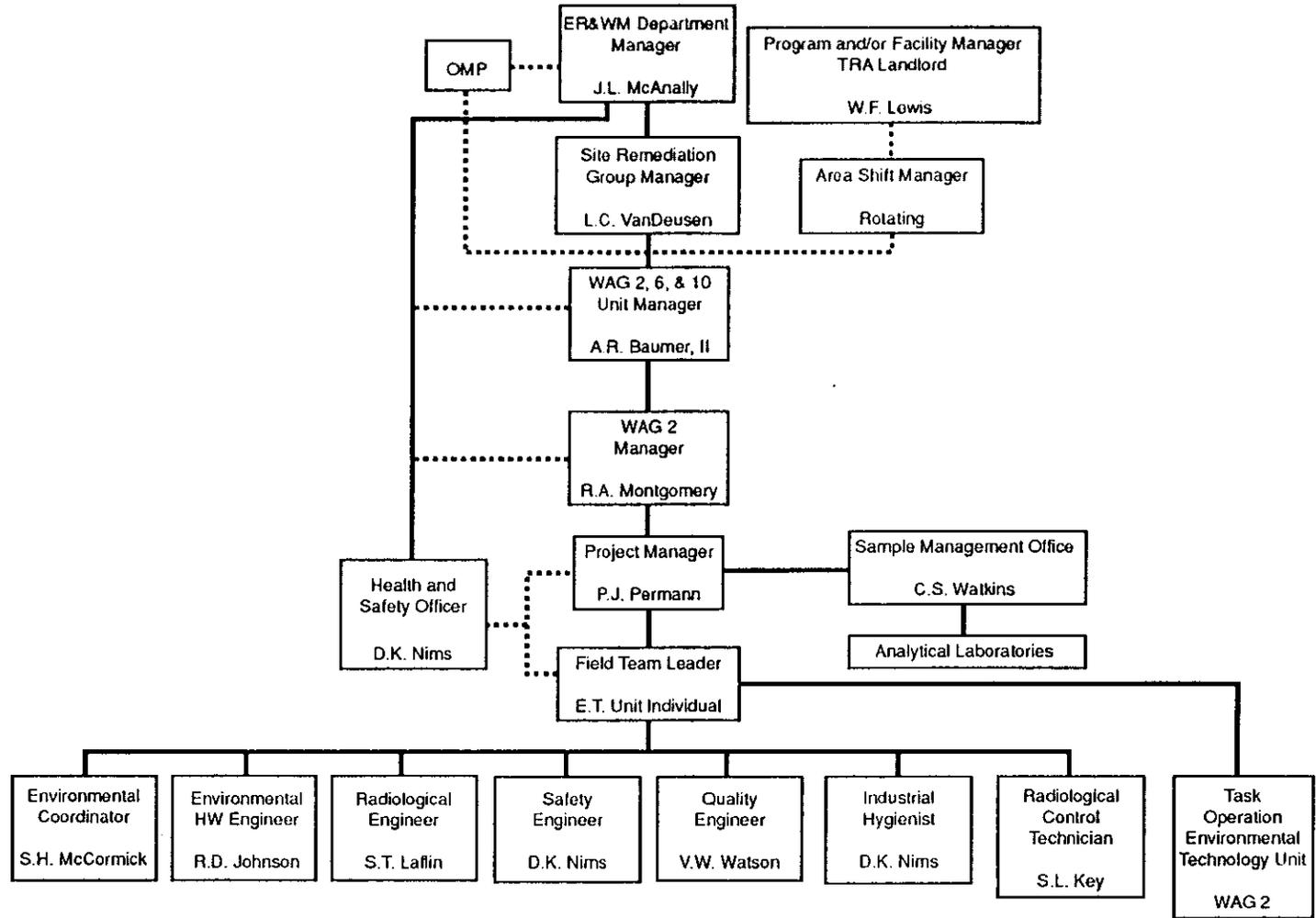
Unfiltered samples from both the SRPA and deep PWS network wells will be analyzed for the remaining contaminants of concern for the PWS RI:

- Fluoride
- Americium-241
- Strontium-90
- Cesium-137
- Cobalt-60
- Tritium.

See Figure 23 for a summary of the network wells, frequency of sampling, and specific analysis.

2.2 Project Organization and Responsibilities

The organizational structure and reporting relationships are illustrated in Figure 6. All field personnel will have received the required training before the start of field activities, including the health and safety training required by the health and safety plan (Appendix A). Field team leaders (FTLs) will report to the EG&G Idaho project manager (PM) and will coordinate onsite activities with the job site supervisor.



———— Lines of communication and responsibility

----- Lines of communication

WAG = Waste Area Group

L93 0417

Figure 6. Organization chart for post-ROD monitoring.

2.3 Quality Assurance Objectives for Measurement

The requirements established by the *Quality Program Plan for the Environmental Restoration Department*, QPP-149 (EG&G Idaho 1991), address the quality for data collected in support of environmental restoration activities. The data use categories that are applicable to the post-ROD monitoring include performance assessment and monitoring during remedial action. The goal of the post-ROD monitoring program is to produce data of known and documented quality at a quality level appropriate for its intended use.

2.3.1 Data Quality Objectives

Data quality objectives (DQOs) are defined as qualitative and quantitative statements that specify the quality of data required to support a decision process (EPA 1987). The post-ROD monitoring activity requires data of a known quality to assess the effectiveness of the no action decision. The precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters are indicators of data quality. The PARCC parameter objectives have been developed to support the end use of the post-ROD monitoring program data and are described in the following sections in terms of field and laboratory objectives. The analytical levels required to meet these objectives are described in Section 2.3.2 and are summarized in Table 1 along with the analytical DQOs, sample analysis, and data validation requirements.

2.3.1.1 Precision. Precision is assessed by means of laboratory duplicate and field replicate sample analysis, and measures the reproducibility of a measurement under a given set of conditions. The closer the numerical values of the measurements, the more precise the overall measurements. Precision will be stated in terms of the standard deviation for three or more measurements or the percent difference for two measurements (EG&G Idaho 1991).

Precision will be stated as the relative percent difference (RPD) for duplicate measurements or percent relative standard deviation (%RSD) for three or more replicate measurements. The standard deviation, s , is calculated from the variance, s^2 , as

$$s^2 = \frac{(x_i - x)^2}{n - 1}$$

where

x_i = the measurement of the i^{th} population unit

x = arithmetic mean of n measurements

n = number of samples.

Table 1. Analytical DQOs, sample analysis, and data validation requirements.

Task (management)	Method	Analytical level	Data validation level	Data uses ^a	Precision ^b	Accuracy	Detection limit
Water level	Electronic sensor	II	C	PA, M	NA	± 0.01 ft	0.01 ft
Temperature	Hydrolab	II	C	M	NA	± 0.15°C	0.01°C
Conductivity	Hydrolab	II	C	M	NA	± 1% of range ^c	4 digits
pH	Hydrolab	II	C	PA, M	NA	± pH unit ^c	0.01 units
Dissolved oxygen	Hydrolab	II	C	M	NA		
Metals ^d	ERP-SOW-59	III	B	PA, M	Per ERP-SOW-59	Per ERP-SOW-59	Per ERP-SOW-59
Gamma spectroscopy ^e	ERP-SOW-33	III	B	PA, M	Per ERP-SOW-33	Per ERP-SOW-33	Per ERP-SOW-33
Alpha spectroscopy ^e	ERP-SOW-33	III	B	PA, M	Per ERP-SOW-33	Per ERP-SOW-33	Per ERP-SOW-33
Tritium, strontium-90 ^e	ERP-SOW-33	III	B	PA, M	Per ERP-SOW-33	Per ERP-SOW-33	Per ERP-SOW-33

a. M = monitoring during remedial action
PA = performance assessment.

b. NA = not applicable.

c. Variation from calibration value.

d. Refer to Table 2 for target and analyte list of inorganic compounds for water samples. Appendix B contains ERP-SOW-59.

e. Refer to Tables 3, 4, and 5 for target analyte lists of radionuclides for water samples. Appendix C contains ERP-SOW-33.

The %RSD is then

$$\%RSD = \frac{s}{x} \times 100$$

The standard deviation and %RSD are calculated for every replicate measurement or sample analysis. For duplicate measurements, the precision expressed as RPD is calculated as

$$RPD = \frac{C_1 - C_2}{(C_1 + C_2)/2} \times 100$$

C_1 and C_2 are the two values obtained from the analysis of the duplicate samples. C_1 is the larger of the two observed values. One field duplicate sample will be collected per sampling round. A reproducibility goal of $\pm 20\%$ is set for field precision.

2.3.1.1.1 Laboratory Precision—Laboratory precision will be within established control limits for a particular method. Laboratory precision will be evaluated with laboratory duplicates and spiked samples for inorganic and radiochemical analyses. Precision will be calculated as RPD for duplicate measurements. Standard deviation (%RSD) calculations will be used for the assessment of precision on three or more replicate measurements. Numeric precision goals for laboratory measurements are provided in the ER Sample Management Office (SMO) laboratory SOWs (Appendices B and C).

2.3.1.2 Accuracy. Accuracy is defined as the degree of agreement between the average measurements for a parameter and the accepted reference or true value (EG&G Idaho 1991). Accuracy is assessed by means of reference samples and percent recovery of matrix spikes.

2.3.1.2.1 Field Accuracy—Accuracy of the sample collection process is addressed, in a qualitative sense, by the representativeness of the sampling network design. However, because no accepted reference or true value exists for contaminants being measured in the field, no quantitative assessment can be made to determine whether a sample will yield results that accurately reflect the true concentration of the contaminants in the groundwater. Cross-contamination of the samples would yield inaccurate results. The probability of cross-contamination occurring can be estimated with field quality control sample results. Therefore, one equipment rinse to determine the thoroughness of cross-contamination control and one field blank to measure background will be submitted for analysis for each sampling round. Contaminants detected in the blanks will be assessed for impact on the accuracy of the analytical results. The objective for the field program is to have no detectable levels of contaminants in the blanks.

2.3.1.2.2 Laboratory Accuracy—Laboratory accuracy will be within established control limits for a particular method. Laboratory accuracy is calculated by assessing the percent recovery of matrix spike samples and the percent recovery of laboratory control samples. Surrogate spike recoveries are also applicable for assessing the accuracy of the organic analyses.

Laboratory accuracy will be used to help determine if the laboratory is in control and to assign uncertainties to the data.

Accuracy expressed as percent recovery for a standard reference material (laboratory control sample) is calculated as follows:

$$\%R = \frac{C_m}{C_{srm}} \times 100$$

where

C_m = measured concentration value obtained by analyzing the sample

C_{srm} = reference concentration of the analyte in the standard.

For measurements where matrix spikes or surrogate spikes are used, the percent recovery is calculated by

$$\%R = \frac{S - U}{C_{sa}} \times 100$$

where

S = measured concentration in the spiked aliquot

U = measured concentration in the unspiked aliquot

C_{sa} = actual concentration of the spike added.

Numeric accuracy goals for laboratory measurements are provided in the ER SMO laboratory SOWs (Appendices B and C). The laboratory is also required by the laboratory SOW to run a sufficient number and type of blanks to detect laboratory contamination.

2.3.1.2.3 Radiological Laboratory Precision and Accuracy—For radiological analyses, uncertainties traditionally have not been broken down into precision and accuracy components. Instead, the analyses have reported either a statistical uncertainty based on Poisson statistics of radioactive emissions, or a total uncertainty, in which other error components are combined with the statistical uncertainty by adding in quadrature. The statistical component is a function of the number of counts in the instrumental peak response. Because the decay of radioactive elements is subject to Poisson statistics, the statistical uncertainty is equal to the square root of the number of counts in the peak (i.e., the characteristic energy for the specific radionuclide). For gamma spectrometry, where peak-fitting programs are used to quantify the peak area, the statistical uncertainty is dependent on the peak-fitting routine. Other components added may be uncertainties from the chemical procedure (efficiency or geometry uncertainties), or may be added separately. Because of cascade summing effects of some gamma decays,

uncertainties may be higher for samples containing more than one radionuclide or for samples not in the exact geometry used to calibrate the detector.

Results of radiological analyses are very dependent on the geometry and matrix of the sample. If the actual geometry and matrix are not the same as those specified, both the detection limits and the range of uncertainties may change in ways that can only be determined by an experienced analyst. An experienced analyst should always be consulted for each individual analysis to resolve these and other questions.

2.3.1.3 Representativeness. Representativeness expresses the degree to which sample data represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter that is most concerned with the proper design of the sampling program. The representativeness criterion is best satisfied by making certain that sampling locations and methods are selected and documented properly and that a sufficient number of samples are collected (EG&G Idaho 1991).

Wells in the vicinity of TRA were evaluated for inclusion in the monitoring well network for the post-ROD monitoring activities. Existing well construction data and information regarding historic well uses and contamination history were assessed for both deep PWS and SRPA wells. These data were assessed to select appropriate wells to monitor groundwater levels and water quality. The wells selected represent locations hydrologically upgradient of the deep PWS, within the boundaries of the deep PWS, and hydrologically downgradient of the deep PWS. The location map in Figure 5 shows the monitoring locations. The field sampling plan (Section 3) details the rationale and purpose for the locations selected.

2.3.1.4 Completeness. Completeness is defined as a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected under a normal condition (EG&G Idaho 1991). A set of data must be complete so that it can be used with confidence in assessing the effectiveness of the no action decision (i.e., there must be enough samples and valid data from analyses to make the assessment). An integral part of obtaining valid data is to design the sampling network in a manner that provides the minimum data necessary for monitoring and identifies critical samples.

2.3.1.4.1 Sampling Completeness—Sampling completeness for the monitoring program will be assessed by comparing the number of samples collected to the number of samples planned. Sampling completeness for the project will be determined by the following calculation:

$$\%C = \frac{V}{N} \times 100$$

where

V = number of samples obtained (data points)

N = total number of samples planned.

The goal for completeness for the post-ROD monitoring program to provide enough planned data to meet the project objectives. The overall completeness goal for all sampling efforts is 90%. This means that at least 90% of all samples requested in this document must be collected. Sampling completeness will be computed on an annual basis.

2.3.1.4.2 Analytical Completeness—Completeness of sample analyses will also be examined. Analytical completeness is defined as the percentage of all requested sample analyses that have been completed and are compliant with the method requirements (EG&G Idaho 1991). It is reduced by the following factors: expiration of sample holding times; sample damage incurred during handling, shipping, unpacking, or storage; and inability to validate laboratory data and reanalyze the corresponding samples. These factors must be minimized in order to maximize analytical completeness. Analytical completeness is computed using the following equation:

$$\%C_a = \frac{V_a}{N_a} \times 100$$

where

V_a = number of requested analyses completed and compliant with method requirements

N_a = total number of requested analyses.

The overall analytical completeness goal of the program is 90%. Analytical completeness will be calculated on an annual basis following the completion of all data validation and reduction.

2.3.1.5 Comparability. Comparability expresses the confidence with which one set of data can be compared to another set of data. To assist in comparing data, all chemical analyses will be accomplished using an EPA or equivalent method as prescribed through the laboratory SOWs. All analytical results and field measurements will be reported in the concentration values and units required for entry into the Environmental Restoration Information System (ERIS) data base (EG&G Idaho 1991). For data from subsequent sampling at the same site or facility to be compared, established monitoring wells have been selected for the post-ROD monitoring activities. Comparability will be assessed by comparing the following information for each data set:

- Field collection methods
- Field and laboratory quality assurance/quality control procedures
- Laboratory detection limits.

2.3.2 Data Analytical Level

QPP-149 (EG&G Idaho 1991) gives the data analytical level requirements for different data uses. The data uses for the post-ROD monitoring are described as performance assessment and

monitoring during remedial action. In accordance with QPP-149, performance assessment data applications are used to predict the migration of contaminants from the area including release, movement along migration pathways, and residence within a secondary source. The performance assessment provides predictions of contaminant concentrations as a function of distance and future time so that remedial alternatives can be evaluated. Monitoring during remedial action uses data collected during the remediation (in this case the remediation is considered no action) to evaluate the effectiveness of the action (EG&G Idaho 1991).

Analytical Level III is suggested in QPP-149 for both of the data uses described above. Level III analytical data requires that analyses are performed at a permanent fixed laboratory remote to the site of sampling operations. The analytical methods used are approved by EPA or the American Society for Testing and Materials or equivalent. The methods do not necessarily follow Contract Laboratory Program procedures. Uncertainty in analytical results will be quantified on a sample-set basis by using duplicates and matrix spikes (EG&G Idaho 1991).

2.4 Sampling Procedures

Section 3, the field sampling plan, details all aspects of the field program including sampling procedures, frequency of monitoring, monitoring network design, sampling objectives, and documentation requirements.

2.5 Sample Custody

Sample custody procedures will follow ER Program Directive 5.7, Chain of Custody Record (Appendix D) and ERSOP 11.3, Chain-of-Custody, Sample Handling, and Packaging (Appendix E), for samples going to an ER&WM-approved off-Site laboratory.

2.6 Calibration Procedures

Each piece of equipment will be identified in the field logbook so calibration and maintenance can be tracked (see Appendix F). The equipment will have an individual calibration log and will be calibrated or standardized before use or as part of the operational use. The manufacturer's recommended procedures and the procedures detailed in this section will be followed.

Measuring and test equipment will be calibrated at prescribed intervals and/or before use. Frequency will be based on the type of equipment, inherent stability, manufacturer's recommendations, intended use, and experience.

The instrument calibration data will be recorded in the field logbook as specified in Program Directive 4.2 (Appendix F). Daily checks to verify instrument function using check sources also will be entered into the field logbooks.

2.6.1 Field Instrument Calibration

The hydrolab (or equivalent) and radiological measurement instrumentation will require calibration and a field check before use. The electronic water elevation meter will be calibrated as appropriate and operated in accordance with ERSOP 11.9 (Appendix G). Radiological instrumentation will be maintained and calibrated in accordance with the *EG&G Idaho Radiological Control Manual* (EG&G Idaho 1993b) and applicable SOPs. The portable field radiation detection instrumentation will require daily verification of operability in addition to the annual calibration that is traceable to the National Institute of Standards.

2.6.2 Laboratory Instrument Calibration

Calibration procedures and protocols are documented for all analyses (radiological and chemical) in the appropriate SOWs (Appendices B and C).

2.6.3 Calibration Records

Records will be maintained in the field logbook (see Appendix F) for each piece of calibrated equipment used in the field to show that established calibration procedures have been followed. Calibration records for the equipment controlled by the various laboratories, offices, and groups will be maintained by the respective organizations during analysis. A copy of the instrument calibration logs for field instruments will be provided to the FTL weekly to indicate calibration status when the samples were collected. Any necessary deviations from the instrument operating specifications will be documented, dated, and signed. At the end of the project, all records will be forwarded to ER&WM Administrative Records and Document Control (ARDC) for final archiving.

Calibration records applicable to the prescribed laboratory analytical methods are detailed in the appropriate SOWs (Appendices B and C). All laboratory documentation, which includes calibration records, is part of the data package deliverables and will be forwarded to ARDC and the SMO for method validation (EG&G Idaho 1992c).

2.6.4 Calibration Failure

Field and laboratory equipment out of calibration will be recalibrated in accordance with the requirements of this section and Section 2.13, Corrective Actions. The FTL will be notified immediately by the operator when field test equipment is found to be out of calibration, damaged, lost, or stolen. An evaluation will be made to ascertain the validity of a previous inspection of test results and the acceptability of components inspected and/or tested since the last calibration check. When it is necessary to ensure the acceptability of suspect items, the originally required inspections and/or tests will be repeated using properly calibrated equipment. Suspect results where a questionable device was used will be listed in a nonconformance report or deficiency notice and forwarded to the ER&WM quality engineer with an information copy to the FTL. Test equipment consistently found to be out of calibration will be repaired or replaced. Inspection and test reports will include identification of the test equipment used to perform the inspection or test.

2.7 Analytical Procedures

The *EG&G Idaho Radiological Control Manual* gives procedures for analyzing the radioactive smears taken on the field sampling equipment between sampling locations (EG&G Idaho 1993b). Procedures for collecting other field measurement data (e.g., pH, temperature, and conductivity) are detailed in the specific SOP for that measurement.

Analytical procedures for laboratory analysis of groundwater samples will be provided and or referenced in task order SOWs prepared by the ER&WM SMO. The Task Order SOWs refer to the EPA methods or laboratory SOPs applicable to the parameter being measured (i.e., organics, metals, or radionuclides). These procedures will be performed by approved laboratories under contract with the EG&G Idaho SMO and/or the Radiation Measurements Laboratory at the INEL. The parameters to be analyzed are summarized, along with the required detection limits, in Tables 2-5.

2.8 Data Reduction, Validation, and Reporting

Field and analytical laboratory procedures and results for the project must be fully documented and contain sufficient quality control results, as discussed in Section 2.3 to allow reviewers and end users to determine the quality of the data. The data reduction, reporting, and validation requirements follow.

2.8.1 Data Reduction

Data reduction refers to computations and calculations performed on the data. This includes computing summary statistics, standard errors, confidence limits, tests of hypotheses relative to the parameters, and model validation. Standard equations and statistically acceptable procedures will be used. Section 2.12, *Data Assessment Procedures*, provides details of the data analysis procedures to be used for the post-ROD program. When appropriate, as determined by the type of analysis, data will be reported with statistically supported limits of uncertainty to indicate limitations on the use of the data. All data, when reported, will be rounded to the number of significant figures consistent with the confidence limits.

Laboratory data reduction is addressed in the laboratory contracts. All calculations will document sample preparation activities in a bound laboratory notebook, which will serve as the primary record for subsequent data reduction. Final data reduction of analyses performed will be the responsibility of the individual compiling the final report. Results from each data collection activity will be reported in consistent units throughout each task. When applicable, as when presenting data on contaminant concentrations, any applicable State or Federal regulatory limits will be presented with the analytical data.

2.8.2 Data Reporting

Field measurements will be recorded in the field logbook. The field logbooks are archived at ARDC, and will contain the following information (EG&G Idaho 1992c) where appropriate:

Table 2. Target analyte list and detection limits for inorganics.

Chemical Abstract Service number	Compound	Detection limits in water ^a ($\mu\text{g/L}$)
7440-38-2	Arsenic	10
7440-41-7	Beryllium	5
7440-43-9	Cadmium	2
7440-47-3	Chromium	10
7440-48-4	Cobalt	50
7782-41-4	Fluoride	5
7439-92-1	Lead	1
7439-96-5	Manganese	15

a. Detection limits are highly matrix dependent. The detection limits listed herein are the contract-required detection limits under ERP-SOW-59 (Appendix B).

Table 3. Target analyte list and detection limits for alpha-emitting isotopes.

Isotope	Detection limit ^{a,b,c} (pCi/L)
Americium-241	0.2

a. Based on 100 mL of water sample. If a smaller volume is analyzed, the detection limits may be higher.

b. Isotope-specific analysis will be done if gross alpha/beta analysis of sample is >10 pCi/L.

c. Source: ERP-SOW-33 (see Appendix C).

Table 4. Target analyte list and detection limits for beta-emitting isotopes.

Isotope	Detection limit (pCi/mL)
Strontium-90	1E-03
Tritium	4E-01

Table 5. Target analyte list and detection limits by gamma spectrometry for gamma-emitting isotopes.

Radionuclide	Detection limit ^{a,b} (pCi/mL)
Cobalt-60	2E-02
Cesium-137	3E-02

a. Limits furnished by the Radiation Measurements Laboratory.

b. If a smaller sample is analyzed, the detection limits may be higher.

- Project title (TRA PWS Post-ROD Monitoring)
- Operable Unit (2-12, Perched Water System)
- Date of sample collection
- Date of sample analysis
- Date of report and/or logbook entry
- Type of analysis
- Name, address, and telephone number of analyst
- Sample identification number(s)
- Matrix of samples
- Instrument identification numbers
- Calibration logbook reference.

Laboratory data reporting will follow the procedures and format specified in the SOW for that laboratory (EG&G Idaho 1992c). Results and quality control data for each analysis will be transcribed onto analytical reporting forms specific to the particular analysis. These forms will be provided in the analytical data package according to the SOW. All data will be checked for accuracy and precision at the bench and instrument operator/analyst level and at the laboratory manager level before the data package is submitted to EG&G Idaho. Laboratory reports will include the following at a minimum (EG&G Idaho 1992c):

- Project title (TRA PWS Post-ROD Monitoring)

- Operable Unit (2-12, Perched Water System)
- Name of report
- Date of sample receipt at the laboratory
- Date of sample analysis
- Date report was prepared
- Analysis performed
- Name, address, and telephone number of analyst
- Sample identification number(s)
- Matrix of samples.

The reporting requirements for Analytical Level III data are outlined in QPP-149 (EG&G Idaho 1991).

2.8.3 Method Data Validation

Data verification and method data validation, including uncertainty calculations, determine whether a sample measurement, method, or piece of data is useful for a specified purpose. A description of the method validation levels and supporting validation procedures are contained in SOPs SMO-SOP-12.1.1, Levels of Methods Validation, SMO-SOP-12.1.2, Radiological Data Validation," and SMO-SOP-12.1.5, "Inorganic Data Validation."

Data obtained from field measurements will be validated to Level C. Level C method validation ensures that the data have been checked so that the value returned from the laboratory or field instrument is the value that is input into the ERIS (i.e., transcription error checking). These data will be checked for completeness, and any deficiencies will be resolved. The EG&G Idaho PM is responsible for ensuring that these checks are completed.

All data obtained from the radiological and off-Site laboratories will be validated to Level B by the ER&WM SMO or their designated subcontractor. Level B validation includes a check of completeness and an assessment of adherence to requirements of the analytical method criteria. Level B method data validation is appropriate for data that will be used for site characterization activities.

In addition to the data package completeness check, data entry into the ERIS will be verified. All of the procedures used for the data entry and automated method data validation steps performed by Integrated Environmental Data Management System personnel are described

in EG&G Idaho Statistics, Reliability, and Assessment Unit internal operating procedures.^a The product of both Level C and Level B method data validation is an upload of results to the ERIS. Additionally, a limitations and validation report is prepared for Level B method validation (EG&G Idaho 1992b).

2.8.4 Data Quality Objective and Field Data Validation

The validation process for DQOs and field data is a comparison of analytical data and field documentation. The information is obtained by investigating project specifications for data quality and data quantity (Jenkins 1992). The DQOs for the post-ROD monitoring program are delineated in Section 2.3. The DQO validation will focus on, but may not be limited to, the following items:

- Data completeness based on the specified requirements of the investigation.
- The degree to which sample data accurately and precisely represent a characteristic of a population. The information is obtained from the project definitions or the statistical design of the sampling scheme. Some information may also be found in the limitations and validation reports.

The EG&G Idaho PM or designee will validate that DQOs have been successfully fulfilled using *Requirements and Guidance for Data Validation* (Jenkins 1992) as a guide. The EG&G Idaho PM or designee also will validate the field data according to the referenced guidance by comparing the information in the monitoring plan with the data in the field logbook, chain-of-custody data, and/or the data in the quality engineer's monitoring surveillance report (Jenkins 1992).

2.9 Internal Quality Control

Internal quality control will be performed in accordance with QPP-149, Section 11 (EG&G Idaho 1991). As discussed in QPP-149, quality control checks are one of the mechanisms to monitor DQOs. The quality control checks provide a measure of the error or uncertainty associated with the sampling and analysis effort. The checks prescribed in QPP-149 are document review, field quality control samples, and laboratory quality control samples.

All documents will be reviewed in accordance with Program Directive 4.8, Internal and Independent Review of Documents. Laboratory quality control samples will be processed as required by the laboratory SOW.

Field quality control samples required for this plan include equipment rinsate blanks, field blanks, and field duplicates. A description of each is provided below. The frequency of collection for all field quality control samples is one per sampling event. A sampling event is considered the sampling of all network wells; nine wells make up the monitoring network. Field judgment by the

a. Unpublished report of EG&G Idaho, Inc., Idaho Falls, Idaho.

FTL will be exercised in selecting the locations from which the field quality control samples will be collected for each event. The quality control samples are described below.

- Equipment rinsate blanks are samples of the final analyte-free water rinse from the equipment cleaning and are collected during a sampling event. The rinsates are analyzed for the same analytes as the samples. One equipment rinsate blank will be collected per sampling event.
- Field blanks are samples of analyte-free water that is used to determine if cross-contamination is occurring because of field activities or sample containers. One field blank will be collected per sampling event.
- Field duplicates are water samples collected simultaneously from the same location. One field duplicate will be collected per sampling event.

2.10 System and Performance Audits

The frequency of system and performance audits will be determined by the assigned quality engineer. The EG&G Idaho PM or FTL will notify the quality engineer of the start date of the sampling activities at least two weeks in advance so the assessment can be scheduled and a checklist can be prepared. All assessment activities will be performed in accordance with the assessment requirements of QPP-149, Section 12 (EG&G Idaho 1991). All analytical support laboratories must be ER&WM-approved.

2.11 Preventative Maintenance

All preventative maintenance will be performed according to the manufacturer's operating and maintenance manual or SOP for each piece of equipment used. All maintenance will be recorded in the instrument calibration logbooks, as required by ER Program Directive 4.2, Logbooks (Appendix F). Laboratories will provide for appropriate preventative maintenance practices in their internal quality assurance documents.

2.12 Data Assessment Procedures

Data analysis techniques to support the project objectives include comparing post-ROD monitoring concentrations with respect to the predicted future concentrations, evaluating concentration trends with respect to calculated tolerance intervals, and evaluating observed concentrations in response to discontinued discharge to the warm waste pond.

2.12.1 Concentration Trends

A statistical analysis was conducted to establish the baseline trends, if any, in chromium and tritium and calculate tolerance limits for each well that had sufficient data. Tolerance limits will be used to positively identify excursions (outliers) in the data collected during the post-ROD monitoring program. The tolerance limits (TLs) for a normal distribution of measurements with unknown mean and unknown standard deviation are computed using the equation below where k

is determined such that the given limits contain a certain percentage of the measurements with a specified degree or level of confidence.

$$TL = x_m \pm ks$$

where

$$x_m = \frac{\sum x_i}{n} = \text{mean concentration}$$

k = normal distribution tolerance factor (can be found in a variety of statistical literature)

$$s = \sqrt{\frac{n \sum x_i^2 - (\sum x_i)^2}{n(n-1)}} = \text{standard deviation}$$

x_i = sample concentration

n = total number of data points.

Figures 7 through 22 illustrate the results of these calculations. The statistical analysis was limited to chromium and tritium in wells with a sufficient number of data points (i.e., greater than five). The data set for other contaminants is presently too small (i.e., one-time sampling) to conduct a comparative analysis. As the monitoring program is implemented, these analyses will be performed for all of the contaminants of concern in all of the network wells. Data analysis will be initiated after five data points are available (i.e., five sampling events).

For wells with a sufficient number of data points, concentration versus time plots for each well were constructed as the initial step in the analysis. Following this step, a linear regression analysis was performed and the upper and lower tolerance limits were calculated. Other types of trend analyses (curvilinear regression, orthogonal polynomial regression, etc.) may be used for future computations if deemed appropriate as new sample data is incorporated. The linear regression trend model is defined by the following:

$$y = mx + b$$

where

$$m = \frac{n \sum_{i=1}^n x_i y_i - \left(\sum_{i=1}^n x_i \right) \left(\sum_{i=1}^n y_i \right)}{n \sum_{i=1}^n x_i^2 - \left(\sum_{i=1}^n x_i \right)^2}$$

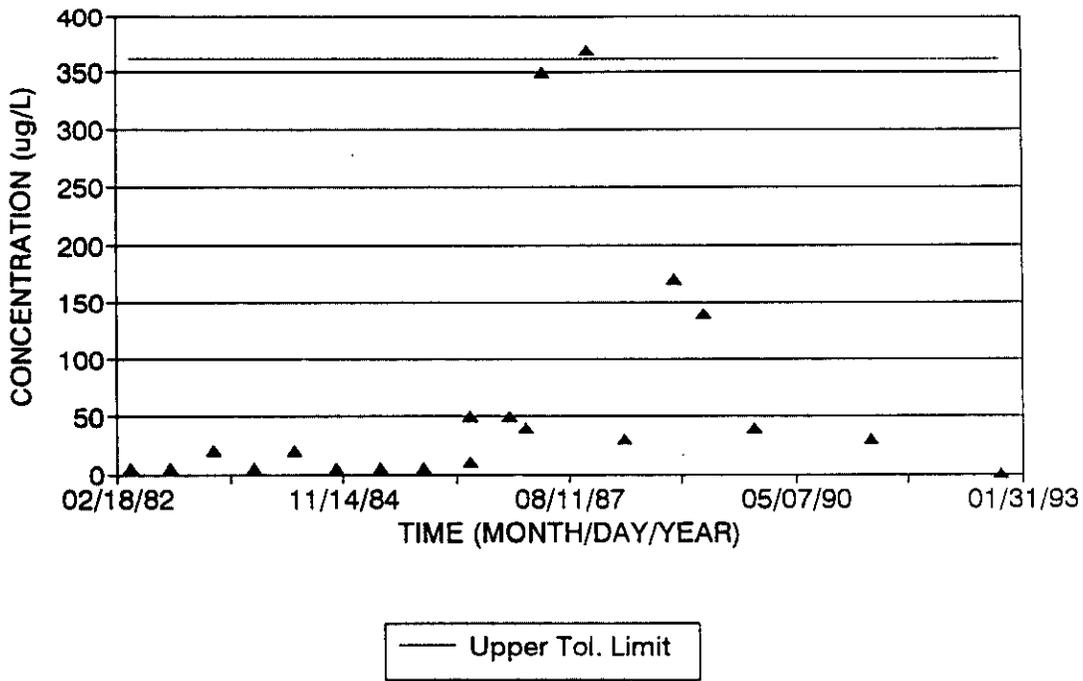
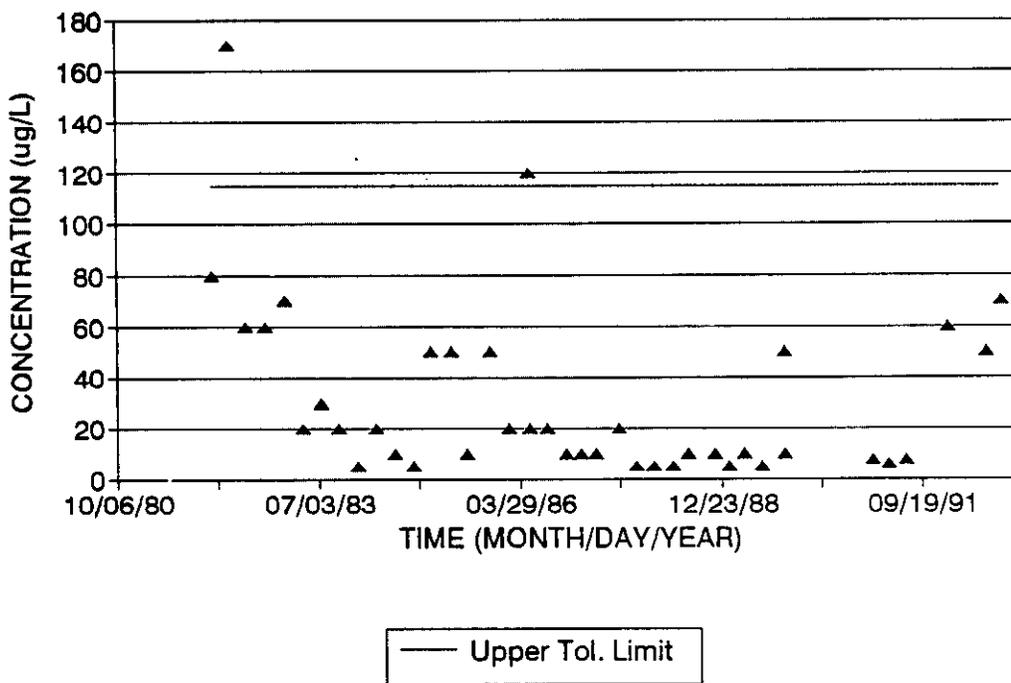


Figure 7. Tolerance interval calculation for Well USGS-53 total chromium.



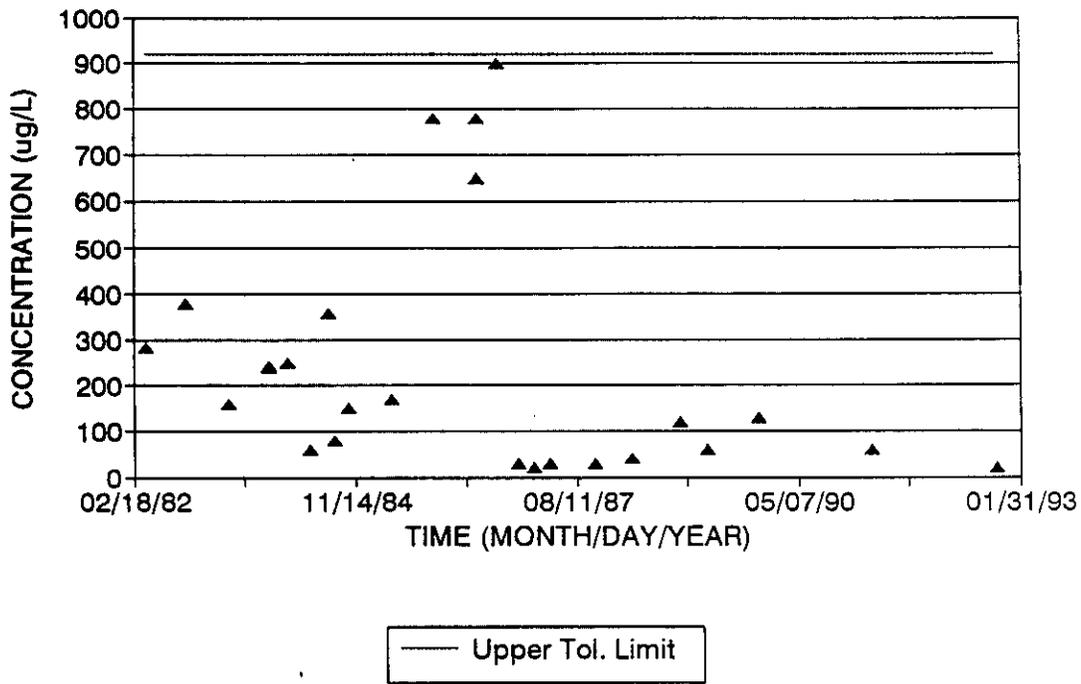


Figure 9. Tolerance interval calculation for Well USGS-55 total chromium.

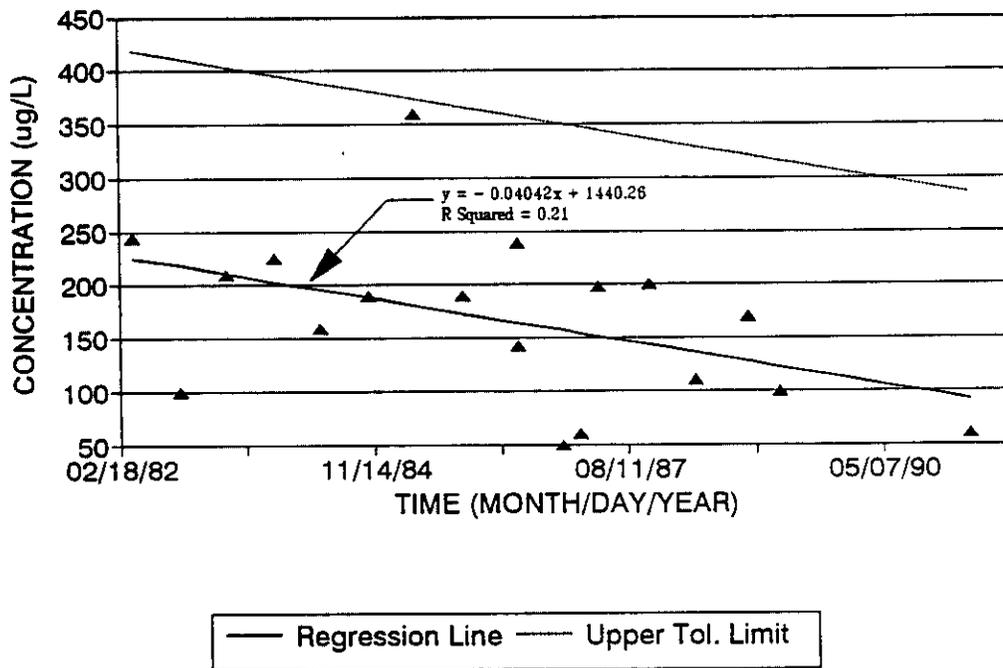


Figure 10. Tolerance interval calculation for Well USGS-56 total chromium.

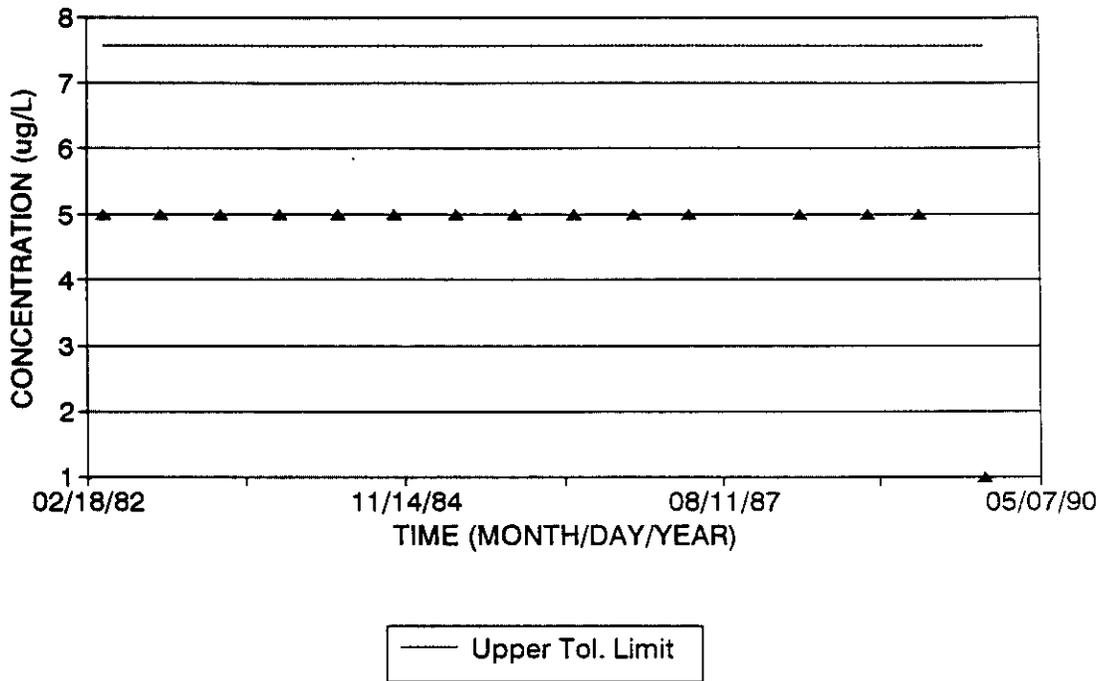


Figure 11. Tolerance interval calculation for Well TRA-03 total chromium.

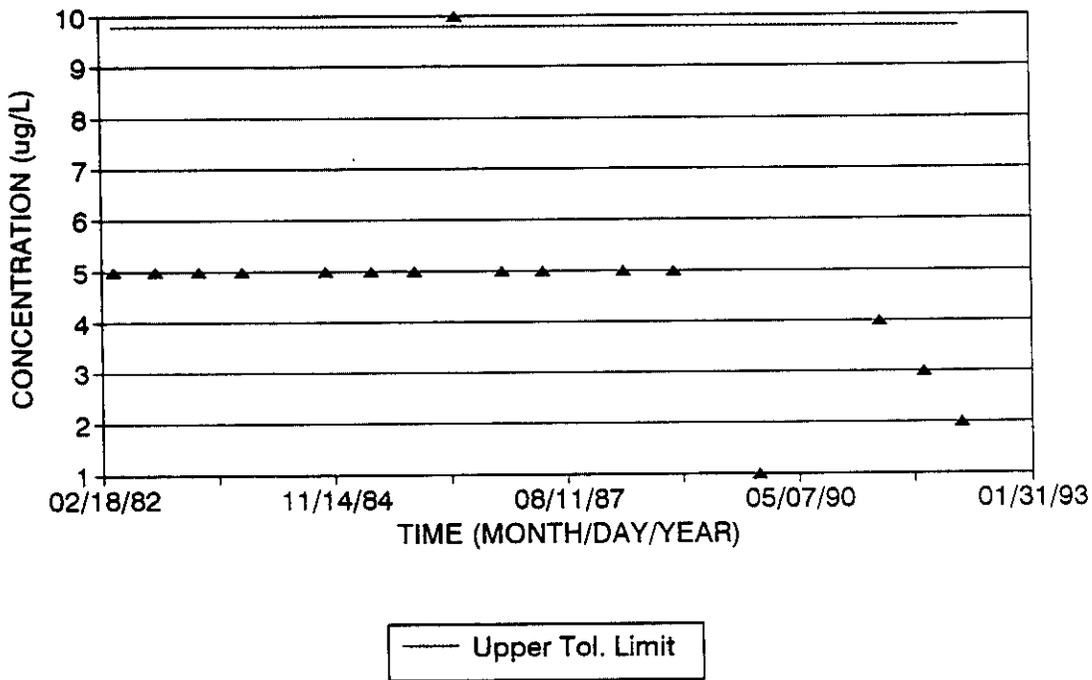


Figure 12. Tolerance interval calculation for Well TRA-04 total chromium.

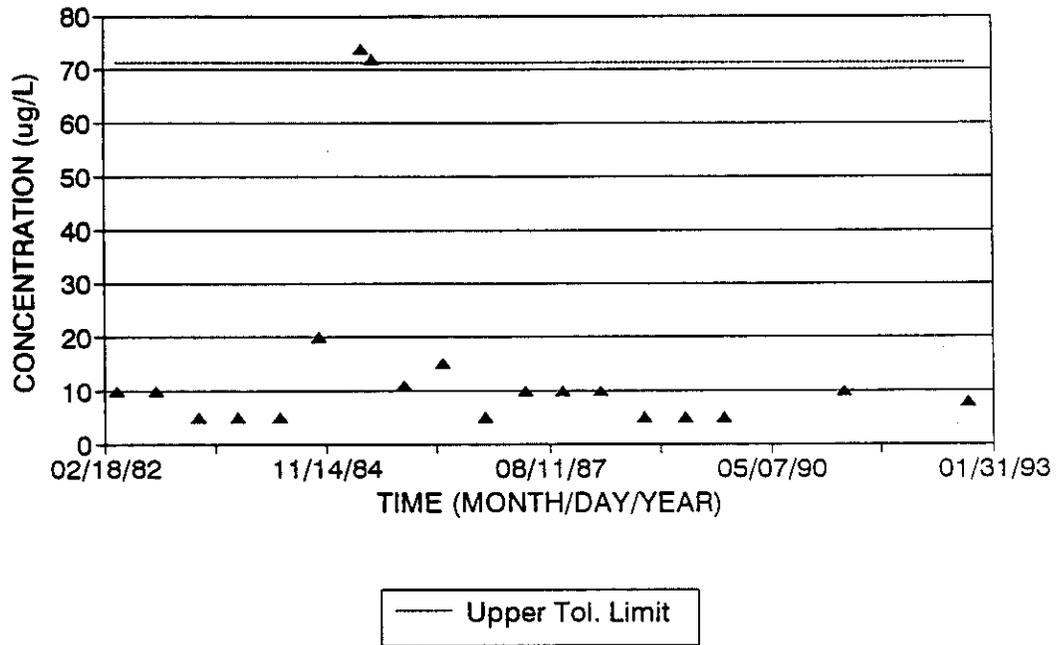


Figure 13. Tolerance interval calculation for USGS-58 total chromium.

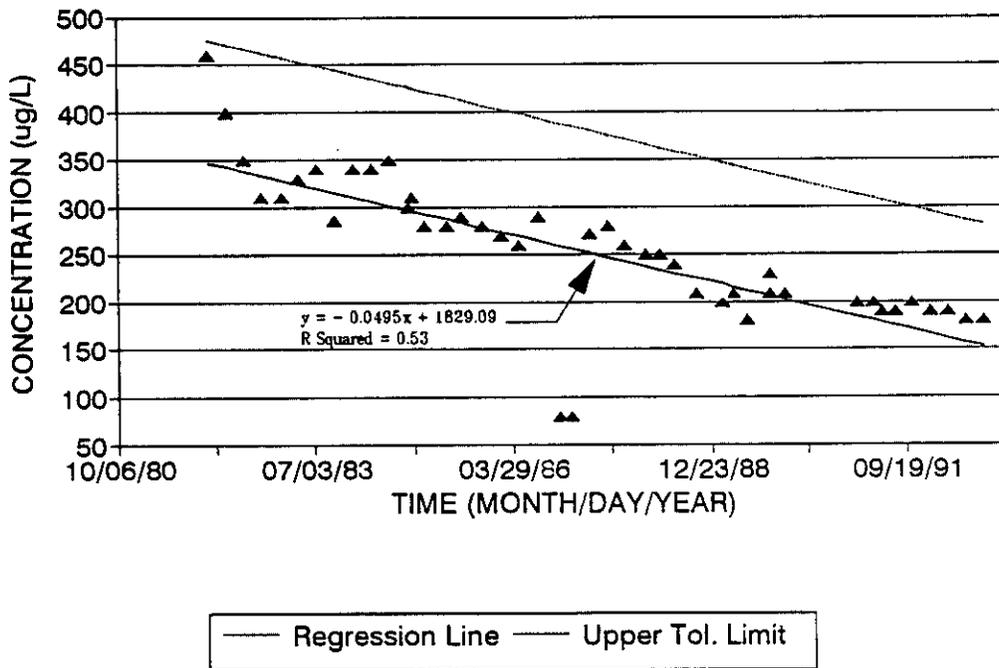


Figure 14. Tolerance interval calculation for Well USGS-65 total chromium.

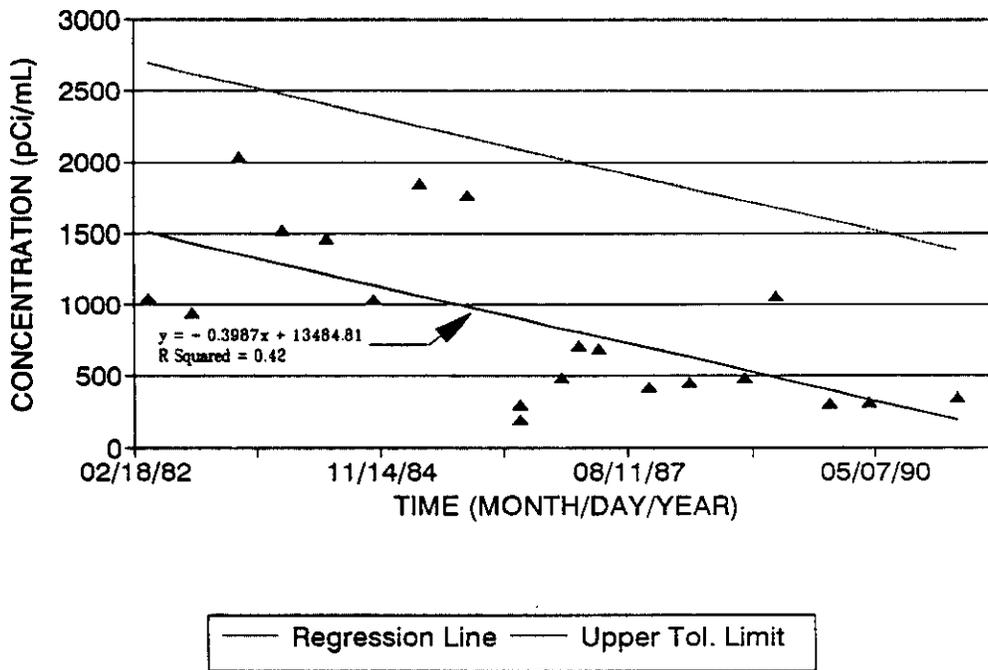


Figure 15. Tolerance interval calculation for Well USGS-53 tritium.

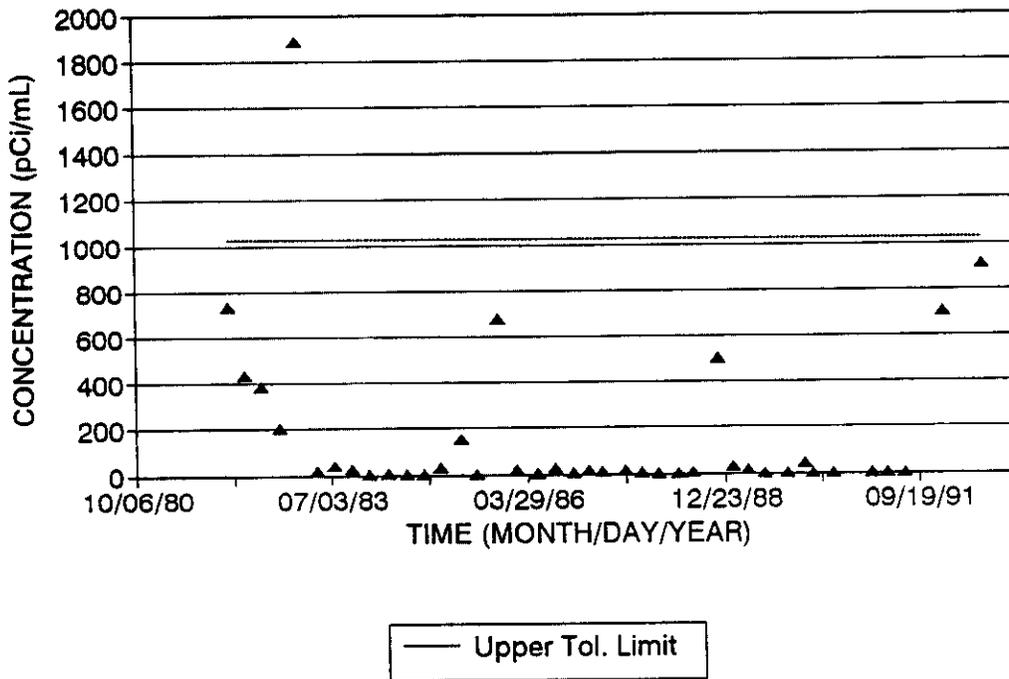


Figure 16. Tolerance interval calculation for Well USGS-54 tritium.

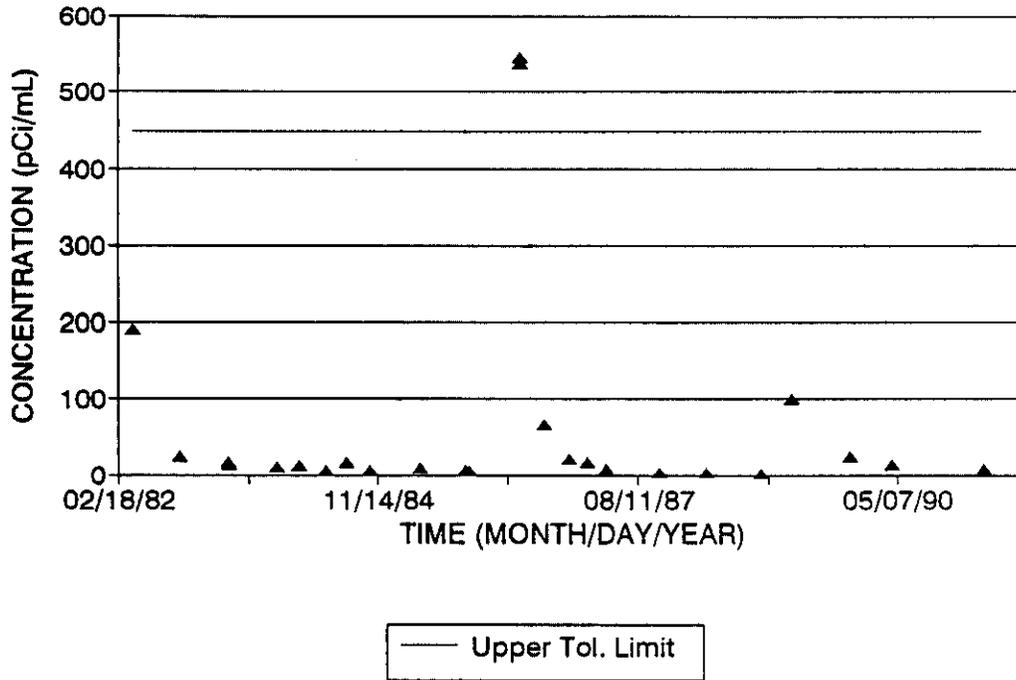


Figure 17. Tolerance interval calculation for Well USGS-55 tritium.

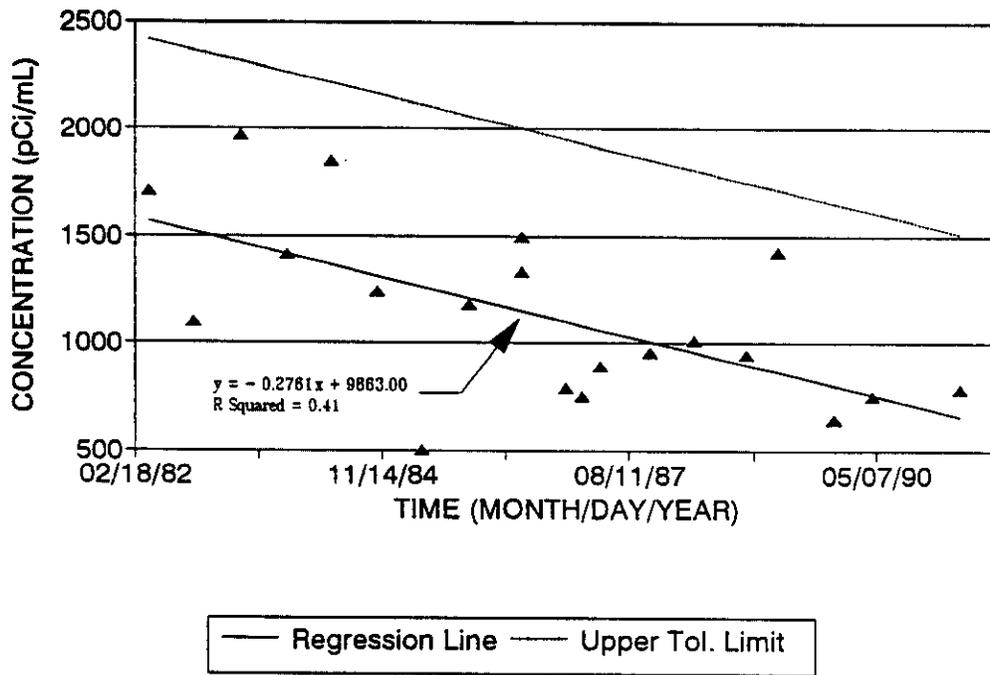


Figure 18. Tolerance interval calculation for Well USGS-56 tritium.

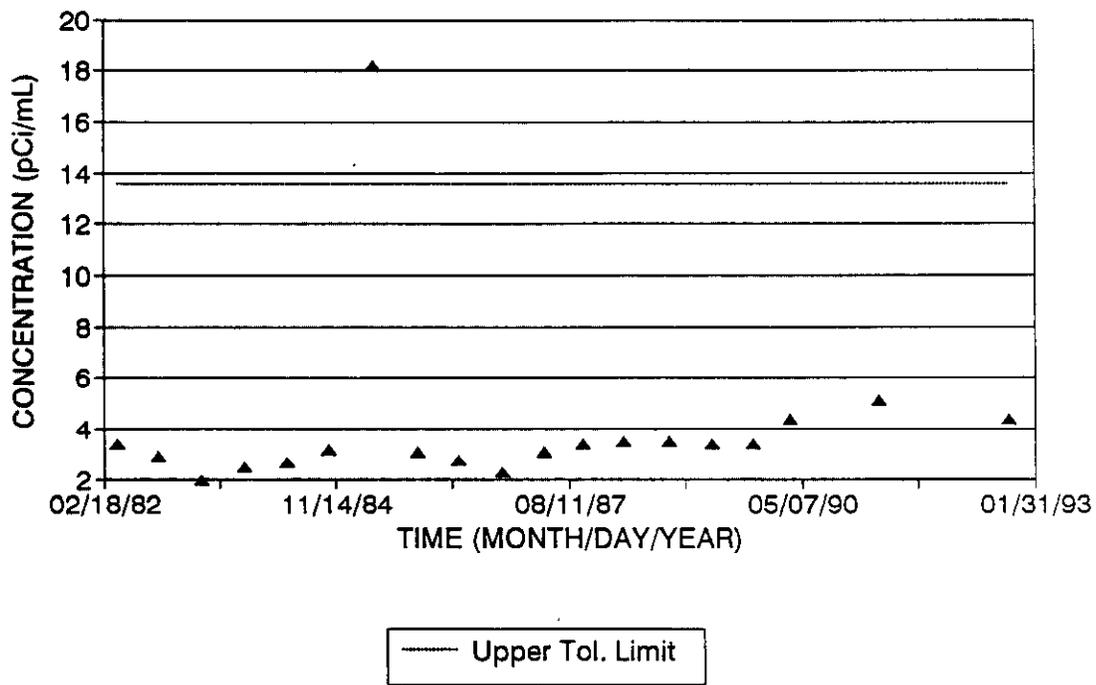


Figure 21. Tolerance interval calculation for Well USGS-65 total tritium.

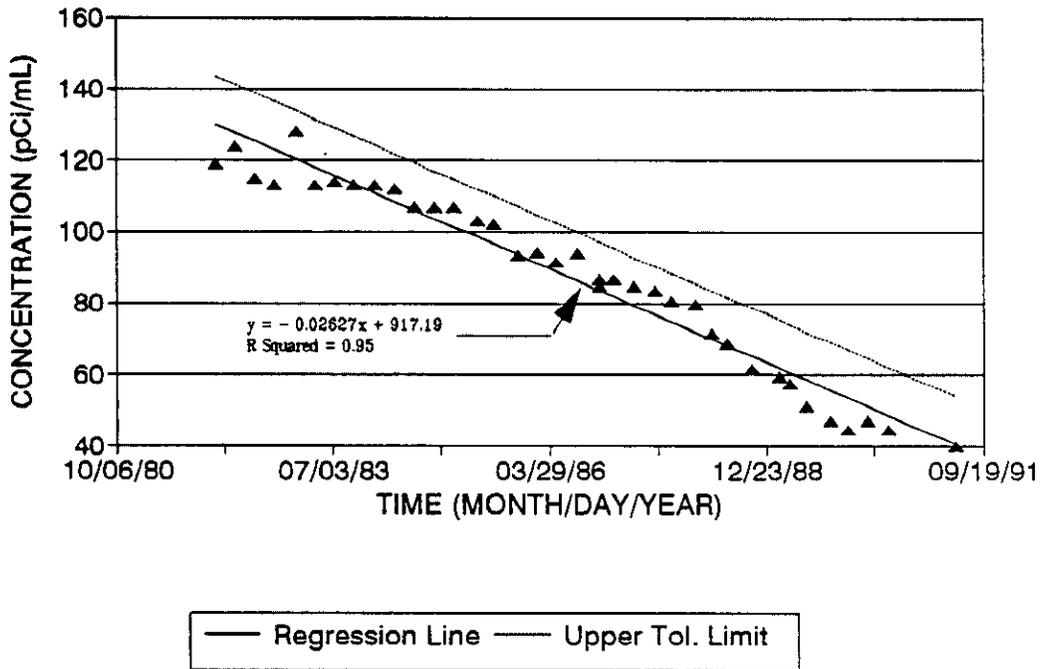


Figure 22. Tolerance interval calculation for Well USGS-58 tritium.

$$b = y_m - mx_m$$

n = total number of data points

x_i = time in days

y_i = sample concentration

x_m = mean time in days

y_m = mean concentration.

The tolerance limits were calculated as described above such that 95% of the observed concentrations fall within these limits with a 99% confidence level. Tolerance limits are used to control the false identification of a trend change. As new samples are collected (i.e., quarterly for deep PWS wells and semiannually for SRPA wells), the results will be compared to existing tolerance limits to determine whether the sample represents an excursion (i.e., trend change). The trend and tolerance limits will be recalculated annually, incorporating new data. It is assumed that concentrations will usually fall within the tolerance limits. The concentrations will be input to the database to develop the annual technical memorandum.

The expected near-term changes for the concentrations of the contaminants of concern in the SRPA are summarized as follows (Lewis et al. 1992):

- Americium-241 concentrations are expected to remain below detection
- Arsenic concentrations are expected to remain below detection
- Beryllium concentrations are expected to remain below detection
- Cadmium concentrations may increase and be followed by a rapid decline
- Cesium-137 concentrations are expected to remain below detection
- Chromium concentrations are expected to continue to decrease
- Fluoride concentrations are expected to remain below detections
- Lead concentrations are expected to remain below detection
- Manganese concentrations are expected to remain below detection
- Strontium-90 concentrations may increase and be followed by a decrease
- Tritium concentrations are expected to continue to decrease.

The expected changes are based on the fate and transport computer model predictions. The predicted increases in the concentrations of cadmium, cobalt-60, and strontium-90 are uncertain because of conservative model parameters used for the PWS RI fate and transport assessment. As a result, the concentrations of these contaminants may not exhibit a measurable increase. Additionally, the potential increase in cobalt-60 and strontium-90 concentrations predicted is unlikely because of radioactive decay. Cobalt-60 has a half-life of approximately 5.2 years, strontium-90 approximately 29 years (Lewis et al. 1992).

The results from the post-ROD monitoring will be qualitatively compared to the expected changes listed above to verify that the contaminant trends observed are comparable to those predicted. The tolerance limits calculated before and updated during the post-ROD monitoring will aid in this comparison. An excursion is a value that falls outside the tolerance limit and potentially triggers a contingency action. For the post-ROD monitoring program, a change in the concentration trend, other than those anticipated by the computer model (listed above), will require verification. For example, if a chromium result above the upper tolerance limit is observed, this data point will require verification. Verification is required because chromium concentrations are expected to decrease, not increase, in the near term. The excursion will first be verified by review of raw analytical data. If an analytical or reporting error is not identified for the concentration, the result will be verified pending the results from the next scheduled round of sampling and analysis. At that time, the PMs or their designees from the regulatory agencies will establish contingency actions (i.e., increased sampling and analysis frequency). The need for verification of excursions (i.e., resampling) will be evaluated on a case-by-case basis. Resolution of the problem will be documented, as appropriate, in a letter from the U.S. Department of Energy to the Agencies or in PM meeting minutes. Contingency actions planned or implemented and the outcome or conclusions drawn will be documented in the technical memorandum issued annually (see Section 2.14).

As stated above, post-ROD concentrations falling within the tolerance limits will be assumed to be usual and will require no contingency actions.

2.12.2 Concentration Changes in the Deep Perched Water System from Discontinued Discharge to the Warm Waste Pond

The results from post-ROD monitoring will be analyzed to identify the impact on contaminant of concern concentrations in the deep PWS after discharge is discontinued to the warm waste pond. The expected impact is a decline in deep PWS concentrations for all contaminants of concern because of the dilution effect from discharge to the cold waste pond. The monitoring results will be compared to the baseline data to assess whether the expected decreases in concentration are actually observed. The results will be assessed and verified, if necessary, as described in Section 2.12.1.

2.13 Corrective Actions

The overall project direction will be established by the U.S. Department of Energy and regulatory PMs or their designees. Corrective action will be initiated when the project objectives are not met or when assessment of the data reveals questionable or unknown data quality. These corrective actions may include, but are not limited to, modifications of the sampling procedure,

sampling design, analytical techniques within EPA-approved guidelines, and data reporting procedures. Field corrective action may be initiated by any individual on the project. If a problem occurs that might jeopardize the integrity of the project, cause a quality assurance objective to not be met, or impact data quality, the EG&G Idaho PM will be notified and corrective measures will be decided and implemented with the responsible parties. The EG&G Idaho PM will document the situation, the objective affected, the corrective action taken, and the result of the action. Copies of the documentation will be provided to the quality engineer, the ER manager, and ARDC. Corrective actions will be documented in the data transmittal package submitted after each sampling event (see Section 2.14).

2.13.1 Field Corrective Action

The initial responsibility for monitoring the quality of field measurements lies with the field personnel. The FTL is responsible for verifying that all quality assurance procedures are followed. This requires the FTL to (a) assess the correctness of field methods and their ability to meet quality assurance objectives, and (b) make a subjective assessment of the impact a procedure change will have on field objectives and subsequent data quality. If a problem occurs that might jeopardize the integrity of the project, cause a quality assurance objective to not be met, or impact data quality, the FTL will immediately notify the project supervisor. The FTL will document the situation, the field objectives affected, the corrective action taken, and the results of that action. Copies of the documentation will be provided to the PM and the project quality assurance officer.

Corrective action will be implemented when the project objectives are not met or when conditions adverse to quality have been identified. Conditions adverse to quality will be promptly identified and corrected as soon as possible. The cause and corrective actions to prevent recurrence will be determined and documented for significant conditions adverse to quality.

2.13.2 Laboratory Corrective Action

The laboratory corrective action plan will be detailed in the laboratory quality assurance program plan. The need for corrective action may come from several sources: equipment malfunctions, failure of internal quality control checks, method blank contamination, failure of performance or system assessments, or noncompliance with quality assurance requirements. ER Program Directive 5.5, "Obtaining Laboratory Services," ER Program Directive 5.8, "Control of Nonconforming Analytical Data," and QPP-149 (EG&G Idaho 1991) outline ER&WM requirements for laboratory quality assurance/quality control and reporting requirements.

2.14 Reporting Requirements and Decision Criteria

A data transmittal package containing the following deliverables will be provided within 75 to 120 days after each sampling event in accordance with Section 19 of the FFA/CO. A sampling event is considered the sampling of network wells in support of this plan.

- Cover letter
- Analytical data (diskette if possible)

- Water levels for wells sampled
- Concentration versus time plots.

A technical memorandum will be prepared annually and the data will be formally evaluated. Each report will include the following information as appropriate:

- Introduction
- A tabulation of the validated analytical results for the samples collected since the previous technical memorandum
- Tabulated water level data
- A discussion of the results from the data assessment and evaluation as described in Section 2.12 against the program objectives to include revised time-series plots, regression analyses, and tolerance limit calculations
- An evaluation of deep PWS concentrations in relation to discontinued discharge to the warm waste pond
- The identification of excursions observed and verified according to Section 2.12, if any
- A description of contingency actions planned and/or implemented as a result of any observed excursions, if appropriate
- A discussion of deviations, if any, from the monitoring plan
- Summary.

The annual technical memorandum will be submitted to EPA and the State of Idaho within 30 working days after the receipt of validated analytical data from the final sampling round for that reporting period. For the first year the last sampling round is April 1994.

The review of the monitoring results and data evaluations reported in each annual technical memorandum will be used by the Agencies to determine whether modifications to the monitoring program are necessary. Criteria for modification may result from contingency or corrective action responses or a reevaluation of program data needs or uses. Decision types relate to determining changes in frequency, wells to be monitored, and contaminants of concern; contingency actions in response to excursions (i.e., when to resample); and when to stop monitoring. The criteria for these decisions are discussed below.

2.14.1 Criteria for Determining Changes in Frequency, Wells, and Contaminants of Concern

An evaluation will be made annually to determine if any changes should be made in regard to the frequency of monitoring, the wells included in the network, and the contaminants of

concern. The concentration of chromium and tritium will be used as indicators for determining the wells to be monitored and the frequency of monitoring. Contaminants of concern will be evaluated according to observed trends on an individual basis.

2.14.2 Criteria for Determining the Need to Resample

Resampling will take place immediately if sample integrity is lost. Resampling may also occur if an excursion is observed in the data and the cause cannot be determined. This situation will be evaluated on a case-by-case basis, taking into consideration the amount of time until the next scheduled sampling event, and the excursions conformance to previous trends.

2.14.3 Criteria for Determining to Cease Monitoring

The decision to cease the post-ROD monitoring program will be based on contaminant concentration trends with emphasis on when the contaminant concentration trends drop below and remain below risk levels. Monitoring, as outlined in this plan, is anticipated to be conducted at least through the WAG RI/FS. At that time, a decision will be made as to whether monitoring should be broader in scope and possibly be superseded by a separate WAG plan.

3. FIELD SAMPLING PLAN

3.1 Site Background

TRA is located in the southwestern portion of the INEL, north of the Big Lost River and approximately 47 miles west of Idaho Falls. The facility houses high neutron flux nuclear test reactors. More than 73 buildings and 56 structures have been constructed at TRA, providing four major types of functional support: reactor, laboratory, office, and crafts. There are three production wells at TRA in the northeast corner of the facility.

The subsurface movement of water and contaminants or advective transport at TRA follows a general path. Initially, the wastewater is discharged into a variety of unlined surface ponds and percolates into the shallow perched zone, flows downward to the deep PWS, and eventually flows to the SRPA. The percolated wastewater has penetrated through the surficial alluvium and underlying basalt bedrock.

The waste stream discharged to each disposal pond has a unique chemistry that can be traced into the deep PWS. The chemical waste pond is used to dispose of wastewater that is high in dissolved solids but with no radioactivity. Discharge water containing tritium and other radionuclides, as well as hexavalent chromium, is disposed of in the warm waste pond. Discharge to the warm waste pond is scheduled to cease in 1993 when the lined evaporation pond becomes operational. The cold waste pond is used to discharge wastewater with no radioactive content but with low to moderate dissolved salts. The sanitary waste pond is used to dispose of wastewater with elevated nitrate concentrations and no radioactivity.

There are 27 monitoring wells within the deep PWS monitoring network that were sampled during the site investigation and used for the final PWS RI (Lewis et al. 1992). The PWS RI focused on using these data, in conjunction with the historical information, to identify contaminants of concern, assess fate and transport of the contaminants of concern, and conduct the baseline risk assessment. The contaminants of concern for the PWS are

- Americium-241
- Arsenic
- Beryllium
- Cadmium
- Cesium-137
- Chromium (trivalent and hexavalent)
- Cobalt
- Cobalt-60

- Fluoride
- Lead
- Manganese
- Strontium-90
- Tritium.

A summary of the site characterization efforts, the contaminant of concern identification process, and site risks to human health and the environment are documented in the final PWS RI report (Lewis et al. 1992). The contaminants of concern are the analytes to be monitored under the post-ROD monitoring program.

3.2 Sampling Objectives

Sampling will collect the data required to (a) verify the accuracy of contaminant of concern concentration trends in the SRPA predicted by computer modeling and (b) evaluate the effect that discontinued discharge to the warm waste pond has on contaminant of concern concentrations in the SRPA and deep PWS. These objectives were delineated in the PWS ROD issued in December 1992 (EG&G Idaho 1992b). The groundwater monitoring network, frequency of monitoring, and analytical parameters have been designed and selected to achieve these objectives.

A three-year review of the no action decision will be conducted by the Agencies to ensure that human health and the environment are being protected by the no action response and that the assumptions used for the no action decision are still valid. The data collected under this plan will support the three year review.

The data collected under the post-ROD monitoring program will be transferred to ARDC from the field logbooks and the laboratory analytical files twice a year. The sample collection and analytical methodology will be validated and transferred to the ERIS. A more detailed explanation of procedures can be found in the data management plan for ER (EG&G Idaho 1992c). The PM will then qualify the data and subsequently incorporate it into various reports. Data will be formally reported to EPA and the State of Idaho through a quarterly data transmittal package after each sampling event and in the annual technical memorandum.

3.2.1 Sample Location

Wells in the vicinity of TRA were evaluated for inclusion in the monitoring well network for the PWS post-ROD monitoring activities. Existing well construction data and information regarding historic well uses and contamination history were assessed for both deep perched zone wells and SRPA wells. These data were assessed to select appropriate wells to monitor water quality in support of the PWS ROD.

The sample locations for this post-ROD monitoring effort are illustrated in Figure 5 in Section 2. Six deep PWS wells and three SRPA monitoring wells were selected for inclusion in the monitoring network. Two of the deep PWS wells, PW-11 and PW-12, were installed in 1990. The other deep PWS wells, USGS-53, 54, 55, and 56, were installed in 1960. Discharge to the warm waste pond is scheduled to discontinue in 1993 when the warm waste evaporation pond is completed. Monitoring of these wells will aid in evaluating the effects of cessation of warm liquid waste disposal to the subsurface.

The three SRPA wells selected for inclusion into the sampling network are TRA-07, USGS-58, and USGS-65. TRA-03 and TRA-04, production wells that are used for both industrial and drinking water purposes, are located upgradient of contamination in the SRPA beneath TRA and will not be sampled as part of the post-ROD monitoring program. However, data from these wells will be used to supplement the SRPA data set if increases in contaminant concentrations are observed in the network wells.

Both TRA-07 and USGS-65 are located downgradient of the disposal ponds and are screened in the upper portion of the SRPA. Historical data from USGS-65 was used to calibrate the computer model and supports verification of the modeled contaminant of concern trends in the SRPA. USGS-58 is located immediately adjacent to the warm waste pond.

The selected wells are outlined in Table 6, which summarizes the rationale for selection of each well, the date drilled, and the depth of the screened interval(s). Also included are comments regarding the integrity of the construction of the selected wells.

3.2.2 Monitoring Frequency

For the first year, the post-ROD monitoring program requires sampling twice a year for SRPA wells and four times a year for deep PWS wells. After the first year, the frequency of monitoring, wells being monitored (along with the number of wells), and contaminants of concern will be reevaluated and modified as deemed necessary. In the reevaluation, the concentrations of chromium and tritium will be used as indicators for determining the number of wells to be monitored and the frequency of monitoring. Contaminants of concern will be evaluated on an individual basis according to observed trends. The first reevaluation is tentatively scheduled for June 1994.

3.3 Sample Designation

Unique identification numbers will be assigned for chemical analysis parameters for each sampling event. The identification scheme will consist of four numbers and two letters. The first four numbers will be randomly generated by the Integrated Environmental Data Management System (IEDMS), and the last two characters will represent the sample analysis code. The sampling designation scheme will continue through the entire monitoring period. Figure 23 depicts the sampling and analysis tables and provides a summary of the sample numbers, sample type, location, and analyses for the post-ROD program. Quality control samples are also provided in the tables.

Table 6. TRA PWS groundwater monitoring well network.

Well	Hydrologic unit	Date installed	Well screen/open ^a	Screened interval	Rationale for inclusion in monitoring network ^b	Well construction comments
PW-11	Deep PWS	1990	Well screen	109-129	The water level and water quality in this well will monitor changes in the PWS in the area of the warm waste pond after discharge to the warm waste pond has stopped. Water quality monitoring should demonstrate whether dilution effects from continued cold waste discharge are affecting water quality in this area or if desorption of contaminants from the warm waste pond sediments (remediated or unremediated) is occurring from natural infiltration.	Variance from State standards does not compromise sample integrity.
43 PW-12	Deep PWS	1990	Well screen	108-128	Located near the western extent of the perched water zone, in the direction of water movement from the warm waste pond based on water-level measurements in the perched water zone (conducted in April 1988).	Variance from State standards does not compromise sample integrity.
USGS-53	Deep PWS	1960	Open	75-80	To monitor the effects of discontinued discharge to the warm waste pond in the immediate vicinity of the pond. The well is located downgradient of the warm waste pond and monitors perched water at approximately 65 ft below land surface.	A seal is recommended to upgrade the well construction to State standards; however, without the upgrade, water quality sample integrity is not compromised, and comparability with the historical data set is maintained.

Table 6. (continued).

Well	Hydrologic unit	Date installed	Well screen/open ^a	Screened interval	Rationale for inclusion in monitoring network ^b	Well construction comments
USGS-54	Deep PWS	1960	Open	60-91	To monitor the effects of discontinued discharge to the warm waste pond in the immediate vicinity of the pond. The well is located near the warm waste pond and monitors perched water at approximately 70 ft below land surface.	A seal is recommended to upgrade the well construction to State standards; however, water quality sample integrity is not compromised, and comparability with the historical data set is maintained.
USGS-55	Deep PWS	1960	Open	45-80	To monitor the effects of discontinued discharge to the warm waste pond in the immediate vicinity of the pond. The well is located near the warm waste pond and monitors perched water in the basalt.	A seal is recommended to upgrade the well construction to State standards; however, water quality sample integrity is not compromised, and comparability with the historical data set is maintained.
USGS-56	Deep PWS	1960	Open	59-80	To monitor the effects of discontinued discharge to the warm waste pond in the immediate vicinity of the pond. The well is located near the warm waste pond and monitors perched water in the top 20 ft of the basalt.	A seal is recommended to upgrade the well construction to State standards; however, water quality sample integrity is not compromised, and comparability with the historical data set is maintained.
TRA-07	SRPA	1990	Well screen	463-493	To monitor concentration trends in the SRPA. The well is located along the southwest extent of the perched water zone and is intended to provide information on the amount of contaminants entering the SRPA to the west.	Variance from State standards does not compromise sample integrity.

Table 6. (continued).

Well	Hydrologic unit	Date installed	Well screen/open ^a	Screened interval	Rationale for inclusion in monitoring network ^b	Well construction comments
USGS-58	SRPA	1961	Open	218-503	To monitor the effects of discontinued discharge to the warm waste pond on water quality in the SRPA immediately below the pond. The well is located adjacent to the warm waste pond.	A seal is recommended to upgrade the well construction to State standards; however, water quality sample integrity is not compromised, and comparability with the historical data set is maintained.
USGS-65	SRPA	1960	Open	456-493	To monitor concentration trends in the SRPA downgradient of the PWS. The well is located downgradient of the disposal ponds, monitors water quality in the upper portion of the SRPA, and best represents the undiluted effects of the PWS on the SRPA.	A seal is recommended to upgrade the well construction to State standards; however, water quality sample integrity is not compromised, and comparability with the historical data set is maintained.
TRA-03	SRPA	1957	Open	470-497 518-592	To provide information on upgradient water quality in the SRPA.	None.

Table 6. (continued).

Well	Hydrologic unit	Date installed	Well screen/ open ^a	Screened interval	Rationale for inclusion in monitoring network ^b	Well construction comments
TRA-04	SRPA	1963	Open	900-965	To provide information on upgradient water quality in the SRPA.	None.

a. Well screen or open in hydrologic unit being monitored.

b. Source: DOE 1993.

SAMPLE DESCRIPTION					PLANNED DATE	SAMPLE LOCATION				ENTER ANALYSIS TYPES (AT) AND QUANTITY REQUESTED																			
SAMPLING ACTIVITY	SAMPLE TYPE	MEDIA	COLL TYPE	SAMPLING METHOD		AREA	LOCATION	TYPE OF LOCATION	DEPTH (ft)	AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
										CR	CU	F1	LF	LH	R4	R5	R6	RB	RM										
0017	REG	GROUND WATER	GRAB		07/01/93	TRA	USGS-65	AQUIFER WELL	N/A	1	1	1	1	1	1	1	1	1											
0018	REG	GROUND WATER	GRAB		07/01/93	TRA	USGS-53	PERCHED WELL	N/A		1	1	1		1	1	1	1	1										
0019	REG	GROUND WATER	GRAB		07/01/93	TRA	USGS-54	PERCHED WELL	N/A		1	1	1		1	1	1	1	1										
0020	REG	GROUND WATER	GRAB		07/01/93	TRA	USGS-55	PERCHED WELL	N/A		1	1	1		1	1	1	1	1										
0021	REG	GROUND WATER	GRAB		07/01/93	TRA	USGS-56	PERCHED WELL	N/A		1	1	1		1	1	1	1	1										
0022	REG	GROUND WATER	GRAB		07/01/93	TRA	USGS-58	AQUIFER WELL	N/A	1	1	1	1	1	1	1	1	1	1										
0023	REG	GROUND WATER	GRAB		07/01/93	TRA	TRA-07	AQUIFER WELL	N/A	1	1	1	1	1	1	1	1	1	1										
0024	REG	GROUND WATER	GRAB		07/01/93	TRA	PM-11	PERCHED WELL	N/A		1	1	1		1	1	1	1	1										
0025	REG	GROUND WATER	GRAB		07/01/93	TRA	PM-12	PERCHED WELL	N/A		1	1	1		1	1	1	1	1										
0026	QC	GROUND WATER	DUP		07/01/93	TRA	TBD	WELL	N/A	1	1	1	1	1	1		1	1	1										
0027	QC	WATER	FBLK		07/01/93	TRA	QC	FIELD BLANK	N/A	1		1		1	1		1	1	1										
0028	QC	WATER	RNST		07/01/93	TRA	QC	RINSATE	N/A	1		1		1	1		1	1	1										

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Enter the appropriate analysis type code in the boxes between the double lines under "ENTER ANALYSIS TYPES". Refer to SAP Table 2, Sampling And Analysis Plan Table - Codes & Descriptions. Enter the number of bottles in the single line boxes below the analysis type for each sampling activity. Any descriptions for non-standard analysis types (not given in SAP Table 2) should be entered under "COMMENTS" on the lines below.

- AT1: Chromium VI (Cr+6) - Unfiltered
- AT2: Chromium VI (Cr+6) - Filtered
- AT3: Fluoride
- AT4: CLP Metals (TAL) - (As/Be/Cd/Cr/Co/Pb/Mn) - Filtered
- AT5: CLP Metals (TAL) - (As/Be/Cd/Cr/Co/Pb/Mn) - Unfiltered
- AT6: Gamma Spec (Cs-137/Co-60)
- AT7: Gamma Screen
- AT8: Tritium
- AT9: Strontium-90
- AT10: Alpha Spec (Americium-241)

- AT11: _____
- AT12: _____
- AT13: _____
- AT14: _____
- AT15: _____
- AT16: _____
- AT17: _____
- AT18: _____
- AT19: _____
- AT20: _____

COMMENTS

Figure 23. Sampling and analysis plan table—chemical parameters.

SAMPLE DESCRIPTION					PLANNED DATE	SAMPLE LOCATION				ENTER ANALYSIS TYPES (AT) AND QUANTITY REQUESTED																			
SAMPLING ACTIVITY	SAMPLE TYPE	MEDIA	COLL TYPE	SAMPLING METHOD		AREA	LOCATION	TYPE OF LOCATION	DEPTH (ft)	AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
										CR	CJ	F1	LF	LN	R4	R5	R6	RB	RM										
0039	REG	GROUND WATER	GRAB		10/01/93	TRA	USGS-53	PERCHED WELL	N/A		1	1	1		1	1	1	1	1										
0040	REG	GROUND WATER	GRAB		10/01/93	TRA	USGS-54	PERCHED WELL	N/A		1	1	1		1	1	1	1	1										
0041	REG	GROUND WATER	GRAB		10/01/93	TRA	USGS-55	PERCHED WELL	N/A		1	1	1		1	1	1	1	1										
0042	REG	GROUND WATER	GRAB		10/01/93	TRA	USGS-56	PERCHED WELL	N/A		1	1	1		1	1	1	1	1										
0043	REG	GROUND WATER	GRAB		10/01/93	TRA	PW-11	PERCHED WELL	N/A		1	1	1		1	1	1	1	1										
0044	REG	GROUND WATER	GRAB		10/01/93	TRA	PW-12	PERCHED WELL	N/A		1	1	1		1	1	1	1	1										
0045	QC	GROUND WATER	DUP		10/01/93	TRA	TBD	PERCHED WELL	N/A		1	1	1		1		1	1	1										
0046	QC	WATER	FBLK		10/01/93	TRA	QC	FIELD BLANK	N/A	1		1		1	1		1	1	1										
0047	QC	WATER	RHST		10/01/93	TRA	QC	RIMSATE	N/A	1		1		1	1		1	1	1										

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Enter the appropriate analysis type code in the boxes between the double lines under "ENTER ANALYSIS TYPES". Refer to SAP Table 2, Sampling And Analysis Plan Table - Codes & Descriptions. Enter the number of bottles in the single line boxes below the analysis type for each sampling activity. Any descriptions for non-standard analysis types (not given in SAP Table 2) should be entered under "COMMENTS" on the lines below.

- AT1: Chromium VI (Cr+6) - Unfiltered
- AT2: Chromium VI (Cr+6) - Filtered
- AT3: Fluoride
- AT4: CLP Metals (TAL) - (As/Ba/Cd/Cr/Co/Pb/Mn) - Filtered
- AT5: CLP Metals (TAL) - (As/Ba/Cd/Cr/Co/Pb/Mn) - Unfiltered
- AT6: Gamma Spec (Cs-137/Co-60)
- AT7: Gamma Screen
- AT8: Iritium
- AT9: Strontium-90
- AT10: Alpha Spec (Americium-241)

- AT11: _____
- AT12: _____
- AT13: _____
- AT14: _____
- AT15: _____
- AT16: _____
- AT17: _____
- AT18: _____
- AT19: _____
- AT20: _____

COMMENTS

Figure 23. (continued).

SAMPLE DESCRIPTION					PLANNED DATE	SAMPLE LOCATION				ENTER ANALYSIS TYPES (AT) AND QUANTITY REQUESTED																		
SAMPLING ACTIVITY	SAMPLE TYPE	MEDIA	COLL TYPE	SAMPLING METHOD		AREA	LOCATION	TYPE OF LOCATION	DEPTH (FT)	AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19
									CR	CJ	F1	LF	LN	R4	R5	RB	RS	RN										
0058	REG	GROUND WATER	GRAB		04/01/94	TRA	USGS-53	PERCHED WELL	N/A		1	1	1		1	1	1	1	1									
0059	REG	GROUND WATER	GRAB		04/01/94	TRA	USGS-54	PERCHED WELL	N/A		1	1	1		1	1	1	1	1									
0060	REG	GROUND WATER	GRAB		04/01/94	TRA	USGS-55	PERCHED WELL	N/A		1	1	1		1	1	1	1	1									
0061	REG	GROUND WATER	GRAB		04/01/94	TRA	USGS-56	PERCHED WELL	N/A		1	1	1		1	1	1	1	1									
0062	REG	GROUND WATER	GRAB		04/01/94	TRA	PV-11	PERCHED WELL	N/A		1	1	1		1	1	1	1	1									
0063	REG	GROUND WATER	GRAB		04/01/94	TRA	PV-12	PERCHED WELL	N/A		1	1	1		1	1	1	1	1									
0064	QC	GROUND WATER	DUP		04/01/94	TRA	TBD	PERCHED WELL	N/A		1	1	1		1	1	1	1	1									
0065	QC	WATER	FBLK		04/01/94	TRA	QC	FIELD BLANK	N/A	1		1		1	1		1	1	1									
0066	QC	WATER	RNST		04/01/94	TRA	QC	RINSATE	N/A	1		1		1	1		1	1	1									

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Enter the appropriate analysis type code in the boxes between the double lines under "ENTER ANALYSIS TYPES". Refer to SAP Table 2, Sampling And Analysis Plan Table - Codes & Descriptions. Enter the number of bottles in the single line boxes below the analysis type for each sampling activity. Any descriptions for non-standard analysis types (not given in SAP Table 2) should be entered under "COMMENTS" on the lines below.

AT1: <u>Chromium VI (Cr+6) - Unfiltered</u>	AT11: _____	_____
AT2: <u>Chromium VI (Cr+6) - Filtered</u>	AT12: _____	_____
AT3: <u>Fluoride</u>	AT13: _____	_____
AT4: <u>CLP Metals (TAL) - (As/Be/Cd/Cr/Co/Pb/Mn) - Filtered</u>	AT14: _____	_____
AT5: <u>CLP Metals (TAL) - (As/Be/Cd/Cr/Co/Pb/Mn) - Unfiltered</u>	AT15: _____	_____
AT6: <u>Gamma Spec (Cs-137/Co-60)</u>	AT16: _____	_____
AT7: <u>Gamma Screen</u>	AT17: _____	_____
AT8: <u>Iritium</u>	AT18: _____	_____
AT9: <u>Strontium-90</u>	AT19: _____	_____
AT10: <u>Alpha Spec (Americium-241)</u>	AT20: _____	_____

Figure 23. (continued).

3.4 Sampling Equipment and Procedures

The following sections provide Site-specific considerations needed to implement the field sampling plan. Health and safety considerations are provided in detail in Appendix A. The following ER procedures have been included in this plan as appendices:

Program Directive 5.7	Chain-of-Custody Record	Appendix D
ERSOP 11.3	Chain-of-Custody, Sample Handling, and Packaging	Appendix E
Program Directive 4.2	Logbooks	Appendix F
ERSOP 11.9	Measurement of Ground Water Levels	Appendix G
ERSOP 11.8	Ground Water Sampling	Appendix H
Program Directive 4.1	Document Control	Appendix I
ERSOP 11.5	Field Decontamination of Sampling Equipment	Appendix J.

3.4.1 Field Decontamination Procedures

Tap water will be run through the pumps for 1 minute to decontaminate the system. Deionized water will then be run through the pump as a final rinse. All other sampling equipment will be cleaned first with nonphosphorous soap, then rinsed with tap water followed by deionized water. Decontamination solutions will be combined with purge water for disposal. Equipment will be wiped dry with a paper wipe. The wipes will be surveyed for radioactivity using hand-held instrumentation. All radioactivity measurements will be performed by a qualified technician. If the wipes are determined to be clean, they will be disposed of as sanitary waste. If the water or wipes are found to contain radiological contamination, the environmental engineer and/or radiological engineer will be notified for disposal. Procedures and equipment release criteria are specified in the *EG&G Idaho Radiological Control Manual* (EG&G Idaho 1993b). The SOP for decontamination of sampling equipment is contained in Appendix J.

3.4.2 Groundwater Sampling Procedures

This section briefly summarizes some of the details not provided in ERSOP 11.8, "Groundwater Sampling" (Appendix H). All results and field notes will be recorded in the logbooks, which will be kept on file with ARDC. A logbook number will be included for easy reference.

All wells will be purged before sample collection. The purged water will be stored in a container suitable to handle the anticipated volume based on previous sampling events. A minimum of three wellbore volumes (borehole diameter) of water, including the volume in the sandpack, will be removed before sampling. If the well is pumped dry, samples will be collected the following day, or as soon as the water has recovered adequately to fill the required sample bottles. Purging will be performed using a portable Bennette pump^b (or equivalent) for the deep

b. Mention of specific products and/or manufacturers in this document implies neither endorsement or preference, nor disapproval by the U.S. Government, any of its agencies, or EG&G Idaho, Inc. of the use of a specific product for any purpose.

PWS wells. A Bennette pump is a gas-powered piston submersible pump. The system is operated by compressed gas and driven by an air motor. The pump is self-priming, and the gas that drives the pump does not contact the purged water. The pump is constructed of stainless steel and can be decontaminated easily. The appropriate purge location of the pump is below the water level and above the screen. Dedicated Grundfos submersible pumps for the existing USGS wells will be used along with a dedicated turbine pump for the TRA production wells. Table 7 gives the calculated purge volume required for removal of one wellbore volume.

During the purge operation, a Hydrolab-brand instrument or equivalent will be used to measure the pH, temperature, specific conductance, and dissolved oxygen content of the water. After three wellbores, including sandpack, are evacuated, and when three consecutive Hydrolab readings are within the following limits, water quality samples will be collected:

- pH ± 0.1 standard units
- Temperature $\pm 0.5^{\circ}\text{C}$
- Specific conductance $\pm 10 \mu\text{s}/\text{cm}$.

If the Hydrolab readings do not stabilize, a maximum of five wellbore volumes will be removed before sampling.

All water sample containers will be field tested for gamma and wipe tested for any removable radioactive contamination by the radiological control technician onsite. Any containers showing signs of contamination will be thoroughly decontaminated and verified to be clean before leaving the sampling location. In addition, the sample containers and handling equipment will be checked for any potential cross contamination.

3.5 Sample Handling and Analysis

Sample bottles for liquid samples will be filled to approximately 90% of volume allowing for some expansion except for those samples being delivered to the Radiation Measurements Laboratory at TRA for a gamma screen analysis. These sample bottles will be filled as full as possible. All samples requiring cooling will be cooled to 4°C. Samples to be analyzed for filtered and unfiltered metals will be acidified to a pH < 2 using 10% ultrapure nitric acid. Hexavalent chromium samples will be unacidified. One 500-mL unfiltered sample will be collected to perform fluoride analysis. Refer to Table 8 for a summary of the required sample containers and preservation techniques.

Table 7. Purge volume calculations.^a

Monitoring well	Land elev. (ft msl) ^b	Well completion depth ^c (ft bls) ^d	Water level depth (ft bls)	Casing diameter (in.)	Casing depth interval (ft bls)	Sat. casing length ^f (ft)	Bore-hole diameter (in.)	Bore-hole depth interval (ft bls)	Completion interval (ft bls)	Sat. open bore-hole length (ft)	Sat. sandpack length (ft) ^g	Sand-pack porosity	Well storage (gal)	
PW-11	4,915.6	129.0	63.8	10.0	0-44	0.0	12.0	0-45	103-134	NA	26.0	0.3	43	
				4.0	0-129	26.0	9.9	45-135						
							3.6	135-168.8						
PW-12	4,923.0	128.0	75.9	10.0	0-40	0.0	12.0	0-43	103-133	NA	26.0	0.3	43	
				4.0	0-128	26.0	9.9	43-133						
							3.6	133-141.5						
TRA-7	4,931.1	493.0	474.0	10.0	0-46	0.0	12.0	0-46	455-501	NA	19.0	0.3	31	
				4.0	0-493	19.0	9.9	46-501						
USGS-53	4,922.5	80.0	62.7	6.0	0-25	0.0	6.0	0-90	75-80	NA	NA	NA	11	
				4.0	25-90	17.3								
USGS-54	4,921.6	81.75	66.1	6.0	0-60	0.0	6.0	0-91	60-91	24.9	NA	NA	37	
USGS-55	4,920.6	80.0	68.0	6.0	0-45	0.0	6.0	0-80	45-80	12.0	NA	NA	18	
USGS-56	4,921.5	80.0	62.7	6.0	0-59	0.0	6.0	0-80	59-80	17.3	NA	NA	25	
USGS-58	4,919.2	503.0	456.7	12.0	0-51	0.0	12.0	0-101	218-503	0.0	NA	NA	68	
				8.0	0-101	0.0	8.0	101-218						
				6.0	0-218	0.0	6.0	218-503			46.3			
USGS-65	4,925.9	498.0	464.1	6.0	0-325	0.0	12.0	0-60	456-498	0.0	NA	NA	29	
				4.0	0-456	0.0	10.0	60-325						
							6.0	325-472						
							4.0	472-498					26.0	

NA Not Applicable

a. Source: Mattick and Doornbas 1990; Doornbas et al. 1992.

b. Feet above mean sea level.

c. Bottom of completed interval.

d. Feet below land surface.

e. Elevation estimated from topographic map.

f. Water level elevation minus bottom of perforated interval.

g. Top of sandpack minus bottom of perforated interval.

Table 8. Required sample containers and preservation techniques.

Sample type	Sample volume required	Container type ^a	Preservation
Alpha emitting radionuclides (Am-241)	2 L	Plastic	HNO ₃ to pH <2
Tritium	1 L	Plastic	None required
Strontium-90	2 L	Plastic	HNO ₃ to pH <2
Gamma emitting radionuclides (Cs-137, Co-60)	540 mL	Plastic	HNO ₃ to pH <2
Total metals (unfiltered)	1 L	HDPE	HNO ₃ to pH <2, 4°C
Dissolved metals (filtered)	1 L	HDPE	HNO ₃ to pH <2, 4°C
Hexavalent chromium (filtered)	500 mL	HDPE	4°C
Hexavalent chromium (unfiltered)	500 mL	HDPE	4°C
Fluoride	500 mL	HDPE	4°C

a. HDPE = high-density polyethylene.

3.5.1 Sample Containers and Preservation

The required containers and preservation techniques are listed in Table 8.

3.5.2 Packaging, Labeling, and Shipping

To determine the appropriate shipping procedures, the Radiation Measurements Laboratory at TRA will perform a gamma screen analysis on one sample per well. Samples will be packaged and shipped according to all appropriate and relevant U.S. Department of Transportation shipping requirements and ERSOP 11.3, "Chain-of-Custody, Sample Handling, and Packaging" (Appendix E). This procedure covers the samples from the time they are acquired until they are received at the destination laboratory.

3.5.3 Documentation

All documentation will be in accordance with ER Program Directive 4.1, "Document Control" (Appendix I). A copy of the following documentation will be forwarded to ARDC upon completion of each sampling event:

- Chain-of-custody record. Samples for off-Site analysis must be labeled and handled according to standard custody procedures to ensure the project objectives are met. These procedures will be in accordance with ER Program Directive 5.7, "Chain-of-Custody Record," (Appendix D) and ERSOP 11.3, "Chain-of-Custody, Sample Handling, and Packaging" (Appendix E).
- Field logbooks. Field activities must be recorded with indelible ink in the appropriate field logbooks. Logbooks will be used in accordance with ER Program Directive 4.2, "Logbooks" (Appendix F).
- Field data. Field data and field measurements from the sampling will be reported to Donna Kirchner, EG&G Idaho, Inc., Environmental Restoration, PO Box 1625, Idaho Falls, ID 83415-3904, telephone (208) 526-9873.
- Final data. A report incorporating the sample data will be issued to the PM upon completion of data evaluation.
- Training. Pre-job briefings and personnel training sessions will be documented in the FTL's logbook. Records of training will be reported to the employees safety training representative and filed in individual training files.

3.6 Waste Management

Waste generation from the groundwater sampling is expected to include items such as purged water and potentially contaminated equipment. Water removed from the deep PWS has the potential to be radiologically contaminated and should be treated as such.

3.6.1 Identification/Generation

Waste will be generated when equipment is decontaminated and purge water is developed from the well sampling activities. Other potential contaminated waste forms include paper towels, gloves, and other disposables. Decontamination will be conducted in accordance with ERSOP 11.5 (Appendix J) with one exception: the isopropanol rinse has been eliminated because of its inapplicability to the decontamination of equipment contaminated with the PWS contaminants of concern.

3.6.2 Minimization

Waste minimization will involve a basic understanding of how to reduce the volume of material generated. The amount of waste material generated will be minimal considering the types of activities proposed.

Source reduction will involve prudent housekeeping in that the use of unnecessary equipment will be minimized. Contamination of disposables also will be kept to a minimum. Equipment decontamination rinsate will be mixed with the purged water. The disposables and other potentially contaminated field equipment will be field screened and wipe tested according to the *EG&G Idaho Radiological Control Manual* (EG&G Idaho 1993b).

3.6.3 Disposal

3.6.3.1 Purge water. Purge water from groundwater sampling will be disposed of in the warm waste system as soon as practicable after generation (see Appendix K, "Position Paper for the Disposition of Groundwater Collected Through ERP Characterization Activities at TRA"). The purge water will be transported to the disposal area by a water truck used for radiologically contaminated water, or another method deemed appropriate.

3.6.3.2 Decontamination Liquids. Water generated from equipment decontamination will be combined with the purge water generated from the sampling effort for disposal.

3.7 Schedule

The post-ROD monitoring program will be implemented in 1993 after the monitoring plan is finalized. The sampling events will be initiated in July and scheduled quarterly for the deep PWS monitoring wells and semiannually for the SRPA wells. An annual technical memorandum summarizing data since the last memorandum will be provided to EPA and the State of Idaho within 30 working days after the receipt of validated analytical data from the final sampling round for that reporting period (i.e., 105 to 150 days after the last sampling event). For the first year, the last sampling round is April 1994.

The duration of the post-ROD monitoring program is contingent upon the observations made throughout the monitoring period. As indicated under the comparative analysis discussion, the interval calculations and plotting of the monitoring data will be updated after each sampling event. Post-ROD monitoring program results will be available for a three-year review. This review is approximately the half-way point in the anticipated monitoring period. The three-year review will allow, if appropriate, a reevaluation of the monitoring program goal and the observations being made.

The overall duration of the post-ROD monitoring anticipated at this time is through 1998. At this time, the WAG 2 comprehensive RI will be nearing completion and the WAG 2 comprehensive ROD will be under development for signature in June 1999. At that time, an assessment of the post-ROD monitoring program data can be used to either extend or terminate monitoring related to the PWS. This decision is expected to be included in the WAG 2 comprehensive ROD.

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Appendix A

Health and Safety Plan for the Post-Record of Decision Monitoring Plan



**Idaho
National
Engineering
Laboratory**

*Managed
by the U.S.
Department
of Energy*

EGG-ER-10551
Revision 1
August 1993

**Health and Safety Plan for the
Post-Record of Decision Monitoring
Plan—Test Reactor Area Perched
Water System (Operable Unit 2-12)**



*Work performed under
DOE Contract
No. DE-AC07-76ID01570*

Health and Safety Plan for the Post-Record of Decision Monitoring Plan—Test Reactor Area Perched Water System (Operable Unit 2-12)

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**Prepared for EG&G Idaho, Inc., and
the U.S. Department of Energy
Assistant Secretary for
Environmental Restoration and Waste Management
Under DOE Idaho Operations Office
Contract DE-AC07-76ID01570**

Health and Safety Plan for the Post-Record of Decision Monitoring Plan—Test Reactor Area Perched Water System (Operable Unit 2-12)

EGG-ER-10551

Original signatures appear on DRR ER-931



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Date

J. P. Shea, Chair
ER Independent Review Committee

Date

ABSTRACT

This health and safety plan (HSP) establishes the procedures and requirements that will be used to minimize health and safety risks to persons during the post-Record of Decision monitoring for the Test Reactor Area Perched Water System (Operable Unit 2-12 of Waste Area Group 2). This HSP has been prepared to meet the requirements of the Occupational Safety and Health Administration, other regulatory agencies, and EG&G Idaho, Inc.

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ACRONYMS

ALARA	as low as reasonably achievable
anti-C	anti-contamination
ARDC	Administrative Records and Document Control
CFA	Central Facilities Area
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
DOE-ID	DOE Idaho Operations Office
EG&G Idaho	EG&G Idaho, Inc.
EPA	U.S. Environmental Protection Agency
ER&WM	Environmental Restoration and Waste Management
ERSOP	Environmental Restoration Standard Operating Procedure
FSP	field sampling plan
FTL	field team leader
HSO	health and safety officer
HSP	Health and Safety Plan
IH	industrial hygienist
INEL	Idaho National Engineering Laboratory
MTR	Materials Test Reactor
NIOSH	National Institute of Occupational Safety and Health
NRTS	National Reactor Testing Station
OMP	Occupational Medical Program
OSHA	Occupational Safety and Health Administration
PPE	personal protective equipment
PWS	Perched Water System
RE	radiological engineer
RCT	radiological control technician
ROD	Record of Decision
SE	safety engineer
SRPA	Snake River Plain Aquifer
TLD	thermoluminescent dosimeter
TRA	Test Reactor Area
TRU	transuranic
USCG	U.S. Coast Guard
USGS	U.S. Geological Survey

Health and Safety Plan for the Post-Record of Decision Monitoring Plan—Test Reactor Area Perched Water System (Operable Unit 2-12)

1. INTRODUCTION

This health and safety plan (HSP) establishes the procedures and requirements that will be used to minimize health and safety risks to persons working at the task site. This HSP meets the requirements of the Occupational Safety and Health Administration (OSHA) standard, 29 Code of Federal Regulations (CFR) 1910.120, "Hazardous Waste Operations and Emergency Response." It has been prepared in recognition of and is consistent with the [National Institute of Occupational Safety and Health] NIOSH/OSHA/[U.S. Coast Guard] USCG/[U.S. Environmental Protection Agency] EPA Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities (NIOSH 1985), the EG&G Idaho, Inc. (EG&G Idaho) Company Procedures Manual (EG&G Idaho 1993a), the EG&G Idaho Safety Manual (EG&G Idaho 1993b), the EG&G Idaho Industrial Hygiene Manual (EG&G Idaho 1993c), and the EG&G Idaho Radiological Control Manual (EG&G Idaho 1993d).

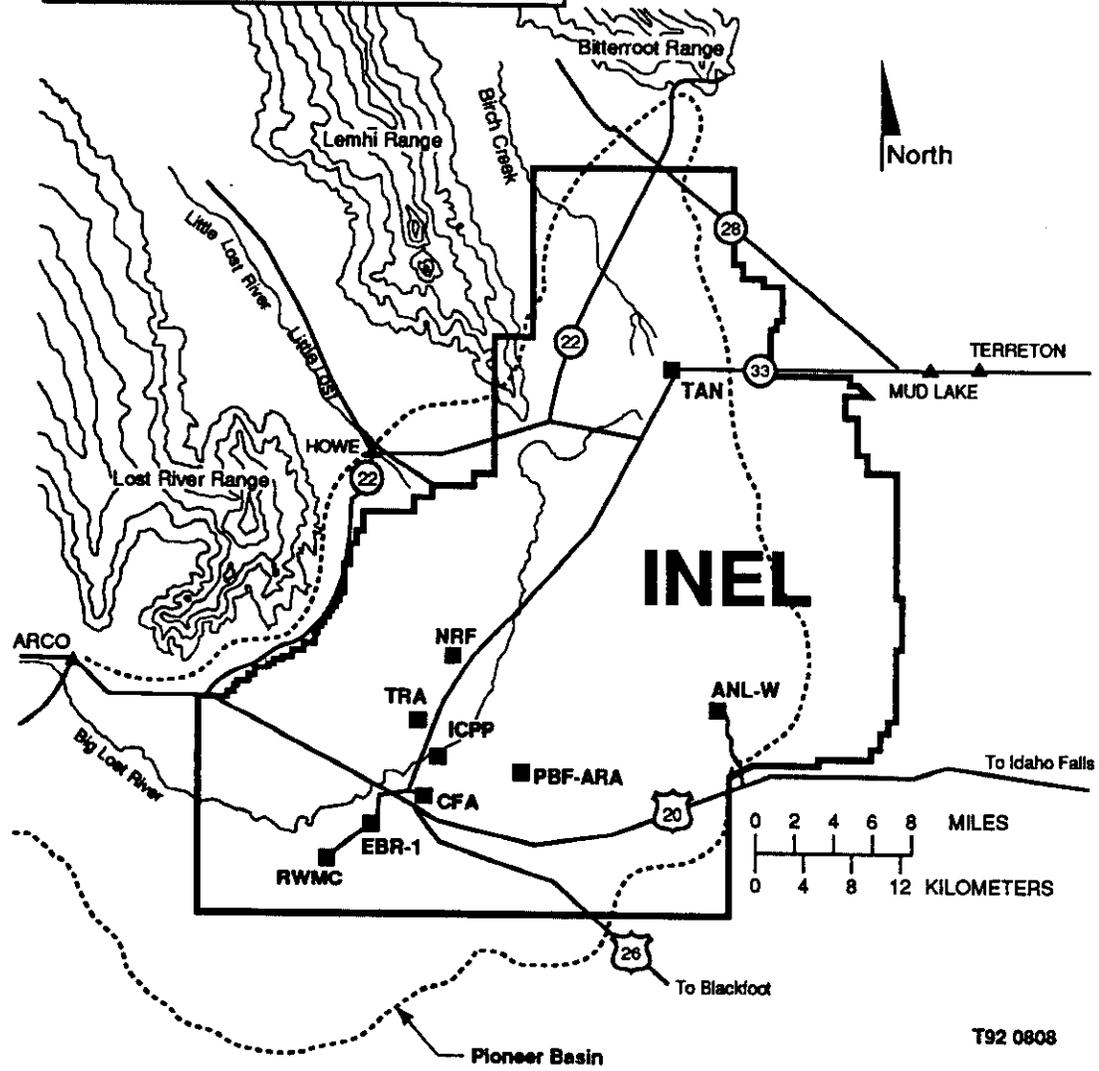
This HSP will govern all work conducted while implementing the *Post Record of Decision Monitoring Plan for the Test Reactor Area Perched Water System* (EG&G Idaho 1993e). This HSP applies to employees of EG&G Idaho, subcontractors to EG&G Idaho, and employees of other companies or U.S. Department of Energy (DOE) laboratories. Persons not normally assigned to work at the task site, such as representatives of DOE, the State of Idaho, OSHA, and EPA will be considered to be "occasional site workers," in accordance with OSHA 29 CFR 1910.120, and are subject to the requirements of this HSP.

This HSP will be reviewed and revised by the health and safety officer (HSO) in collaboration with the field team leader (FTL) and other health and safety professionals as necessary to ensure the effectiveness and suitability of this HSP.

1.1 Site Description

The Idaho National Engineering Laboratory (INEL), formerly the National Reactor Testing Station (NRTS), encompasses 890 mi², and is located approximately 20 mi west of Idaho Falls, Idaho (Figure 1). The United States Atomic Energy Commission, now DOE, established the NRTS in 1949 as a site for building and testing a variety of nuclear facilities. The INEL also has been a storage facility for transuranic (TRU) radionuclides and low-level radioactive waste since 1952. At present, the INEL supports engineering and operations efforts of DOE and other Federal agencies in areas of nuclear safety research, reactor development, reactor operations and training, nuclear defense materials production, waste management technology development, and energy technology/conservation programs. The DOE Idaho Operations Office (DOE-ID) has responsibility for the INEL, and designates authority to operate the INEL to government contractors. The largest prime contractor for DOE-ID at the INEL is EG&G Idaho, Inc., which provides maintenance and operation services to the majority of INEL facilities. Other contractors who operate facilities at the INEL, but are not

- ARA Auxiliary Reactor Area
- ANL-W Argonne National Laboratory-West
- CFA Central Facilities Area
- EBR I Experimental Breeder Reactor I
- EBR II Experimental Breeder Reactor II
- ICCP Idaho Chemical Processing Plant
- IET Initial Engineering Test
- LOFT Loss-of-Fluid Test Facility
- NRF Naval Reactor Facility
- PBF Power Burst Facility
- RWMC Radioactive Waste Management Facility
- TAN Test Area North
- TRA Test Reactor Area
- TREAT Transient Reactor Test Facility
- TSF Test Support Facility
- WMO Waste Management Operations
- WRRTF Water Reactor Research Test Facility
- ZPPR Zero Power Plutonium Reactor



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Figure 1. Map of the INEL and surrounding area.

covered by this HSP, include Westinghouse Idaho Nuclear Company, Argonne National Laboratory, Westinghouse Electric Corporation, and Babcock and Wilcox.

1.2 Task Site Description

TRA is located in the southwestern portion of the INEL, north of the Big Lost River and approximately 47 mi west of Idaho Falls (see Figure 1). The area around TRA is flat with a gentle slope to the west southwest corner and to the east northeast corner. TRA occupies an area that measures 1,900 by 1,700 ft and is surrounded by a double security fence.

Wastewater discharge has occurred at several locations at TRA, including the warm waste pond, cold waste pond, an injection well, and a chemical waste pond. Contaminants have percolated downward through the surficial alluvium into the underlying basalt bedrock (Lewis and Sinton et al., 1992). The ROD for the Perched Water System (PWS) was signed in October 1992 and mandated that no remedial action is required; however, monitoring of the system is needed. This HSP covers the monitoring activities during the post-ROD period. The groundwater samples taken to date have indicated the presence of volatile organic compounds only slightly above the detection limits and cadmium, chromium, and manganese above the Federal limits for groundwater in the PWS. Fluoride and radionuclides (e.g., tritium and strontium-90) are also present in the PWS. The Snake River Plain Aquifer (SRPA) groundwater sampling in this area has shown the presence of chromium and tritium.

1.3 Scope of Work

Groundwater samples will be taken at a series of monitoring well locations surrounding and within TRA. Groundwater elevations will be recorded as part of the field activity. The specific well locations are identified in the field sampling plan (FSP) and are summarized below. The wells are completed in the deep PWS and the SRPA.

SRPA	Deep PWS	
TRA-07	PW-11	USGS-54
U.S. Geological Survey (USGS)-58	PW-12	USGS-55
USGS-65	USGS-53	USGS-56

Figure 2 illustrates the general site locations for these wells. Sampling will be conducted as specified in Environmental Restoration Standard Operating Procedures (ERSOPs) 11.8, "Groundwater Sampling," and 11.9, "Measurement of Groundwater Levels." The details regarding well purging techniques and sample container requirements are documented in these procedures. Decontamination will be conducted in accordance with ERSOP 11.5, "Field Decontamination of Sampling Equipment."

Groundwater sampling involves collecting groundwater for geochemical and radionuclide contaminant chemistry analysis. Before purging and sampling of the well, the static water level in the well must be measured as specified in ERSOP 11.9. The water in the well is purged (usually three to five times the calculated volume of water in the well) to obtain a representative sample. A bottom

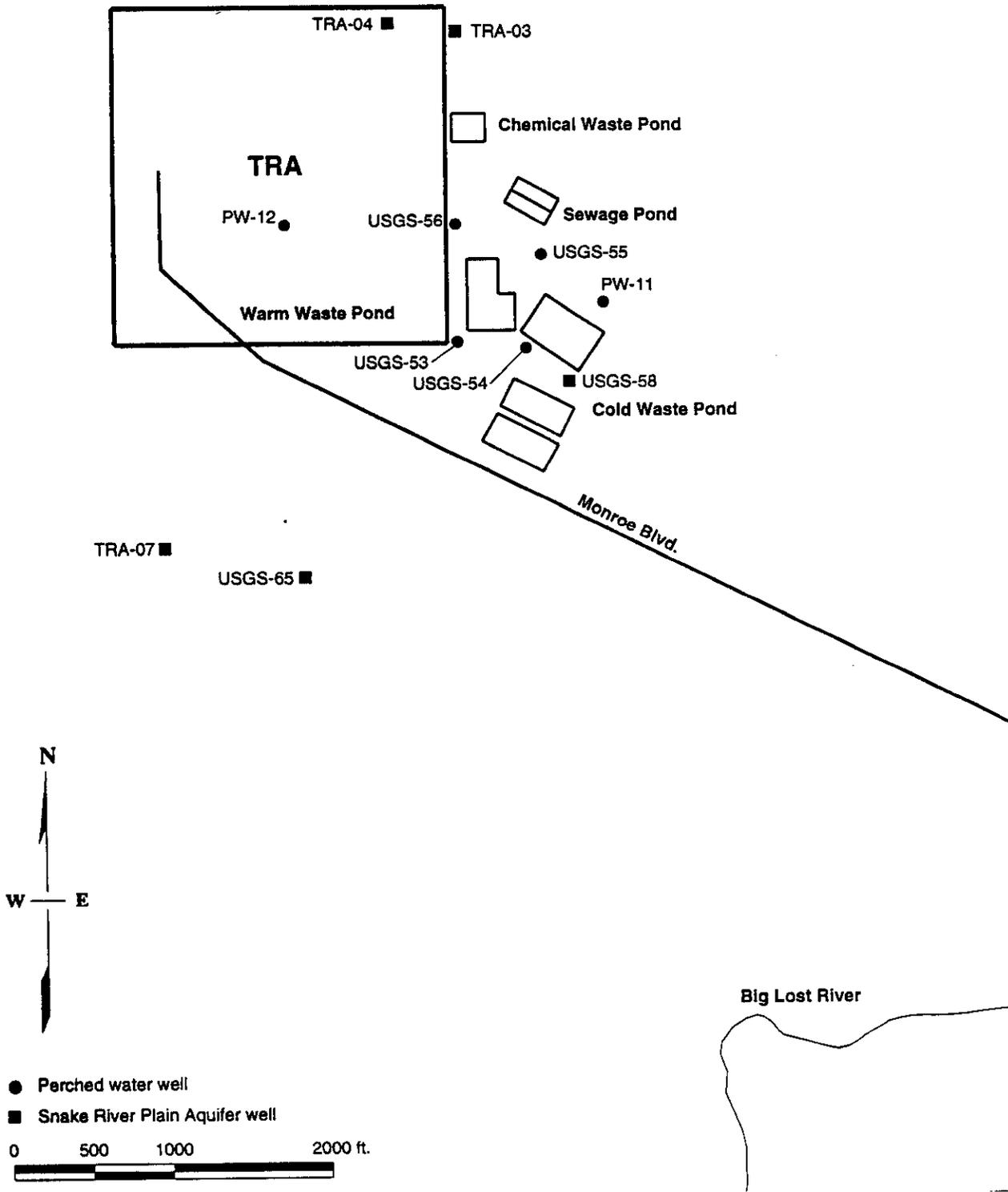


Figure 2. TRA Perched Water System groundwater monitoring well network.

filling bailer or suitable sampling pump will be used to remove the stagnant water in the monitoring wells and to obtain samples. The sampler will use gloves to transfer water samples to suitable containers to prevent possible contact. Other protective equipment requirements will be covered in a later section of this HSP. The sample containers will be labelled appropriately as specified in the ERSOPs. Field equipment blanks and duplicates will also be taken as specified in the Post-ROD Monitoring Plan (EG&G Idaho 1993e).

2. TASK SITE RESPONSIBILITIES

2.1 Task Site Personnel

The organizational structure for this task reflects the resources and expertise required to perform the task, while minimizing risks to personal health and safety. Key personnel and lines of responsibility and communication are shown on the organizational chart for the task (Figure 3). The following sections outline responsibilities of key site personnel.

2.1.1 Environmental Restoration and Waste Management Department Manager

The Environmental Restoration and Waste Management (ER&WM) Department manager is responsible for investigation and remediation activities performed by the department. This manager provides technical coordination and interfaces with the DOE-ID Environmental Support Office. The ER&WM manager

- Ensures that all activities are conducted in accordance with DOE, EPA, and State of Idaho requirements and agreements
- Monitors and approves program budgets and schedules
- Ensures the availability of necessary personnel, equipment, subcontractors, and services
- Provides direction for developing tasks, evaluating findings, developing conclusions and recommendations, and producing reports.

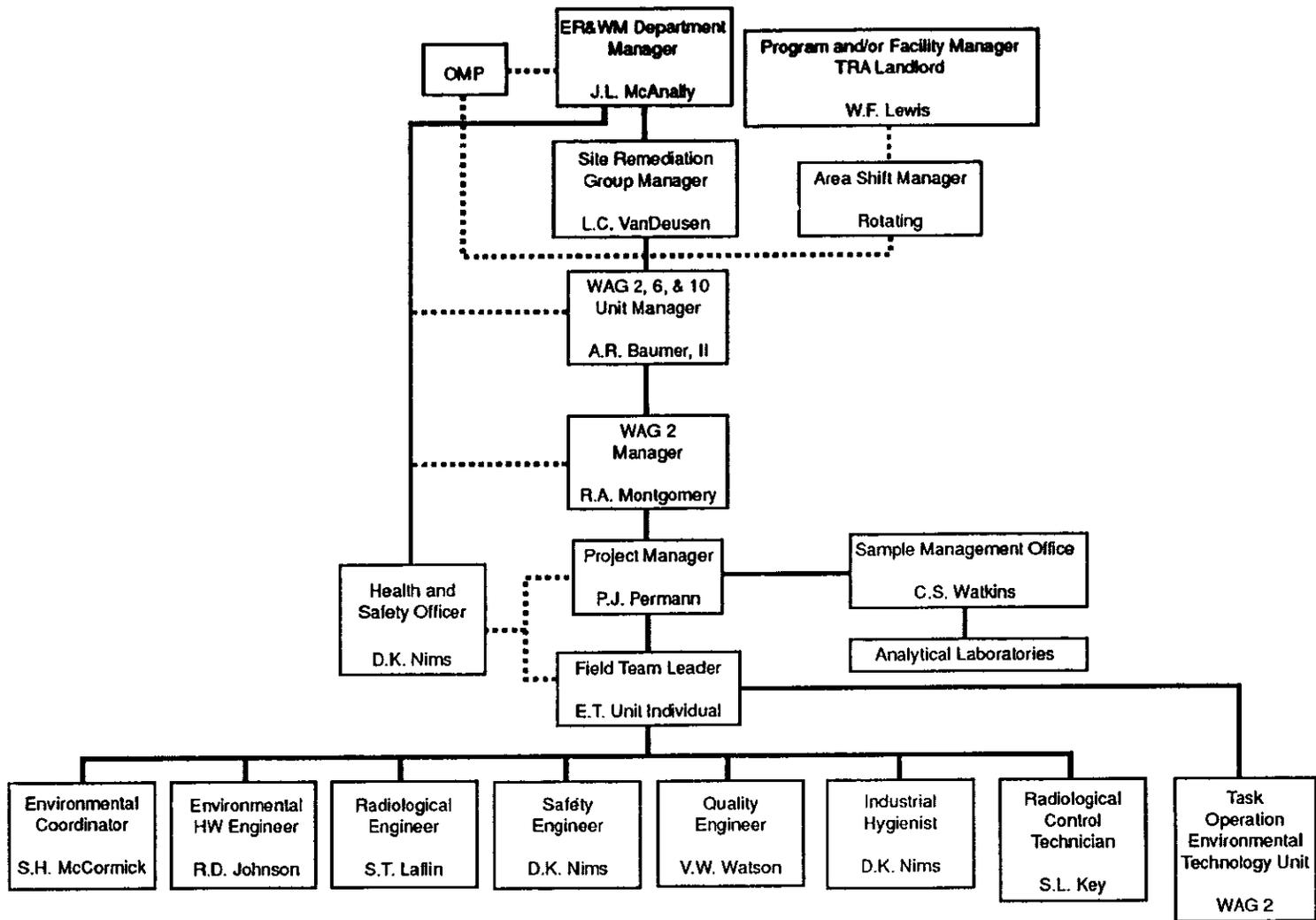
The ER&WM Department manager has primary responsibility for the technical quality of all projects and the safety of personnel.

2.1.2 Project Manager

The project manager ensures that all tasks conducted during the project are in compliance with the EG&G Idaho Environmental Restoration management plans and all applicable OSHA, EPA, DOE, U.S. Department of Transportation, and State of Idaho requirements. The project manager is responsible for ensuring that tasks comply with the *Quality Program Plan for the Environmental Restoration Program* (QPP-149) (EG&G Idaho 1991), Environmental Restoration program directives (EG&G Idaho 1993f), and the Post-ROD Monitoring Plan (EG&G Idaho 1993e). The project manager coordinates all field, laboratory, and modeling activities.

2.1.3 Field Team Leader

The FTL represents ER&WM at the task site and has the ultimate responsibility for the safe and successful completion of the project. The FTL works with the facility manager to manage field operations and execute the work plan. The FTL enforces site control and documents task site activities. The FTL and facility manager conduct daily safety briefings at the start of the shift. All health and safety issues at the task site must be brought to the attention of the FTL.



— Lines of communication and responsibility

- - - Lines of communication

WAG = Waste Area Group

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Figure 3. Field organization chart for post-ROD monitoring.

If the FTL leaves the task site, an alternate individual will be appointed as the acting FTL. Persons acting as FTL at the task site must meet all training requirements for the FTL, as outlined in Section 3. The identity of the acting FTL will be conveyed to task site personnel and recorded in the FTL logbook. The identity of the acting FTL also should be communicated to the facility representative when appropriate.

2.1.4 Task Site Personnel

All task site personnel, including EG&G Idaho and subcontractor personnel, are responsible for understanding and complying with requirements of this HSP. Task site personnel will be briefed by the FTL at the start of each shift. Task site personnel should report potentially unsafe situations or conditions to the FTL or HSO for corrective action. *If unsafe conditions develop, task site personnel are authorized to stop work and then notify the FTL or HSO of the unsafe condition.*

2.1.5 Nonworkers

All persons who may be on the task site and who are not a part of the field team are considered nonworkers for the purposes of this project. Nonworkers will be considered occasional site workers in accordance with 29 CFR 1910.120, and must meet minimum training requirements for "occasional site workers" as described in the OSHA standard, and any additional task-specific training that is specified in Section 4.

Nonworkers, including EG&G Idaho employees from other departments and representatives of DOE or State or Federal regulatory agencies, may not proceed beyond the support zone without receiving a safety briefing, wearing the appropriate protective equipment, and providing proof of meeting the training requirements specified in Section 4 of this HSP. Nonworkers will be escorted by a fully trained task site representative (the FTL or HSO, or a designated alternate), at all times while on the site. Personnel will be considered to be "on site" when they are present within the designated support zone or any other zone, as identified in Section 6.

2.1.6 Health and Safety Officer

The HSO is the person located at the task site who serves as the primary contact for health and safety issues. The HSO advises the FTL on all aspects of health and safety, and is authorized to stop work at the site if any operation threatens worker or public health or safety. The HSO has other specific responsibilities as stated in other sections of this HSP. The HSO is supported by other health and safety personnel at the task site (safety engineer, industrial hygienist, radiological control technician, radiological engineer, and facility representative, as necessary). The HSO or alternate HSO must be qualified to recognize and evaluate hazards, and must have the authority to take or direct actions to ensure workers are protected. When sampling is conducted, an HSO or designee thereof will be present to ensure that the necessary precautionary measures are taken.

If it is necessary for the HSO to leave the site, an alternate individual will be appointed by the HSO to fulfill this role; the identity of the alternate HSO will be recorded in the FTL's logbook.

2.1.7 Industrial Hygienist

The industrial hygienist (IH) is the primary source of information regarding hazardous and toxic agents at the task site. The IH will monitor the task site to determine worker exposures to hazardous agents in accordance with the *Company Procedures Manual* (EG&G Idaho 1993a) and the *Industrial Hygiene Manual* (EG&G Idaho 1993c). The IH also will recommend appropriate hazard controls for protection of task site personnel, review the effectiveness of monitoring and personal protective equipment (PPE) required in this HSP, and recommend changes as appropriate. Following an evacuation, the IH will assist in determining whether conditions at the task site are safe for reentry. Employees showing health effects resulting from possible exposure to hazardous agents will be referred to the Occupational Medical Program by the IH. The IH may have other duties at the task site as specified in other sections of this HSP or in the EG&G Idaho implementing procedures and policy and requirements manuals.

2.1.8 Safety Engineer

The safety engineer (SE) offers guidance on all safety issues arising at the task site, observes site activity, advises the FTL on required safety equipment, and recommends solutions to safety issues that arise at the task site. The SE, under the direction of the IH, also may perform air sampling to evaluate the presence of combustible mixtures of gases and toxic or low-oxygen atmospheres. The SE may have other duties at the task site as specified in other sections of this HSP or in the EG&G Idaho implementing procedures and policy and requirements manuals.

2.1.9 Radiological Control Technician

The radiological control technician (RCT) is the primary source of information and guidance on radiological hazards. The RCT will be present at the task site during any task operations when a radiological hazard to operations personnel may exist or is anticipated. Responsibilities of the RCT include radiological surveying of the task site, equipment, and samples; providing guidance for radiological decontamination of equipment and personnel; and accompanying the victim to the nearest INEL medical facility (TRA-667) for evaluation if significant radiological contamination occurs. These tasks will be performed in accordance with the *Radiological Control Manual* (EG&G Idaho 1993d). The RCT must notify the FTL of any radiological occurrence that must be reported as directed by the *Safety Manual*, Section 3, Appendix II (EG&G Idaho 1993b). The RCT will have other duties at the task site as specified in other sections of this HSP or in the EG&G Idaho implementing procedures and policy and requirements manuals.

2.1.10 Radiological Engineer

The radiological engineer (RE) is the primary source of information and guidance for radiological controls imposed on a task. The RE will make recommendations to minimize health and safety risks of task operations personnel if a radiological hazard exists or occurs at the task site. Responsibilities of the RE include performing radiation exposure estimates and as low as reasonably achievable (ALARA) evaluations, identifying the type(s) of radiological monitoring equipment necessary for the task, advising the FTL and RCT of changes in monitoring or PPE, and advising on task site evacuation and reentry. Conduct of these tasks also will conform to the *Radiological Control Manual* (EG&G Idaho 1993d).

2.1.11 Occupational Medical Program

The INEL Occupational Medical Program (OMP) provides medical surveillance for personnel assigned as hazardous waste site workers in accordance with OSHA. OMP personnel are also responsible for evaluation of personnel injured or exposed to hazardous materials at the task site. See Section 4 for details of the medical surveillance program.

2.1.12 Facility Manager

The facility manager is responsible for managing all aspects of their assigned area, and must be cognizant of work being conducted in the area.

2.1.13 Facility Representative

The facility representative serves as the area landlord representative, and is responsible for the safety of personnel and the safe completion of all project activities conducted within the area. Therefore, the facility representative will be kept informed of all activities performed in the area. When applicable, the facility representative and FTL will agree upon a schedule for reporting task progress and plans for work. The facility representative may serve as an advisor to task operations personnel with regard to the area operations.

2.1.14 Environmental Engineer

The environmental engineer oversees, monitors, and advises EG&G Idaho organizations performing field activities at the INEL. Responsibilities include ensuring compliance with DOE orders, EPA regulations, and other regulations concerning the effects of activities on the environment.

2.1.15 Quality Engineer

The quality engineer provides guidance on task site quality issues when requested. The quality engineer observes task site activities and verifies that task operations comply with quality requirements pertaining to these activities. The quality engineer identifies activities that do not comply or have the potential to not comply with quality requirements and suggests corrective actions for such activities.

2.2 Recordkeeping Requirements

2.2.1 Industrial Hygiene and Radiological Control Monitoring Records

If applicable, the IH will record air monitoring and personal sampling data on Form EG&G-737, "Industrial Hygiene Monitoring Data Form." Additionally, data will be entered into the IH System 80 data management system. Industrial hygiene monitoring data are treated as limited access information and are maintained by the IH in accordance with Company Procedure 11.14 (EG&G Idaho 1993a). The RCT keeps a logbook of all radiological monitoring, daily operational activities, and instrument calibrations.

2.2.2 Field Team Leader Logbook

The FTL will keep a record of daily task site events in the FTL logbook. Records will be maintained as stated in Section 3.4.3 of the Post-ROD Monitoring Plan (EG&G Idaho 1993e) and Chapter 8, Section 3.1, "Calibration and Control" of the *Radiological Control Manual* (EG&G Idaho 1993d). The FTL is also responsible for maintaining an accurate record of all personnel (workers and nonworkers) who are at the task site each day. This logbook must be obtained from Administrative Records and Document Control (ARDC) and submitted to ARDC at the end of the project.

2.2.3 Administrative Record and Document Control Office

ARDC is responsible for organizing and maintaining data and reports generated by ER&WM field activities. ARDC maintains a supply of all controlled documents and provides a documented checkout system for the control and release of controlled documents, reports, and records. Copies of the Environmental Restoration management plan, and the Post-ROD Monitoring Plan (which includes this HSP) are maintained in the project file by ARDC. All project records and logbooks, except IH and RCT logbooks, will be forwarded to ARDC within 30 days after completion of the task.

3. PERSONNEL TRAINING

All task site personnel will receive training as specified by OSHA 29 CFR 1910.120 and the *Company Procedures Manual*, 1.11 (EG&G Idaho 1993a). Table 1 summarizes training requirements for task site personnel. Specific training requirements for each worker will vary depending on the hazards associated with the job assignment.

Proof of completion of all required training courses (including refresher training) must be maintained on the site at all times. Form EG&G-2580, "Health and Safety Permit Card," is acceptable proof of training. A copy of the certificate issued by the institution where the training was received may be carried by task site personnel in lieu of Form EG&G-2580.

Before beginning work at the task site, a project safety orientation will be conducted by the FTL. The orientation will consist of a complete review of this HSP and any relevant attachments, with time for discussion and questions. At this time, personnel training will be checked and verified to be current and complete for all required training shown in Table 1. Upon completing the safety orientation, personnel will sign the training acknowledgement form to indicate that they have received and understand the HSP (see Section 10).

Table 1. Required training for task site personnel.

Training	FTL	Sampling team	HSO	Nonworkers
Task site orientation	X	X	X	X
Decontamination ^a	X	X	X	X ^b
Hazard communication ^a	X	X	X	X
Signs, tags, warning devices ^a	X	X	X	X
Emergency action plan for task site ^b	X	X	X	X
Hazardous waste operator ^c	X	X	X	
Hazardous waste operator—24 hours field experience	X		X	
Hazardous waste site supervisor ^d	X		X	
Hearing conservation				X ^e
Radiation worker qualification	X	X	X	X ^e
Medic First ^e	X		X	
Respirator qualification and fit test	X			X ^f
Hazardous waste operator—occasional worker ^g				X

a. Will be included in task site orientation.

b. Includes 24 hours of field experience.

c. As appropriate.

d. At least one person with OSHA supervisor training must be on-site at all times.

e. Two Medic First-qualified individuals must be present during site activities.

f. If entering areas requiring respirator use.

g. Includes 24 hours of classroom instruction and 8 hours of on-the-job training.

4. OCCUPATIONAL MEDICAL PROGRAM AND MEDICAL SURVEILLANCE

Task site personnel will participate in the INEL OMP according to the requirements of OSHA 29 CFR 1910.120, which requires medical surveillance examinations before assignment, annually, and after termination of hazardous waste duties. This includes employees who are or may be exposed to hazardous substances at or above published exposure limits, without regard to respirator use for 30 or more days per year, as well as those who wear a respirator for 30 or more days per year. Employees who must use a respirator in their job or who are required to take training to use a respirator to perform their duties under this plan must be medically evaluated for respirator use at least annually. Job-related information must be provided to the OMP for each hazardous material worker by completing Form EG&G-735, "Industrial Hygiene Identification of an Employee for a Medical Surveillance Program to OMP." This information must be submitted to the OMP before work begins and as long as the employee is required to maintain hazardous waste/hazardous material worker medical clearance.

The OMP is responsible for evaluating the physical ability of a worker to perform the task assigned and providing medical clearance of the worker for the work to be performed. The OMP may impose medical restrictions on the employee that may limit the amount of work performed.

Areas addressed by the OMP for hazardous waste site workers include

- Current comprehensive medical examinations in an INEL medical facility for full-time employees
- Records and reports from employees' private physicians, as required by the Site occupational medical director
- Medical evaluation by the OMP on return to work following an absence in excess of one workweek (40 consecutive work hours) resulting from illness or injury
- Medical evaluation when a supervisor questions the physical condition of an employee
- Medical evaluation when an employee questions their own physical condition.

The information provided on the forms and by employee examination are used to determine the following for each employee:

- Ability to perform relevant occupational tasks
- Ability to work in protective equipment and heat stress environments
- Ability to use respiratory protection

NOTE: If the OMP does not have sufficient information at the time of request for clearance for respirator training, the employee's supervisor will be notified and clearance

will be withheld until the needed information is provided and any additional examination or testing is completed.

- Need to be entered into additional specific medical surveillance examination programs.

Results of the following tests will be made available to the OMP when any abnormal radiological exposure is noted or a radiological contamination incident occurs:

- Whole body count (baseline, annual, and an actual or suspected radiological contamination incident)
- Bioassay (baseline, as required to assess internal radiation dose and an actual or suspected radiological contamination incident).

4.1 Subcontract Personnel

Medical data from the worker's private physician, collected pursuant to hazardous material worker qualification of subcontract personnel, will be made available to the OMP upon request. Also, subcontract personnel's past radiation exposure histories must be submitted to the Operational Dosimetry Unit of EG&G Idaho [*Radiological Control Manual*, Sections 3.6 and 3.10.2(k) (EG&G Idaho 1993d)].

4.2 Injuries on the Task Site

It is the policy of the OMP to examine all workers, including subcontract personnel, if the workers are injured on the job, if they are experiencing symptoms consistent with exposure to a hazardous material, or if there is reason to believe that they have been exposed to toxic substances or physical agents in excess of allowable limits.

In the event of a known or suspected injury or illness from exposure to a hazardous substance or physical agent, the worker(s) will be transported to the nearest medical facility (TRA-667) for evaluation, with as much information as possible regarding the suspected cause of injury or illness. As much of the following information as is available will accompany the individual to the medical facility:

- Name, job title, work location, and supervisor's name and phone number
- Substances or physical agents exposed to, known or suspected; material safety data sheet, if available
- Date of employee's first exposure to the substance or physical agent
- Locations, dates, and results of exposure monitoring
- PPE in use during this task (for example, respirator and cartridge)

- Number of days per month PPE has been in use
- Anticipated future exposure to the substance or agent.

Further medical evaluation will be in accordance with the symptoms, hazard involved, exposure level, and specific medical surveillance requirements.

4.3 Substance-Specific Medical Surveillance

No substance-specific medical surveillance requirements apply to personnel working at the TRA PWS and SRPA groundwater monitoring sites. Although the contaminants are known to cause health effects in large concentrated doses, this section has been omitted based on the known concentration of the contaminants at this time and in the foreseeable future.

5. SAFE WORK PRACTICES

5.1 General Safe Work Practices

The following are general safe work practices that will be followed at the task site:

- Do not wear contact lenses in designated eye-hazard areas unless they are essential to correct a vision defect not correctable by prescription safety glasses. Additional restrictions may apply in accordance with the *Safety Manual*, Section 16 (EG&G Idaho 1993b).
- Do not eat, drink, chew gum or tobacco, smoke, or perform any other practice that increases the probability of hand-to-mouth transfer and ingestion of hazardous or radioactive materials within the work and radiation zones.
- Report all broken skin or open wounds to the FTL. The OMP will determine if the wound presents a significant risk of internal chemical or radiological exposure. The OMP evaluation will consider whether the wound is to be bandaged and will determine the PPE that will be worn. Personnel with unprotected wounds will not be permitted to enter contamination areas, and they will not be permitted to handle contaminated or potentially contaminated materials at the site.
- Avoid direct contact with potentially contaminated substances. Do not walk through spills or other areas of contamination. Avoid kneeling, leaning, or sitting on equipment or ground that may be contaminated.
- Be alert for dangerous situations, strong or irritating odors, airborne dusts or vapors, and broken containers. Report all potentially dangerous situations to the FTL or HSO.
- Prevent releases of hazardous materials, including those used at the task site. If a spill occurs, contain it (if possible) and report it to the FTL (and facility representative, where applicable). Steps must then be taken to clean up the spill in accordance with the appropriate procedure, which may mean activating the emergency preparedness procedures for the area. Guidelines for spill cleanup found in Appendix III of the *Company Procedures Manual*, Section 11.6 (EG&G Idaho 1993a), may be useful. Appropriate spill kits or other containment and absorbent materials will be maintained at the work site.
- Avoid splashing during decontamination.
- Keep all ignition sources at least 50 ft from explosive or flammable environments and use nonsparking, explosion-proof equipment if advised to do so by a safety professional.
- Be familiar with the physical characteristics of the task site, including, but not limited to the following:
 - Wind direction

- Accessibility of fellow workers, equipment, and vehicles
 - Communications at the task site and with other nearby facilities
 - Areas of known or suspected contamination
 - Major roads and means of access to and from the task site
 - Nearest water sources and firefighting equipment
 - Warning devices and alarms
 - Capabilities and location of nearest emergency assistance.
- Work in teams according to the "buddy system" (see Section 5.1.2 of this HSP) if you are working in the exclusion zone.
 - Proceed directly to a survey station upon leaving a radiological contamination zone. Care should be taken not to touch the face, mouth, and eyes before a survey has been performed.

5.1.1 As Low as Reasonably Achievable Principles

Personnel working at the task site must strive to keep radiation and hazardous material exposures ALARA through the following practices:

- Adhere to all written radiological and material safety data sheet requirements and verbal guidance
- Be aware of personal radiation exposure history
- Work within ALARA guidelines and make suggestions as needed
- Minimize the production of all radiological and hazardous waste
- Minimize personal radiation or hazardous material exposure with these basic protection techniques:
 - Time—Exposure is minimized as time is minimized
 - Distance—Maintain a maximum distance from the radiation source
 - Shielding—Use any solid material (such as lead, steel, or concrete) as a shield
 - PPE—Use PPE that is appropriate for the job

- Limits—Radiation exposure limits are contained in the *Radiological Control Manual*, Chapters 2 and 3 (EG&G Idaho 1993d).

5.1.2 The Buddy System

The buddy system will be used at the task site to ensure that each worker's mental and physical well-being is monitored during the course of the day. Task site personnel will be assigned a "buddy" by the FTL to work with and regularly check on during the day. A record of the buddy assignments will be maintained by the FTL and updated as necessary. Workers need to be able to see or hear and effectively communicate with their buddy at all times when in the exclusion zone. Everyone should watch for signs and symptoms of illness or injury in their assigned buddy.

6. SITE CONTROL AND SECURITY

Based on the expected levels of contamination and work activity anticipated by each task, work/radiation zones may be established if sampling locations are located in a radiation control area. Entry into the work zone must be controlled through the appropriate use of barriers, signs, and other measures and are described in detail in this section. Personnel not directly involved with the task at hand will be excluded from entering work zones. Nonworkers, such as inspectors, will be admitted to the task site provided they are on official business and have demonstrated compliance with the training requirements in Section 3 of this HSP.

The following work zones will be set up as deemed necessary by the well location and contaminant levels. Work zones will be required only if the sampling location is a radiation control area. If sampling locations are not located in a radiation control area, the exclusion and support zones will be used exclusively. External radiation control areas and radioactive contamination zones are identified and posted at TRA. Barriers are used to help confine radiological hazards to a specific area. Yellow and magenta ribbons, ropes, tags, and signs are used to keep unauthorized personnel out of the area. External radiation control areas and radioactive contamination zones will be posted in accordance with the *Company Procedures Manual*, Section 10.10 (EG&G Idaho 1993a), and the *Radiological Control Manual*, Chapter 2 (EG&G Idaho 1993d). The need for continued segregation of work zones will be evaluated periodically by the HSO during the performance of the sampling activities.

6.1 Contamination Reduction Zone

The contamination reduction zone is a transition area that surrounds the exclusion zone, and is located between the exclusion zone and the support zone. A designated portion of this zone, called a decontamination corridor, will serve as a decontamination area for equipment and a PPE removal area for task operations personnel. The contamination reduction zone may serve as a staging area for equipment and a temporary rest area for workers. Because of the potential for contamination, PPE and sample packaging and preparation equipment should *not* be stored here. Control of contaminated areas and removal of PPE when exiting contamination control zones shall be performed in accordance with Chapter 4 of the *Radiological Control Manual* (EG&G Idaho 1993d).

6.2 Support Zone

The support zone is the area outside the contamination reduction zone (when work is being performed in a radiation controlled area). If work is not being performed in a radiation controlled area, the support zone will be adjacent to the exclusion zone. The support zone may contain the equipment trailer, command post, vehicle parking, additional equipment staging, or any support activity related to the task at hand.

Radiological control zones must be established or incorporated into the work zones as appropriate for the levels of radiological contamination or radiation present. Task site areas with radiological contamination in excess of the limits established in Chapter 4 of the *Radiological Control Manual* (EG&G Idaho 1993d) will be posted or labeled as specified in Chapter 2 of the manual.

Ingestion of hazardous substances is likely when workers do not practice good personal hygiene habits. It is important to wash hands, face, and other exposed skin thoroughly after completion of work and before smoking, eating, drinking, and chewing gum or tobacco. ***NO SMOKING, CHEWING, EATING, OR DRINKING IS ALLOWED AT THE TASK SITE***, except in an area that is designated as an eating area. The designated eating area at the task site will be determined by the HSO. The actual location will vary according to the daily activity and specific well location. The contamination zones will be recognized to the fullest extent with contamination screening performed before any break. The designated eating area will be verified "clean" on a daily basis by the HSO or RCT. The designated eating area will be checked with radiological screening techniques using the appropriate instrumentation as specified in the *Company Procedures Manual* (EG&G Idaho 1993a).

The RCT will be responsible for radiological monitoring in accordance with Chapter 2, Section 3.8 and Chapter 4, Section 3.4 of the *Radiological Control Manual* (EG&G Idaho 1993d), and Section 10 of the *Company Procedures Manual* (EG&G Idaho 1993a). All health physics equipment will be source checked and calibrated in accordance with Chapter 8 of the *Radiological Control Manual* (EG&G Idaho 1993d). The equipment will be maintained by the RCT according to the manufacturer's instructions. Survey equipment will be used to verify boundaries and work zones, survey personnel and equipment before leaving the task site, and confirm that waste items are sent to the appropriate disposal facility.

To evaluate exposure to ionizing radiation, all task site personnel will be required to wear a thermoluminescent dosimeter (TLD) while at the task site. Personal sampling pumps (lapel monitors) may also be worn by personnel at the request of the RCT to evaluate individual exposures. Guidance for personnel dosimetry can be found in Chapter 2, Section 3.10 of the *Radiological Control Manual* (EG&G Idaho 1993d).

7. HAZARD EVALUATION

Personnel may be exposed to chemical and physical hazards while working at the task site. Tables 2 and 3 contain information about the hazardous materials that are expected to be encountered at the task site. The radiological and industrial hygiene hazard monitoring plans are outlined later in this section.

7.1 Heat Stress

Workers may be required to work outdoors during summer months or wear protective clothing that prevents the body from cooling. High body temperatures can result in physical discomfort, heat exhaustion, or heat stroke. Personnel must inform the FTL or HSO if they experience any of the signs and symptoms of heat stress or observe that their work buddy is experiencing these symptoms. *Company Procedures Manual*, Section 11.10 (EG&G Idaho 1993a), discusses the hazards of heat stress.

Monitoring for heat stress conditions will be performed by the IH according to Company Procedure 11.10 (EG&G Idaho 1993a) and the *Industrial Hygiene Manual*, Section 20, "Temperature Extremes" (EG&G Idaho 1993c). The IH will recommend work and/or rest schedules in accordance with Company Procedure 11.10. Depending on the ambient weather conditions, work conditions, and physical response of task operations personnel, the IH will inform the FTL of necessary adjustments to the work and/or rest cycle. The IH may also make exception to the PPE requirements where heat stress is likely in accordance with Chapter 4, Section 3.5.3 of the *Radiological Control Manual* (EG&G Idaho 1993d). A supply of cool drinking water will be provided at the task site and consumed only in the designated eating area.

Workers may be interviewed by the IH or HSO periodically to ensure that the controls are effective and that excessive heat exposure is not occurring. Workers will be encouraged to monitor their body signs and to take a break if symptoms of heat stress occur. The signs of heat exhaustion are clammy skin, dizziness or nausea, fatigue, profuse sweating, skin color change, or vision problems.

Individuals showing any of the symptoms listed above will stop work, move to a shaded area to rest, be given cool drinking water, and be monitored by a Medic First qualified person. If personnel exhibiting symptoms of heat stress do not show signs of immediate recovery when removed to the rest area, they will be transported to the dispensary for medical attention.

Heat stroke is an extremely serious condition that can result in death and should be treated as such. An individual who stops sweating, or who shows symptoms of confusion, slurred speech, or any

Table 2. Task site activities and associated hazards.

Activity	Hazards or hazardous agents
Deep PWS groundwater sampling	Heavy metals, radionuclides
SRPA groundwater sampling	Heavy metals, radionuclides
Groundwater elevation studies	Heavy metals, radionuclides

Table 3. Hazardous materials present in the TRA deep PWS and the SRPA.^a

Hazardous material/CAS number	Exposure limit (PEL/TLV/REL)	Routes of exposure ^b	Symptoms of overexposure ^c	Target organs/systems	Carcinogen (source) ^d	Levels of Exposure ^e
Arsenic/ 7740-38-2	0.2 mg/m ³ TWA	Inh,Abs,Con,Ing	DERM,RESP,NS	Liver, kidneys, skin, lung, lym. sys.	Yes	5 µg/L
Beryllium/ 7740-41-7	0.0022 mg/m ³	Inh	RESP	Lung, skin, eyes, mucous mem.	Yes	1 µg/L
Cadmium/ 7740-43-9	0.05 mg/m ³	Inh,Ing	RESP,NS	Resp. sys., kidneys, blood	No	3 µg/L
Chromium/ 7740-47-3	0.05 mg/m ³	Inh,Ing	RESP	Resp. Sys.	No	90 µg/L
Cobalt/ 7740-47-3	0.05 mg/m ³	Inh,Ing,Abs	RESP,DERM	Resp. Sys.,	Yes	14 µg/L
Lead/ 7439-92-1	0.15 mg/m ³	Inh,Ing,Abs	NS	GI tract, CNS, kidneys,blood, gingival tissue	Yes	9 µg/L
Manganese/ 7439-96-5	5 mg/m ³	Inh,Ing	RESP,NS	Resp. Sys, CNS, blood, kidneys	No	255 µg/L
Fluoride/ 16984-48-8	2.5 mg/m ³	Inh,Ing,Abs	RESP,NS, DERM	Eyes, Resp Sys CNS, skeleton, kidneys, skin	No	200 µg/L
Cobalt-60 ^f	5,000 pCi/L ^g	Ing, Direct ^h	None ⁱ	GI Tract	Yes	14.3 pCi/L
Cesium-137 ^f	3,000 pCi/L ^g	Ing, Direct ^h	None ⁱ	Whole body	Yes	25.0 pCi/L
Americium-241 ^f	30 pCi/L ^g	Ing, Direct ^h	None ⁱ	Bone surface, red bone marrow, liver	Yes	25.0 pCi/L
Strontium-90 ^f	1,000 pCi/L ^g	Ing, Direct ^h	None ⁱ	Bone surface, red bone marrow, GI tract	Yes	31.9 pCi/L
Tritium ^f	2 × 10 ⁶ pCi/L ^g	Ing	None ⁱ	Whole body	Yes	1.15 × 10 ⁵ pCi/L

a. CNS = central nervous system

PEL = permissible exposure limit

REL = recommended exposure limit

TLV = threshold limit value

b. (Inh) Inhalation; (Ing) Ingestion; (Abs) Skin absorption; (Con) Skin or eye contact

c. (NS) Dizziness/nausea/lightheaded; (DERM) Rashes/itching/redness; (RESP) Respiratory effects; (EYES) Tearing/irritation; (O) Other symptoms - must be specified.

d. If yes, identify agency and appropriate designation (ACGIH A1 or A2; NIOSH; OSHA; IARC; NTP).

e. These concentrations represent environment groundwater concentrations (deep PWS mean concentrations). Airborne concentrations are not expected to exceed the exposure limit.

f. Radionuclides do not have CAS numbers

g. Derived concentration guides for the public (DOE 5400.5, Chapter III)

h. Direct exposure minimal at expected concentrations and not further considered

i. No acute health effects expected at these concentrations.

other evidence of change in level of consciousness, will be transported *IMMEDIATELY* to the nearest medical facility for evaluation (for work outside the security fence at TRA, the Central Facilities Area (CFA) dispensary; inside the security fence, the TRA dispensary).

7.2 Cold Stress

Exposure to low temperatures may be a factor if work is done in the winter months, or at any time of year if the conditions are right. Relatively cool ambient temperatures and wet or windy conditions increase the potential for cold injury to personnel. The *Company Procedures Manual*, Section 11.10 (EG&G Idaho 1993a), discusses the hazards of cold stress. The IH will monitor cold stress conditions in accordance with Section 11.10 of the *Company Procedures Manual* (EG&G Idaho 1993a), and Section 20 of the *Industrial Hygiene Manual* (EG&G Idaho 1993c).

7.3 Fire and Explosion Hazards

Fire and explosion hazards at the site are not expected other than those normally found while driving a truck or performing field activities in the hot sun.

7.4 Handling Heavy Objects

Operations personnel may risk injury by lifting heavy objects. All operations personnel should be cautioned against lifting heavy equipment and objects. Mechanical and hydraulic assists will be used whenever possible to minimize lifting dangers.

7.5 Personal Protective Equipment

Wearing PPE will reduce a worker's ability to move freely, see clearly, and hear directions and noise that might indicate a hazard. Also, PPE can increase the risk of heat stress. Work activities at the task site will be modified as necessary to ensure that personnel are able to work safely in the PPE that is required. The PPE requirements at this time will not impair the worker's ability to perform the tasks proposed.

7.6 Decontamination

The chemical and radiological decontamination processes used to remove contaminants from tools, equipment, and task site personnel can spread contamination and increase the risk of exposure if decontamination activities are not performed according to procedures. Decontamination procedures (ERSOP 11.5, "Field Decontamination of Sampling Equipment") must be followed, and appropriate PPE must be used during decontamination activities. However, the use of isopropanol as prescribed in ERSOP 11.5 has been eliminated.

7.7 Inclement Weather

In the event that adverse weather conditions develop that pose a threat to persons or property on the task site, such as sustained strong winds (25 mph or greater), electrical storms, heavy precipitation, or extreme heat or cold, the situation will be evaluated by the FTL with input from the HSO, IH, SE, RCT, and other personnel, as appropriate. A decision to stop all work at the task site will be made by the FTL with input from the HSO, IH, and RCT based on the hazards involved and the situation. In some cases, work at the site may proceed, provided that workers are afforded adequate, appropriate protection. At no time will individual health and safety be jeopardized to continue work.

7.8 Other Task Site Hazards

Task site personnel should look for potential hazards and immediately inform the FTL or HSO of the hazards so that action can be taken to correct the condition.

7.9 Radiological Hazards and ALARA Review

Radioactive contaminants known to be present include low levels of americium, cesium, cobalt, strontium, and tritium. The actual concentrations (in pCi/L) were developed based on laboratory analysis. Radiological instrumentation used in the field will have limited detection capabilities. In order to detect personnel or equipment contamination, wipe samples will be required in addition to the portable field survey techniques. The RCTs will follow the tasks outlined in the *Radiological Controls Manual* (onsite specific radiological control) (EG&G Idaho 1993d). Table 4 shows the radiological contaminants as summarized in the remedial investigation report for the TRA PWS (Lewis and Sinton et al., 1992). The shallow PWS concentrations were significantly higher; however, they are not considered to be part of this monitoring plan.

ALARA is a process to keep radiological doses as far below limits as reasonably achievable while operating under the conservative assumption that any dose has some risk. An aggressive approach must be used to keep radiation doses to the minimum amount practicable consistent with job and

Table 4. Radiological contaminants in the TRA PWS (in pCi/L).

Radioisotope	Radionuclide concentrations in pCi/L		
	Deep PWS mean concentration	SRPA mean concentration	Background
Cobalt-60	14.3	10.0	10.0
Cesium-137	25.0	25.0	25.0
Americium-241	25.0	25.0	25.0
Strontium-90	31.9	1.9E-03	8.17E-03
Tritium	1.15E+05	1.3E+05	1.6E-02

program needs and associated costs. All radiological exposures must be maintained as far below the DOE limits as social, technical, economic, practical, and policy considerations permit. An ALARA review and evaluation in accordance with Chapter 2 and Appendix 2A of the *Radiological Control Manual* (EG&G 1993d) will be conducted when any of the following are true:

- The total estimated dose to accomplish the job is 0.5 person-rem or greater
- The individual dose is expected to be 0.1 rem/day or greater
- The work is to be accomplished in a high (>100 mrem/hr) radiation field
- Zone III contamination levels are involved (this may be at the beginning or anticipated as the work progresses)
- A radioactive system reading greater than 5 mrem/hr at near contact or with potential to exceed Zone II contamination levels is to be breached
- Work evolutions may cause uncontrolled airborne contamination levels to exceed the derived air concentrations.

Questions concerning whether a project requires an ALARA review and evaluation should be directed to a radiological engineer. The ALARA review and evaluation must engineer and ensure compliance with employees' or subcontractors' ALARA goals. Names of subcontractor employees that work on ER&WM projects at the INEL where a radiological exposure hazard exists must be forwarded to the RE to ensure compliance with ALARA goals and the *Radiological Control Manual* (EG&G Idaho 1993d).

7.10 Hazard Monitoring

Personnel may be exposed to hazardous materials or hazardous physical agents, as noted previously. The time duration of the groundwater sampling and elevation tasks is expected to be short term (i.e., less than a day per well location).

All industrial hygiene equipment will be maintained by the IH in accordance with the manufacturer's recommendations. Instruments will be calibrated before and after use, or according to the schedule outlined in the *Company Procedures Manual*, Section 11.4, "Calibration of Industrial Hygiene Instruments" (EG&G Idaho 1993a). Contaminants to be monitored and the types of equipment used to monitor are shown in Tables 5 and 6.

Air sampling will be conducted using NIOSH methods and according to *Company Procedures Manual*, Section 11.5, "Industrial Hygiene Air Contaminant Sampling Procedure" (EG&G Idaho 1993a). Samples will be personal samples whenever possible; the number and frequency of sampling will be dependent upon the IH's assessment of the potential exposures and risk assessment for task site personnel, according to *Company Procedures Manual*, Section 11.9, "Industrial Hygiene/Workplace Surveys," (EG&G Idaho 1993a). Results from direct-reading instruments and field observations will be recorded on Form EG&G-737, "Industrial Hygiene Monitoring Form." The

Table 5. Contaminants to be monitored.

Task or assignment	Contaminant or agent to be monitored
Groundwater sampling	Radionuclides
Groundwater elevations	Radionuclides

FTL will record the four-digit number printed at the upper right-hand corner of the IH monitoring

Table 6. Equipment to be used for monitoring if required by the HSO.

Equipment	Agent to be monitored
Portable radiation survey equipment	Alpha, beta, and gamma radiation
Heat stress monitor (wet bulb globe temperature)	Heat stress conditions

data form that corresponds to that day's industrial hygiene monitoring. This will allow easier access to the monitoring data once entered into the IH System 80 database.

7.10.1 Physical Hazards Control and Monitoring

The FTL will conduct daily inspections of the task site to ensure that barriers and signs are being maintained, unsafe conditions are corrected, and debris is not accumulating on the site. Health and safety professionals present at the task site may, at any time, recommend changes in work habits to the FTL.

Individuals working at the task site are responsible for using safe work techniques, reporting unsafe working conditions, and exercising good personal hygiene and housekeeping habits throughout the course of their job.

7.10.2 Radiological Monitoring

Radioactive contamination surveys, smears, and other sampling will be performed at the discretion of the RCT at the task site.

The RCT will be responsible for radiological monitoring in accordance with the *Radiological Control Manual*, Chapters 2 and 4 (EG&G Idaho 1993d); and Section 10 of the *Company Procedures Manual* (EG&G Idaho 1993a). All health physics equipment will be source-checked daily and calibrated every six months. The equipment will be maintained by the RCT according to the manufacturer's instructions. Survey equipment will be used to verify boundaries and work zones, survey personnel and equipment before leaving the task site, and verify that waste items are sent to the appropriate disposal facility.

The following equipment (or equivalent) may be used to monitor radiological contamination on site:

- Scaler/ratemeter with Geiger-Mueller and alpha scintillation detectors to obtain a direct reading of contaminants on personnel and equipment
- Portable single channel analyzer with planchet counter detector (ZnS) to analyze smears from equipment.

7.11 External Radiation Exposure Control

As discussed in Section 6, wells may be located in areas that are controlled because of the potential for external exposure. External exposure control is accomplished by identifying areas containing sources of radiation and controlling personnel access into these areas. Radiation control areas have been identified at TRA. Chapter 2 of the *Radiological Control Manual* (EG&G Idaho 1993d) discusses external radiation exposure control requirements.

External exposure control is required in the following areas:

- **Controlled area**—Any area where radioactive materials or elevated radiation fields may be present. The area will be clearly and conspicuously posted as a controlled area.
- **Radiation area**—Any area within a controlled area where an individual can receive a dose equivalent greater than 5 mrem but less than 100 mrem in 1 hour at 30 cm from the radiation source.
- **High radiation area**—Any area within a controlled area where an individual can receive a dose equivalent of 100 mrem or greater, but less than 5 rem in 1 hour at 30 cm from the radiation source.
- **Very high radiation area**—Any area within a controlled area where an individual can receive a dose of 5 rem or greater in 1 hour at 30 cm from the radiation source. Access to these areas will be maintained, locked, or physically guarded.

Sampling locations inside radiation control areas will require work zone development described in Section 6 and the PPE described in 7.11.1. Task specific radiation control areas and contamination zones will be determined by the RE and RCT and appropriate measures will be initiated at that time.

7.11.1 Personal Protective Equipment

PPE that will be used at the task site was selected based on the toxicity and anticipated levels of known or suspected hazardous materials and agents (including radiological hazards) at the task site, recommendations contained in NIOSH (1985), and in the hazard analysis in Section 7 of this HSP. Based on the hazard analysis and the recommendations cited above, a modified Level D has been selected using the anti-contamination (anti-C) clothing specified in Zone I as appropriate for

protection of personnel working at the task site. Required PPE is described in the sections that follow. Variations in PPE are allowed at the discretion of the HSO, RCT, or IH.

7.11.1.1 Level D. Level D PPE affords little protection against chemical hazards but is appropriate for use at the task site. Personnel at the task site are not expected to be exposed to hazardous chemicals above an allowable limit and no danger exists from absorption of chemicals through the skin. Level D PPE at the task site consists of

- Standard work uniform
- Eye protection [see Section 16 of the *Safety Manual* (EG&G Idaho 1993b)]
- Safety footwear as described in Supplement 16.4 of the *Safety Manual* (EG&G Idaho 1993b).

7.11.1.2 Level D Modified. Anti-C clothing will be worn in the event the sampling team enters a contamination control zone. Health physics personnel (RCT and RE) will define the anti-C requirements for working in areas on the basis of contamination levels determined by surveys and the guidelines below. When entering an area where contamination is suspected (before determining the extent and level of contamination), Zone II level anti-C clothing will be worn as a minimum unless higher contamination levels are suspected. For entry into Zones II and III, all openings between the coveralls and shoe covers, gloves, and hood will be taped. Anti-C clothing will be donned only at or near the contamination control point of the area to be entered. Guidelines for personnel protection in radioactively contaminated areas are contained in Chapter 4, Section 3.5 of the *Radiological Control Manual* (EG&G Idaho 1993d). The minimum anti-C personal protection for each contamination zone is presented below.

7.11.1.3 Zone I—Low-Level Contamination. The minimum requirements for Zone I anti-C personal protection include

- One pair of cloth anti-C coveralls (or disposable)

Note: This requirement may be deleted by the RCT for walk through entries or health physics surveys.

- One yellow cloth hood (or disposable)
- Two pair of vinyl or latex shoe covers
- One pair of latex gloves.

All personnel required to wear respirators must prove that they have been trained and acceptably fit-tested for the assigned respirator, in accordance with the training and documentation requirements in Section 3 of this HSP. Requirements for respirator use, emergency use, storage, cleaning, and maintenance, as stated in the *Company Procedures Manual*, Section 11.1 (EG&G Idaho 1993a), will be followed. Table 7 lists the PPE and modifications necessary for personal protection at the task site.

Table 7. Level of PPE and modifications for specific tasks.

Task or assignment	Level of PPE	Modifications
Groundwater sampling	Level D/Modified D ^a	Anti-contamination clothing ^a
Groundwater elevation	Level D/Modified D ^a	Anti-contamination clothing ^a

a. Required if entering a radiation control area.

7.12 Decontamination Procedures

Most of the well locations are outside potential radiation control areas; thus, the need for personal decontamination will be minimal. If a well location is within a radiation control area (work zones as identified in Section 6), the decontamination procedures in Table 8 should be followed.

Table 8. Decontamination procedures.

Step number	Location	Task
1	Contamination reduction zone	Remove equipment
2		Wash and rinse boot covers and gloves (if worn)
3		Remove tape
4		Remove boot covers and outer gloves
5		Wash, rinse, and remove boots and suit (if worn)
6		Remove and drop respirator.
7	Support zone	Wash, rinse, and remove inner gloves
8	Control line	Remove coveralls
9		Field wash/shower
10		Put on personal clothing

7.12.1 Radiological Decontamination

Radiological decontamination of personnel will be done under the direct supervision of a health physics professional (RE or RCT) and in accordance with Chapter 4, Section 3.6 of the *Radiological Control Manual* (EG&G Idaho 1993d) and the *Company Procedures Manual*, Section 10.4 (EG&G Idaho 1993a). Personnel and personal property decontamination procedures will include taping, vacuuming (vacuum must be equipped with a high efficiency particulate air filter), washing with soap and water, or other approved techniques based on the effectiveness as determined by the RCT. All decontamination operations for equipment and areas will be performed in accordance with Chapter 4, Section 3.3 of the *Radiological Control Manual* (EG&G Idaho 1993d), and approved task specific procedures.

7.12.2 Decontamination in Medical Emergencies

If a person is injured or becomes ill, the situation will be evaluated by first aid personnel on the task site. Emergency care will be initiated and the emergency preparedness procedure for the facility at which the task is being performed will be activated. Medical care for serious injury or illness will *not* be delayed for decontamination. In such cases, gross contamination may be removed. Additional decontamination may be performed at the medical facility. The IH or RCT may accompany the employee to the medical facility to provide information and decontamination assistance to medical personnel.

7.13 Emergency Procedures, Equipment, and Information

All personnel should be familiar with the following site-specific information. This information will be part of the pre-job briefing.

7.13.1 Emergency Actions

The following are actions to be taken during the specified situation. These situations will always require immediate response but do not necessarily require immediate evacuation of the site. The FTL will determine where personnel will go for the duration of the following events:

- **Lightning or approach of electrical storm**—Work will be halted until the storm has completely passed
- **Unexpected contamination**—Work will be halted until the contamination can be evaluated and proper precautions can be taken in terms of PPE and the adequate containment of the contamination
- **High winds**—Work will be halted until the FTL and HSO have determined that the winds have abated enough to allow safe operations.

7.13.2 Emergency Procedures

Response to emergencies at the work site will be coordinated between the FTL, IH, RCT, and HSO. In emergencies that require immediate evacuation, such as fires, explosions, or other catastrophic events, personnel at the site will be notified by the FTL or designee by radio or using the horns on vehicles at the site. Personnel inside the exclusion zone will be immediately informed by a person outside of the zone and will evacuate at once. Decontamination will be secondary to evacuating the site in a timely fashion. All personnel will meet in the support zone and await instructions from the FTL or designee. In site emergencies, the FTL is responsible for calling the Warning Communications Center. If the emergency is for the INEL or TRA, personnel will follow the emergency action procedure for TRA.

7.13.3 TRA Emergency Action Procedures

Refer to the shaded portions in Figure 4 for locations of emergency facilities and staging areas discussed in the following sections. The closest medical facility is the TRA medical dispensary (TRA-667). Personnel working outside the TRA fence must enter TRA through the main guard gate (see Figure 4) to access all emergency take-cover/medical facilities.

7.13.3.1 Steady Siren. If a steady siren from TRA sounds, personnel are to take cover in the designated take-cover areas within TRA; the Materials Test Reactor (MTR) basements are the preferred location (TRA 603/604). Personnel at the site are to immediately report to the FTL. Evacuation to the TRA guard gate will proceed in as few vehicles as practicable. After arriving at TRA, personnel will proceed to the take-cover locations as directed by the security guard at the main guard gate. When traveling to the TRA facility and once inside the facility, personnel should pay close attention to the environment around them and avoid any hazardous areas.

7.13.3.2 Alternating Siren. The alternating siren at TRA indicates that personnel must evacuate the facility. Personnel located either inside or outside the fence are to check the direction lights located on the MTR and Engineering Test Reactor building roof tops (see Figure 4). An "S" indicates the evacuation is to the primary south staging area located near the front of the TRA main guard gate where the buses load and unload; an "E" indicates the alternate east staging area located outside the east perimeter fence. If an "S" is shown on the rooftops, personnel will report to the FTL and evacuation will proceed to the staging area in as few vehicles as practicable. Once at the staging area, personnel will line up at the sign marked "VISITORS AND OTHERS" while waiting for the evacuation buses. If an "E" is shown on the rooftops, personnel are to report to the east staging area and line up at the sign marked "VISITORS AND OTHERS" while waiting for the evacuation buses. If personnel at the staging area have questions, they should seek out an area warden (wearing a green hat), or the staging area coordinator (wearing an orange hat).

Changes to these evacuation procedures, if required because of relocation of the evacuation buses in the east staging area, will be communicated to all task workers before beginning work.

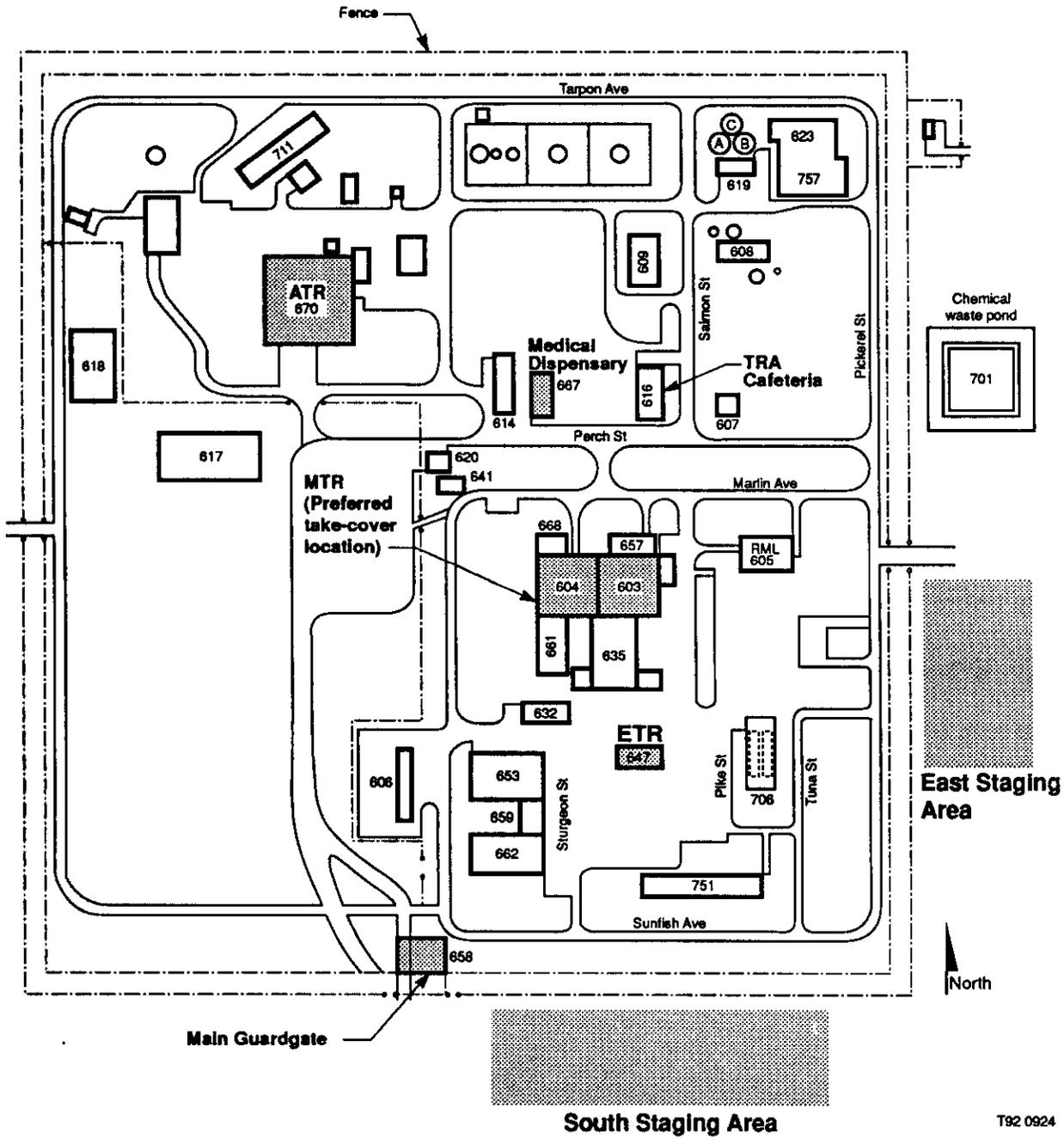


Figure 4. Locations of emergency facilities and staging areas.

7.13.4 Emergency Equipment

Personnel will be briefed on the location of emergency equipment onsite.

The following equipment will be on hand at all times:

- 8-lb ABC fire extinguisher (1)
- First aid kit (1)
- 15-min eye wash
- FNET two-way radio (1)
- Radiological spill kit
- Sufficient supply of clean water and hand soap
- Decontamination wash solution.

The FTL is responsible for ensuring that this equipment is on hand and for verifying its readiness for use before beginning work.

7.13.5 Evacuation Route

The main evacuation route from the site will be by dirt roads to the TRA guard gate depending on conditions present. If the emergency is Site-wide, evacuation from the site will be to the area designated by the TRA emergency evacuation procedures.

8. REFERENCES

EG&G Idaho, 1993a, *Company Procedures Manual*, April.

EG&G Idaho, 1993b, *Safety Manual*, April.

EG&G Idaho, 1993c, *Industrial Hygiene Manual*, April.

EG&G Idaho, 1993d, *Radiological Control Manual*, April.

EG&G Idaho, 1993e, *Post Record of Decision Monitoring Plan for the Test Reactor Area Perched Water System*, EGG-ER-10547, April.

EG&G Idaho, 1993f, *Environmental Restoration Department Program Directives*, April.

EG&G Idaho, Inc., 1991, *Quality Program Plan for the Environmental Restoration Program*, QPP-149, Revision 3, November.

Lewis, S. M., and P. O. Sinton et al., 1992, *Remedial Investigation Report for the Test Reactor Perched Water System (OU 2-12)*, EGG-WM-10002, June.

NIOSH, 1985, *NIOSH/OSHA/USCG/EPA Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*.

9. EMERGENCY PHONE LIST FOR TRA POST MONITORING

This emergency phone list is to be posted at the sampling vehicle.

- Warning Communications Center 526-1515
- Area Emergency Action Director TRA (W. W. Gray III) 526-4438
- First Aid (CFA Dispensary CF-603) 526-2356
- Occupational Medical Program [Willow Creek Building Dispensary] 526-1596
- Fire 777
- Security 777
- Explosives expert (R. C. Green) 526-2702
- Hazardous Materials (HAZMAT) Team (CFA Fire Station) 777
- Environmental Engineer (R. D. Johnson) 526-4201
- Radiological Engineer (S. T. Laflin) 526-4840
- Safety/Industrial Hygiene (D. K. Nims) 526-5935
- Radiological Control Technician (S. L. Key) 526-2749
- Project Manager (P. J. Permann) 525-5889
- Program Manager (A. R. Baumer) 525-3935
- Field Team Leader (Environmental Technology Group Unit personnel to be determined)

10. HEALTH AND SAFETY PLAN TRAINING ACKNOWLEDGEMENT

The signatures below certify that

- The employee has received a copy of the Health and Safety Plan for the Post-Record of Decision Monitoring Plan and the plan has been reviewed with the employee
- The employee understands the hazards that are or may be involved in work at the TRA monitoring site
- The employee agrees to comply with all requirements as outlined in this HSP
- Training is verified complete and current according to HSP requirements by checking the documentation.

Employee's name

Printed

Signed

Date

Company of employment

Task site health and safety officer's name

Printed

Signed

Date

Field team leader's name

Printed

Signed

Date

Appendix B

**ERP-SOW-59
Statement of Work for
Inorganic Analyses Performed for the
Environmental Restoration Program at the
Idaho National Engineering Laboratory**

**STATEMENT OF WORK FOR
INORGANIC ANALYSES PERFORMED FOR THE
ENVIRONMENTAL RESTORATION PROGRAM AT THE
IDAHO NATIONAL ENGINEERING LABORATORY**

September 1991
INFORMATION ONLY

Idaho National Engineering Laboratory
Environmental Restoration Program
EG&G Idaho, Inc.
Idaho Falls, Idaho 83415

STATEMENT OF WORK FOR
INORGANIC ANALYSES PERFORMED FOR THE
ENVIRONMENTAL RESTORATION PROGRAM AT THE
IDAHO NATIONAL ENGINEERING LABORATORY

Sample Management Office
Environmental Restoration Program
EG&G Idaho, Inc.

INFORMATION ONLY

Statement of Work No. ERP-SOW-59

Prepared by:

R. J. Sheehan
R. J. Sheehan, Scientist, ERP SMO

August 29, 1991
Date

Reviewed by:

J. P. Shea by S. L. Jenkins
J. P. Shea, Chairman
Environmental Restoration Program
Independent Review Committee

10/11/91
Date

Approved by:

J. E. Ferguson
J. E. Ferguson, Manager
Data Management Unit

10/10/91
Date

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INFORMATION ONLY

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ACRONYMS AND DEFINITIONS

AA	atomic absorption
ARDC	Administrative Record and Document Control
CCB	continuing calibration blank
CCV	continuing calibration verification
CLP	Contract Laboratory Program
COC	chain of custody
CRA	AA standard at the CRDL
CRDL	contract required detection limit
CRI	ICP standard at two times the CRDL
CRM	standard for miscellaneous analysis at the CRDL
DOE	Department Of Energy
ERP	Environmental Restoration Program
ICB	initial calibration blank
ICP	inductively coupled plasma atomic emission spectrometer
ICP/MS	inductively coupled plasma/mass spectrometry
ICS	interference check sample
ICSA	ICS consisting of only the interferents
ICSAB	ICS consisting of analytes mixed with the interferents
ICV	initial calibration verification
IDL	instrument detection limit
INEL	Idaho National Engineering Laboratory
ISOW	inorganic statement of work (ERP-SOW-59)
LCS	laboratory control sample
LQAP	laboratory quality assurance plan
LRA	linear range analysis
L&V	limitations and validation report
MDL	method detection limit
PB	preparation blank
PE	performance evaluation
SA	subcontracts administrator

SDG	sample delivery group
SMO	Sample Management Office
SOP	standard operating procedure
SOW	statement of work
SOW-390	SOW-3/90 Contract Laboratory Program statement of work
TAL	target analyte list
USEPA	United States Environmental Protection Agency

STATEMENT OF WORK FOR INORGANIC ANALYSES PERFORMED FOR THE ENVIRONMENTAL RESTORATION PROGRAM AT THE IDAHO NATIONAL ENGINEERING LABORATORY

1. INTRODUCTION

EG&G Idaho, Inc., is the management and operations contractor for the Department of Energy (DOE) at the Idaho National Engineering Laboratory (INEL) research and development facility located near Idaho Falls, Idaho. The EG&G Idaho Environmental Restoration Program (ERP), which is a group in the Waste Management Operations Department of EG&G Idaho, is responsible for restoration of various waste disposal sites within INEL boundaries. The ERP Sample Management Office (SMO), under the auspices of the EG&G Idaho ERP, has been delegated the responsibility of formulating an inorganic statement of work (ISOW) subcontract.

This ISOW subcontract specifies the requirements common to all ERP analytical services for inorganic parameters. Individual task orders shall be submitted to the subcontractor to support ERP projects. The task orders will be accompanied by a task-specific statement of work (SOW) for the project. These task-specific SOWs will specify the number of samples, analyses, any specific quality control additional to the methods [e.g., spike frequency, lower contract required detection limit (CRDL)], and expected performance period for the task.

This ISOW was written to clarify the EG&G Idaho ERP requirements for subcontractors that analyze INEL samples for inorganic constituents. Since written communication of detailed requirements is such a formidable task, it was decided that the *United States Environmental Protection Agency (USEPA) Contract Laboratory Program (CLP) SOW for Inorganic Analysis Multi-Media, Multi-Concentration* document¹ (hereinafter referred to as SOW-390) would be the document used as the primary contractual agreement between EG&G Idaho and a subcontracted inorganic chemical analysis laboratory (hereinafter referred to as the Subcontractor). SOW-390 was chosen as the basis for the ISOW for several reasons. Various editions to the inorganic CLP SOW have been evolving over the course of the last ten years. At the time of this publication, SOW-390 is the latest edition to the inorganic CLP

SOW. SOW-390 is a thorough and technically sound work order document. One of the most appealing aspects of using a CLP SOW is that most laboratories are familiar with using this type of protocol for performing inorganic environmental analyses. In addition to soliciting SOW-390 protocol methods, the ISOW may be used as a vehicle to request other types of inorganic procedures, such as wet chemistry, ion chromatography, toxicity characteristic leaching procedure, and inductively coupled plasma/mass spectrometry (ICP/MS).

Because SOW-390 is written specifically for a target analyte list (TAL) of 23 metals and cyanide, certain aspects of SOW-390 protocol will have to be modified to accommodate inorganic parameters that are not contained in the TAL. Any pertinent SOW-390 protocol modifications that are not found in this ISOW will be specified in the task-specific SOWs. In order to correlate the language of the SOW-390 to the EG&G Idaho ERP ISOW, the term "EG&G Idaho ERP" will replace "USEPA" or "Government", "ERP SMO" will replace the "USEPA CLP SMO," and "Subcontractor" will replace "Contractor" whenever the SOW-390 document is being referenced by this ISOW. It is acknowledged that interpretation problems will arise whenever a document of this size is modified to fit a more general array of analyses. In order to minimize deviations from the ISOW's main objectives, SOW-390 will be followed by the Subcontractor exactly as written, unless one of the following three requirements is met: (1) requirements are presented in the task-specific SOW or EG&G Idaho ERP ISOW, which are to be used in favor of SOW-390 protocol, (2) an addendum to the ISOW is distributed by the ERP SMO that changes SOW-390 requirements, or (3) the Subcontractor is given written permission by the ERP SMO to deviate from SOW-390 protocol. The technical contact that needs to be notified by the Subcontractor of a request to implement requirement (3) above will be:

Mr. Robert J. Sheehan
EG&G Idaho, Inc.
ERP Sample Management Office
Idaho Falls, Idaho 83415-1410
(208) 525-5940.

All technical questions and/or concerns with any aspect of this subcontract or the task-specific SOWs issued under this subcontract shall also be directed to Mr. Sheehan.

2. MODIFICATIONS TO SOW-390

Although SOW-390 was written for a specified TAL, the majority of the requirements can be expanded to cover any inorganic constituent for which analysis is requested. This section of the ISOW is designed to make modifications to the individual exhibits that are presented in SOW-390. All Subcontractor personnel that will be doing analyses involving INEL ERP samples are required to have read SOW-390 and the ISOW. Proof of compliance to this required reading must be documented by the Subcontractor. The Subcontractor's laboratory quality assurance plan (LQAP) must contain a section that outlines employee training procedures. The training program initiated by the Subcontractor for this subcontract should provide evidence that the required reading was performed. If any of the Subcontractor personnel do not understand SOW-390 or ISOW subcontract requirements or find parts of these documents either contradictory or unintelligible, their concerns must be resolved with the ERP SMO before the Subcontractor's technical proposal is submitted to EG&G Idaho. Failure on the Subcontractor's part to voice any questions or concerns to the ERP SMO about this subcontract will be considered a declaration of understanding and acceptance of the subcontract in its entirety.

2.1 Summary of Requirements (SOW-390, Exhibit A)

Subcontractors under this ISOW may not sublet any task orders or any portion of a task order to other laboratories. This includes any laboratories affiliated with the Subcontractor in any way, including those possessing the same corporate name, unless both laboratories have complied fully with the requirements specified in this ISOW for ERP SMO laboratory approval, and both have submitted technical proposals during the request for proposal phase of this subcontract.

The Subcontractor will be asked to perform analyses using methods that are USEPA-approved, either directly or by reciprocity (e.g., American Society for Testing and Materials, Standard Methods, etc.). For purposes of this subcontract, the SOW-390 TAL will not necessarily be the only target list requested. Analytes not contained in the SOW-390 TAL and non-SOW-390 methods may also be requested under this subcontract.

Prior to accepting any EG&G Idaho ERP samples, the Subcontractor shall have, in house, the appropriate standards required to run all of the inorganic constituents that have been requested by the EG&G Idaho ERP project manager.

The Subcontractor must provide written documentation, before the subcontract is awarded, on the number of samples per analysis that their laboratory can easily handle for this subcontract in a one-month time frame. These numbers should be based, not only on the analysis of the samples, but also on the completion of the final report in SOW-390 format. Care should be exercised in the formulation of these numbers because they will be expected to be met if the Subcontractor is awarded the subcontract. The onsite evaluation performed by EG&G Idaho prior to the subcontract award will assess the Subcontractor's ability to meet this sample load based on numbers of instruments observed, qualified personnel, etc.

The Subcontractor must submit a complete list of all inorganic analyses, including wet chemistry, that they are experienced in doing and wish to be EG&G Idaho ERP-approved to perform. The method(s) and standard operating procedures (SOPs) used for each analysis, along with the names of the personnel experienced with these methods, must also be submitted by the Subcontractor. Complete resumés, laboratory training SOPs, and employee training records for all Subcontractor personnel associated with EG&G Idaho ERP work, must be submitted to the ERP SMO. After reviewing all resumés, training SOPs, and employee training records, the ERP SMO will delegate which analyses each individual will be authorized to perform under this subcontract. No Subcontractor personnel will be allowed to work on any phase of this subcontract without prior written approval from the ERP SMO.

All instrumentation descriptions, including type, manufacturer, model, age, purchase date, and method of servicing, must be submitted by the Subcontractor for each and every instrument used for INEL ERP work. It must also be noted which personnel are experienced in the operation of each instrument. The amount of experience each operator has on an instrument must be documented and supplied with the instrument information.

Samples must be assigned to sample delivery groups (SDGs) by matrix (i.e., all soils in one SDG, all waters in another). An SDG is a group of 20 or fewer samples that were collected from a common site within a short enough time frame so that all requested analyses can be performed by the

Subcontractor before any of the analytical holding times have expired. Each data package submitted by the Subcontractor is required to contain one and only one SDG.

The samples to be analyzed by the Subcontractor are from known or suspected hazardous waste sites at the INEL and have the potential of containing hazardous organic and/or inorganic materials at high concentration levels. Additionally, the samples may contain radionuclides at environmental levels. EG&G Idaho will request information on the maximum radionuclide activity the Subcontractor will accept, and will not ship any samples that have an activity above the Subcontractor's acceptable limit. Prior to shipment, the samples will be screened for total counts per minute at sample container contact and/or fully characterized at the INEL Radiation Measurements Laboratory. The sample tag will be marked with the results of the pre-shipment screenings. The Subcontractor should be aware of the potential hazards associated with these samples. It is the Subcontractor's responsibility to take all necessary precautions to ensure the health and safety of their employees.

Subcontractors must validate all of their data prior to submitting the data packages to the EG&G Idaho ERP. The Subcontractor's data will be validated again by either the ERP SMO or a validation representative to the ERP SMO (see Section 3). The Subcontractor will be given copies of all data validation reports and will be expected to rectify any procedural or reporting deficiencies detected by the data validator. If the ERP SMO has determined that deviations from the requirements in the subcontract agreement have resulted in a nonconformance, reanalysis of the samples, at the Subcontractor's expense, will be required upon request of the SMO.

The Subcontractor is required to retain unused sample volume and used sample containers until given written notice by the ERP SMO or 180 days after the sample collection date, whichever comes first. Unused sample volume and used sample containers will then be disposed of in accordance with the Subcontractor's LQAP. (NOTE: The LQAP must be submitted to and approved by the EG&G Idaho ERP before any subcontract is awarded.)

Contrary to SOW-390, INEL field sample numbers will likely be longer than six digits in length. If the Subcontractor's electronic data system cannot handle the complete field sample number, the hardcopy submitted by the Subcontractor must have the complete field number delineated on the forms,

even if this means completing the number with a legible hand entry. The Subcontractor will be required to provide a diskette deliverable with all SOW-390 data packages (see Section 2.8).

The Subcontractor is required to immediately notify the ERP SMO if any of the holding times for INEL samples are in danger of being exceeded before the analysis is complete.

EG&G Idaho reserves the right to formulate and enforce addendums to this ISOW. Subcontractors will receive any addendums that the ERP SMO publishes. The Subcontractor will not be held liable to follow addendums that are received while a successfully bid upon project is in progress, but will be held liable for those same addendums on future projects that have not been bid upon before the receipt of the addendums.

2.2 Deliverables and Reporting Requirements (SOW-390, Exhibit B)

2.2.1 Deliverables

NOTE: Distribution of deliverables will be to whichever of the following groups are specified:

- EG&G Idaho ERP SMO
- EG&G Idaho Subcontracts Administrator (SA)
- EG&G Idaho Administrative Record and Document Control (ARDC).

- A. Three copies of the technical proposal and the LQAP will be delivered to the SA as specified in the request for proposal.
- B. One copy of the Subcontractor's updated SOPs (see SOW-390, Exhibit B, pages B-5 and B-6) will be delivered within 45 calendar days after the subcontract is awarded. This copy will be submitted to the ERP SMO.
- C. One copy of the chain-of-custody (COC) forms will be submitted to ARDC within three calendar days after the Subcontractor receives the last sample in an SDG. [NOTE: The laboratory sample custodian shall return the yellow copy of the COC form and the shipping

document (Form EG&G-361) immediately upon receipt of the samples at the laboratory. The laboratory shall return the original EG&G Idaho COC form, along with the laboratory's internal COC documentation, when submitting the last data package produced for samples represented on the EG&G Idaho COC form.]

- D. **Two copies of the sample data package** (see SOW-390, Exhibit B, pages B-7 through B-11) will be delivered within 28 calendar days after the Subcontractor receives the last sample in an SDG. Both copies will be submitted to ARDC for distribution.

- E. **Three copies of data in computer readable format** (see SOW-390, Exhibit B, pages B-11 through B-13) will be delivered within 28 calendar days after the Subcontractor receives the last sample in an SDG. The data shall be submitted on an IBM or IBM-compatible, 3.5-in., double-sided, double-density, 720 K-byte or a high-density, 1.44 M-byte diskette (see Section 2.8). All three copies will be submitted to ARDC for permanent file and distribution.

- F. **One copy of the complete SDG file** (see SOW-390, Exhibit B, pages B-13 and B-14) will be delivered within 28 calendar days after the Subcontractor receives the last sample in an SDG. This copy will be submitted to ARDC for permanent file.

- G. **Two copies of semiannual and annual verification of instrument parameters** will be delivered as follows:

The Subcontractor shall perform and report semiannual (due prior to the beginning of sample analysis and updated every April and October thereafter) verification of instrument detection limits (IDLs), specified in Exhibit E of SOW-390, for each atomic absorption (AA), ICP, and other pertinent instrument (e.g., ICP/MS if approved by the EG&G Idaho ERP) used under this subcontract. For ICP instrumentation, the Subcontractor shall also perform and report annual (due prior to the beginning of sample analysis and updated every April thereafter) interelement correction factors (including method of determination, wavelengths used, and integration times). Forms containing only the results for semiannual and annual verification of instrument parameters must be submitted in each SDG data package. Submission of semiannual and annual verification of instrument parameters must include the raw data used to determine those values reported.

One copy will be submitted to the SMO and one copy will be submitted to ARDC.

Distribution Addresses:

Mr. Cliff Watkins
Environmental Restoration Program
Sample Management Office
EG&G Idaho, Inc.
P.O. Box 1625
Idaho Falls, ID 83415-1410

Ms. Renee Simmons
Subcontracts Administrator
EG&G Idaho, Inc.
P.O. Box 1625
Idaho Falls, ID 83415-2082

Ms. Donna R. Kirchner
Administrative Records and Document Control
EG&G Idaho, Inc.
P.O. Box 1625
Idaho Falls, ID 83415-3904.

2.2.2 Reporting

All raw data pages, including instrument printouts, must contain the date that they were produced and the initials of the analyst responsible for their production. Instrumentation descriptions, including type, manufacturer, and model, must be included with the raw data associated with each analytical instrument used to generate results for this subcontract.

All pages in the data packages, including copies, must be completely legible and understandable. The cost to EG&G Idaho for data validation is substantial. Since data validation costs rise when validators spend time trying to decipher carelessly prepared data packages, unclear and illegible data pages will not be tolerated. The Subcontractor will be required to resubmit any reporting forms and/or raw data pages deemed illegible by the ERP SMO.

There is a great emphasis on documentation at the INEL. Raw data are the most important aspect in producing high quality documentation. The submitted raw data must be complete and understandable.

All reporting forms must be able to be regenerated by a source entirely independent of the Subcontractor, using only the submitted raw data as an information outlet.

The raw data must contain complete and understandable information on the sources and preparation procedures used in making initial calibration verification (ICV), continuing calibration verification (CCV), initial calibration blank (ICB), continuing calibration blank (CCB), preparation blank (PB), CRDL, interference check sample solution A (ICSA), interference check sample solution AB (ICSAB), laboratory control sample (LCS), calibration standards, and spiking solutions.

Complete and understandable information on how interelement and/or isobaric correction factors are calculated and used must be presented in the raw data.

Any raw data present on instrument printouts that are not used for generating the final data package must be clearly marked on the printout. This needs to be done in order to expedite the data validation process.

Results for requested analytes that are on the SOW-390 TAL will be entered on the forms contained in SOW-390. For any requested analyte that is not contained on the SOW-390 TAL, the data must be entered on modified versions of all pertinent CLP-type reporting forms. These modified forms will be similar to SOW-390 forms, with the versatility to be used for most inorganic parameters. Copies of these modified forms are included in Appendix A of this ISOW. Special forms will be provided by EG&G Idaho with the task-specific SOW if CLP forms or the forms provided in Appendix A are not appropriate.

A case narrative is required for every data package submitted by the Subcontractor. The case narrative should be formatted as follows:

- This document shall be clearly labeled "Case Narrative" and shall contain:
 - Laboratory name
 - Sample numbers in the SDG, differentiating between initial analyses and reanalyses

- SDG number
- Detailed documentation of any quality control, sample, shipment, and/or analytical problems encountered in processing the samples reported in the data package.
- Whenever data from reanalyses are submitted, the Subcontractor shall state in the case narrative for each reanalysis, whether it considers the reanalysis to be billable, and if so, why.
- The Subcontractor must also include any problems encountered; both technical and administrative, the corrective actions taken, and resolution.
- The case narrative shall contain the following statement, verbatim:

I certify that this data package is in compliance with the terms and conditions of the EG&G Idaho Inorganic Statement Of Work and any task specific Statements of Work for this project, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the laboratory manager or his designee, as verified by the following signature.

This statement shall be directly followed by signature of the laboratory manager or his/her designee with a typed line below it containing the signer's name and title, and the date of the signature.

- Additionally, the case narrative itself must be signed in original signature by the laboratory manager or his designee and dated.

The State of Idaho, DOE, and USEPA Region X, have allocated relatively short time frames for EG&G Idaho ERP projects to be completed. Since laboratory analyses and data submittal are included in these allocated time frames, the EG&G Idaho ERP requires the Subcontractor to meet all stipulated turnaround times and sample holding times as outlined in this ISOW and/or task-specific SOWs. Due to the large number of samples that will be taken at the INEL, the EG&G Idaho ERP will be employing a number of subcontractors to do inorganic analyses. Subcontractors must only commit themselves to a sample load that they can easily complete in the required turnaround times.

2.3 Inorganic Target Analyte List (SOW-390, Exhibit C)

For this subcontract, inorganic analyte additions or deletions to the CLP TAL may be requested in the task-specific SOW. The CRDLs for analytes to be analyzed that are not on the CLP TAL will be provided for the Subcontractor by the ERP SMO by way of the task-specific SOW.

2.4 Analytical Methods (SOW-390, Exhibit D)

All INEL samples must be kept at 4°C ($\pm 2^\circ\text{C}$) upon receipt until they have undergone method-specific sample preparation. (NOTE: Some samples will require cold storage until the time of the analysis, depending on the parameters being tested.) The inside cooler temperature must be noted on the COC forms at the time the sample shipment arrives at the laboratory. All sample bottles must be capped tightly except at the time of sample preparation or sample analysis.

Any analytical methods that are used for this subcontract must be USEPA and/or ERP SMO approved. The USEPA is currently formulating a SOW that allows samples to be analyzed by ICP/MS methodology.² Once this SOW is published and put into circulation, the ISOW will most likely be revised to include analyses by ICP/MS methods. If the Subcontractor wishes to use ICP/MS methodology before the ISOW allows for such methodology, the Subcontractor must submit an ICP/MS SOP to the ERP SMO for acceptance. ERP approval for the use of ICP/MS methodology by a Subcontractor will be granted on a case by case basis. All calibration, tuning, and interference correction procedures for ICP/MS methodology must be outlined in detail in the Subcontractor's SOP. The ICP/MS SOP must also address the subject of the Subcontractor's electronic deliverables capability (e.g., can the Subcontractor's submitted electronically stored data be printed out to exactly match the concentrations calculated and printed on the original hard copy of the raw data?).

If an ICP/MS instrument is used for this subcontract, the ICP/MS operator is required to have the same qualifications for ICP/MS operation as the inductively coupled plasma atomic emission spectrometer (ICP) operator is required to have for ICP operation under SOW-390 (see SOW-390, Exhibit A, page A-10).

In order to clarify quality control requirements when using the ICP/MS technique, the following controls must be implemented when ICP/MS instrumentation is used.

- All blanks (ICB,CCB, and PB) must be within \pm the CRDL.
- The CRDL standards for furnace AA (CRA) will be used and must be within $\pm 10\%$ of the actual values for As, Pb, Sb, Se, and Tl. (NOTE: If the CRA value is over the ICP/MS calibration range, the CRA may be diluted for the analysis, but must be dilution corrected for reporting purposes.) All other metals will use ICP (CRI) CRDL standards and will require no corrective action limits. (NOTE: In the future, action limits will be required for the CRI solution if stipulated in USEPA CLP SOW revisions.)
- The composition of the ICSA and ICSAB solutions must be addressed in the Subcontractor's ICP/MS SOP. Isobaric elemental, molecular, and doubly charged interference corrections, which use established isotopic response ratios or parent-to-oxide ratios (providing an oxide internal standard is used) will be used to program the ICP/MS data system to help eliminate false positive test results.
- The ICP serial dilution analysis must not cause the reported values to be flagged as estimated (see SOW-390 for qualifying flag discussion) for As, Pb, Sb, Se, and Tl.
- The pre-digestion spikes for As, Pb, Sb, Se, and Tl must be made at the concentrations listed in SOW-390 for furnace AA analysis. The spike recovery must be within the limits of 75 to 125% unless the sample concentration exceeds the spike concentration by a factor of four or more.
- If any of these first five requirements are not met for As, Pb, Sb, Se, or Tl, the nonconforming analyte must be reanalyzed using SOW-390 furnace procedures.
- All analytes that are normally run by ICP must follow all of the rules and requirements that SOW-390 mandates for ICP analyses.

2.5 Quality Assurance/Quality Control Requirements (SOW-390, Exhibit E)

The Subcontractor's laboratory shall have and shall maintain an effective quality assurance program to govern all areas affecting quality during the receipt, analysis, and reporting of samples.

The quality assurance program must be structured to control all areas affecting quality. These areas include, but are not limited to, the following:

- Sample and material identification, storage, and handling
- Chain-of-custody procedures
- Qualification, certification, and training of personnel
- Document control and revision
- Control of nonconformances
- Corrective action
- Independent data verification

2.5.1 Standard Operating Procedures (SOPs)

The Subcontractor is required to submit written SOPs to the ERP SMO, for each method of analysis it will be performing that is not clearly outlined in either SOW-390 or ISOW documents, prior to using these methods under this subcontract. The ERP SMO will either accept or reject the Subcontractor's SOP for each particular method of analysis. If deviations from the Subcontractor's SOPs are required by the ERP SMO, these deviations will be detailed in a task-specific SOW.

The DOE *Environmental Compliance and Planning Manual*³ invokes QAMS 005/80 on laboratories performing work for DOE. Most laboratory operations can be standardized and written as SOPs. The subcontracting laboratory must have written SOPs for all areas of operation that can be standardized and that add to the production of quality data. All employees associated with a particular area of operation must adhere to the SOPs for that same area. These areas include, but are not limited to, the following:

- Sample receipt and storage
- Data package preparation
- Standards preparation
- Sample preparation
- Sample chain of custody
- Analytical procedures
- Technical review of data
- Quality assurance/quality control self-inspection
- Instrument maintenance and calibration
- Preparation of glassware
- Use of logbooks
- Laboratory corrective action
- Data validation
- Records storage and retention
- Preparation of reagents
- Handling and disposal of hazardous materials.

2.5.2 Instrument Calibration

Instruments must be calibrated according to procedures described in SOW-390. For inorganic analytes that are not on the SOW-390 TAL, instrument calibration procedures must be approved by the ERP SMO before any ERP samples are analyzed. Whenever the ERP SMO approves calibration procedures for inorganic analytes that are not on the SOW-390 TAL, the procedures must be documented by the Subcontractor.

2.5.3 ICV and CCV

Every inorganic analysis performed under this subcontract is required to run ICVs and CCVs at the intervals described in SOW-390, unless the ERP SMO specifically tells the Subcontractor otherwise. For inorganic analytes that are not on the SOW-390 TAL, the control limits for both ICVs and CCVs will be $\pm 10\%$ of the true value, unless the ERP SMO specifically tells the Subcontractor otherwise.

2.5.4 CRDL Standards for Furnace AA (CRA), ICP (CRI), and Miscellaneous (CRM)

A standard at the CRDL (see Section 2.3) must be analyzed for all requested inorganic analytes not listed on the SOW-390 TAL, unless specific instructions are given to the contrary by the ERP SMO. Analytes that are requested from the SOW-390 TAL will follow the protocol outlined in SOW-390.

2.5.5 ICB, CCB, and PB

Every inorganic analysis performed under this subcontract is required to run ICBs, CCBs, and PBs at the intervals described in SOW-390, unless the ERP SMO specifically tells the Subcontractor otherwise. For inorganic analytes that are not on the SOW-390 TAL, the control limits for ICBs, CCBs, and PBs will be \pm the CRDL (see Section 2.3), unless the ERP SMO specifically tells the Subcontractor otherwise.

2.5.6 ICP Interference Check Sample

Every analyte that is run by ICP must be contained in the ICSAB. For each analyte that does not have an ICSAB concentration listed in SOW-390, add between 100 and 1000 times the IDL concentration for that particular analyte to the ICSAB. [NOTE: Until the USEPA promulgates a SOW for ICP/MS analyses and this SOW is incorporated into a revised ISOW, the interference check samples for ICP/MS (if applicable) will only be addressed in the Subcontractor's ICP/MS SOP.]

2.5.7 Spike Sample

At least one pre-digestion spike must be run under this subcontract, for each batch of samples, for each analysis performed, unless specific instructions to the contrary are given by the ERP SMO. If specific spiking levels are not listed in SOW-390 for a particular analyte, spike the solution with five times the CRDL (see Section 2.3) of that analyte. Unless specifically stated in SOW-390 to the contrary, any parameter that warrants a qualifying flag of "N" must have a post-digestion spike analyzed. (NOTE: A batch must not exceed 20 samples and each sample in the batch must be of similar matrix.)

2.5.8 Duplicate Sample

Every batch of samples under this subcontract must have at least one duplicate prepared and analyzed according to the specifications outlined in SOW-390. Certain inorganic analyses, at the discretion of the ERP SMO, could be required to have a duplicate for every sample prepared and analyzed. When this is necessary, it shall be stated in the task-specific SOW.

2.5.9 LCS Sample

Each inorganic analysis under this subcontract must have an LCS associated with every batch. Unless instructions to the contrary are given by the ERP SMO, the protocol outlined in SOW-390 will govern the preparation and analysis of each LCS.

2.5.10 ICP Serial Dilution Sample

The ICP serial dilution sample, as defined in SOW-390, will be required when samples are analyzed by either ICP or ICP/MS methods. At the discretion of the ERP SMO, a serial dilution sample may also be required for other methods of analysis. When this is required, it shall be stated in the task-specific SOW.

2.5.11 IDL Determination

Any metal analyte requested that is not on the SOW-390 TAL, must undergo the same IDL determination procedure as described in SOW-390. When wet chemical procedures are requested by a USEPA-approved method, the literature-listed method detection limit (MDL) for that analyte can be substituted for the IDL. The IDL determination procedure will be required every 6 months instead of every 3 months as stated in SOW-390.

2.5.12 Interelement Corrections for ICP

Interelement correction factors must be calculated for the ICP as outlined in SOW-390. The raw data are required to contain complete information on how interelement correction factors are calculated and used. (NOTE: The raw data are required to contain complete information on how isobaric elemental and molecular-ion correction factors are calculated and used if ICP/MS methodology is incorporated.)

2.5.13 Linear Range Analysis (LRA)

The linear range analysis (LRA) will follow the protocol outlined in SOW-390, with an additional requirement that the LRA must be run and be within $\pm 5\%$ of the actual value for every ICP and ICP/MS instrumental run. The LRA must be the first analytical sample (see SOW-390, Exhibit G, for analytical sample definition) to be analyzed after each instrumental calibration.

2.5.14 Furnace AA

All metals that could not meet SOW-390 CRDLs or other SOW-390 requirements, by either ICP or ICP/MS, must be analyzed by furnace methods as outlined in SOW-390. (NOTE: Mercury will be run by cold vapor AA.)

2.5.15 Analytical and Facility Performance Check

The Subcontractor can expect an onsite audit of their laboratory by ERP SMO personnel before any subcontract is awarded. Before EG&G Idaho schedules any onsite audit trip with the Subcontractor,

a compendium of the laboratory's SOW-390 required SOPs must be sent to the ERP SMO for review and acceptance. Once the subcontract is awarded, EG&G Idaho reserves the right to audit the Subcontractor's facility at any time deemed necessary during the performance period.

As of September 1991, the ERP SMO does not have a performance evaluation (PE) program implemented. Until a PE program is set up, the Subcontractor can expect to receive only double blind performance evaluation samples. Once an ERP PE program is in place, the Subcontractor will be required to satisfactorily analyze single blind PE samples on a semiannual basis. The Subcontractor will be responsible for obtaining a pre-agreed upon number of PE sample parameter results, within specified concentration control limits, in order to retain ERP laboratory approval. The laboratory will semiannually receive a maximum of two single blind PE samples, per matrix, for each parameter the laboratory will be ERP-certified to perform. The Subcontractor should be aware, before submitting any sample price bids, that the single blind PE sample analyses will be performed at the Subcontractor's expense.

2.6 Chain of Custody, Document Control, and SOPs (SOW-390, Exhibit F)

As mentioned previously, documentation is very important to the EG&G Idaho ERP and DOE. All documents required by this subcontract must be kept in a neat and legible manner. It should be noted that all data produced by the Subcontractor may be useless if proper document control procedures are not followed.

All SOPs outlined in SOW-390 are required to be written by the Subcontractor and approved by the ERP SMO before any subcontract can be awarded. All Subcontractor personnel who will deal with INEL samples in any way, will be required to have read, understood, and been trained in the use of SOPs. Both evidence of SOPs training for personnel and evidence of SOPs implementation by personnel must be documented. The Subcontractor can expect to be audited to these procedures precisely as they are written.

2.7 Glossary of Terms (SOW-390, Exhibit G)

For this subcontract, the term **analyte** will be defined as the element, ion, compound, or aggregate property of a sample an analysis seeks to determine.

A USEPA-type traffic report will not be used for this project. The INEL equivalent to the USEPA traffic report will be the EG&G Idaho ERP COC forms.

For this subcontract, low or medium concentration levels will not be defined. Since this ISOW considers the concentration level to be relative in nature, the "Level (low/med):" section on the inorganic data sheets does not need to be filled in. (NOTE: If the Subcontractor's CLP software requires an entry in this section, either "low" or "med" may be used.)

2.8 Data Dictionary and Format for Data Deliverables in Computer Readable Format (SOW-390, Exhibit H)

This subcontract requires data from analyses performed using SOW-390 protocol to be submitted in both hard copy and electronic form. The electronic data must be generated using USEPA Format A. The USEPA is currently working to define the Agency standard for diskette deliverable data format. It is likely that at some time during the performance period of this subcontract, this standard format will be finalized. EG&G Idaho will require the subcontractor to convert from Format A to the new standard upon request. Until the time of request for such conversion, Format A will be the only allowable format for diskette deliverables. The data shall be submitted on an IBM or IBM-compatible, 3.5-in., double-sided, double-density, 720 K-byte or a high-density, 1.44 M-byte diskette. The data dictionary for the Format A diskette deliverable is found in Exhibit H of SOW-390.

Any Subcontractor that cannot deliver data in the specified electronic form will not be considered for this EG&G Idaho subcontract.

3. INORGANIC LABORATORY DATA VALIDATION

The inorganic laboratory data submitted by the Subcontractor will be subject to 100% validation by either the ERP SMO or a representative of the ERP SMO. Any reported data points that have not met the subcontract agreement are susceptible to penalty. The penalty will be in the form of either nonpayment for, or reanalysis of, the data points in question. Flagrant or continual infractions of the terms of this subcontract by the Subcontractor will result in the termination of the Subcontractor's services.

A description of the EG&G Idaho data validation procedure is presented to the ISOW Subcontractor in order to help minimize analytical and reporting nonconformances. (Guidelines for inorganic data validation and a full description of the procedure are provided in References 4 and 5, respectively.) The following section on the data validation process describes how the ERP SMO or a representative of the ERP SMO will validate the Subcontractor's data packages.

3.1 Inorganic Validation Process

The data validator must receive legible copies of all correspondence, instructions, and complete data packages that were exchanged between EG&G Idaho and the subcontracting laboratory. Access to this information is essential in order to evaluate the laboratory based on their ability to comply with subcontract requirements. Each SDG must be validated separately. There will be three parts to the data validation process: (1) data confirmation, (2) data clarification, and (3) data assessment. The validation process parts are outlined as follows:

PART 1: DATA CONFIRMATION

The first part of the validation process is to confirm whether or not all of the data that are entered on the report forms can be derived directly from the raw data pages. Comments describing the laboratory's analytical performance and compliance to the subcontract requirements will be documented throughout this part of the validation process.

The raw data will be checked for the following:

- **Completeness and legibility**
- **Comparability to the COC forms**
- **Understandable preparation sheets for standards and quality assurance/quality control solutions**
- **Detailed explanation for any calculations or data manipulations**
- **Compliance to the task-specific SOW and the ISOW including, but not limited to, the following:**
 - **Holding times**
 - **Calibrations**
 - **Blanks**
 - **Interference check samples**
 - **Laboratory control samples**
 - **Duplicate analyses**
 - **Matrix spikes**
 - **Serial dilutions**
 - **Method of standard additions**
- **Detailed explanation for the determination and use of interelement correction factors**
- **Accuracy of statements made in the case narrative**
- **Detailed explanation for any manufacturer programmed qualifiers entered on raw data instrument printouts**

- A copy of the certificate of authenticity from the manufacturer of laboratory control samples
- Detailed explanation of any nonconforming data and subsequent corrective actions taken
- General good laboratory practice.

PART 2: DATA CLARIFICATION

After a comprehensive comparison of the raw data to the reported data has been completed, the data clarification process begins. This part of the process involves putting qualifying flags next to reported values that for one reason or another have questionable accuracy. The usability of data is compromised whenever validation qualifying flags have been added. Descriptions of the validation qualifying flags that will be used are as follows:

- **U** - The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.
- **J** - The analyte was analyzed for and was positively identified, but the associated numerical value may not be consistent with the amount actually present in the environmental sample.
- **R** - The data are unusable.
- **UJ** - The material was analyzed for, but was not detected. The associated value is an estimate and may be inaccurate or imprecise.

PART 3: DATA ASSESSMENT

The data assessment part of the validation process is the formulation of a comprehensive inorganic data limitations and validation (L&V) report. This report will include a description of any results that were given qualifying flags by the data validator. The total number of data points that were analyzed by the laboratory will be listed, along with the total number of data points that required validation qualifying flags. The percentage of compromised data will be reported.

The L&V report will be a detailed summation of the entire validation process. Comments concerning the laboratory's performance will be included and will be based on their compliance to deliver the subcontractually agreed upon product. All comments will be stated as clearly and accurately as possible, since both the project manager and the laboratory will be given copies of the L&V report. Any problems that were caused by EG&G Idaho ERP (such as a poorly written statement of work), rather than by laboratory deficiencies, will also be noted.

It is the intention of the ERP SMO to foster a relationship with the Subcontractor that will facilitate the production of data that conform to the ISOW subcontractual requirements. The L&V report is a means of documenting a Subcontractor's performance. The Subcontractor will avoid repeated requests to conform to the requirements if the recommendations delineated by the data validator in the L&V report are implemented.

4. REFERENCES

1. *USEPA Contract Laboratory Program Statement of Work for Inorganic Analysis, Multi-Media Multi-Concentration*, Document Number ILM01.0, March, 1990 (CLP SOW-390).
2. *Inductively Coupled Plasma - Mass Spectrometry*, Method 6020, Revision 1, Draft, U.S. Environmental Protection Agency, April 1990.
3. *Environmental Compliance and Planning Manual*, DOE/ID-10166, Rev. 3, Department of Energy, April 1991.
4. *Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses*, prepared for the Hazardous Site Evaluation Division, U.S. Environmental Protection Agency, compiled by Ruth Bleyler, Sample Management Office, Viar & Company, prepared by the USEPA Data Review Work Group, July 1, 1988.
5. "Standard Operating Procedure For Inorganic Data Validation," SMO-SOP-12.1.5, Environmental Restoration Program, EG&G Idaho, Inc., 1991.

APPENDIX A

MODIFIED REPORTING FORMS

Appendix C

ERP-SOW-33

**Statement of Work for
Radiological Analyses Performed for the
Environmental Restoration Program at the
Idaho National Engineering Laboratory**

and

**Quality Assurance/Quality Control Program of the
Radiation Measurements Laboratory for
Gamma Spectroscopy and
Direct Gross Alpha/Beta Counting**

ERP-SOW-33

EG&G IDAHO, INC
STATEMENT OF WORK FOR RADIOLOGICAL ANALYSES
ENVIRONMENTAL RESTORATION PROGRAM
IDAHO NATIONAL ENGINEERING LABORATORY

EG&G IDAHO, INC.
STATEMENT OF WORK FOR RADIOLOGICAL ANALYSES
ENVIRONMENTAL RESTORATION PROGRAM
IDAHO NATIONAL ENGINEERING LABORATORY

INFORMATION ONLY

Prepared by:

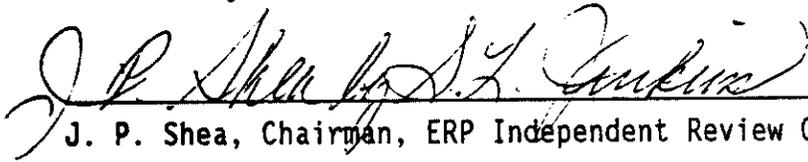


D. A. Anderson, Scientist, ERP SMO

10/10/91

Date

Reviewed by:

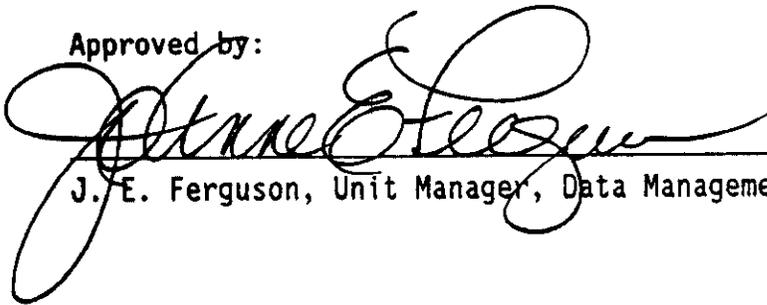


J. P. Shea, Chairman, ERP Independent Review Committee

10/10/91

Date

Approved by:



J. E. Ferguson, Unit Manager, Data Management Unit

10/10/91

Date

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ACRONYMS

ANSI	American National Standards Institute
APHA	American Public Health Association
ASME	American Society of Mechanical Engineers
COC	chain-of-custody
DL	detection limit
EG&G	EG&G Idaho, Inc., Idaho Falls, ID
EML	Environmental Monitoring Laboratory
ERP	Environmental Restoration Program
HPGe	high purity germanium
INEL	Idaho National Engineering Laboratory
LCS	laboratory control sample
LQAP	laboratory quality assurance plan
MEV	million electron volts
NIST	National Institute of Standards and Technology
NRC	Nuclear Regulatory Commission
PE	performance evaluation
QA	quality assurance
QC	quality control
SMO	Sample Management Office
SOP	standard operating procedure
SOW	statement of work
USEPA	United States Environmental Protection Agency

1. INTRODUCTION AND PURPOSE

The purpose of this document is to specify the requirements for control of the accuracy, precision, and completeness of radiological analysis sample data from the point of sample collection through analysis, data reduction, and reporting. The radiological analytical laboratory is referred to in this document as the subcontractor.

1.1 Scope

The requirements of this document apply to EG&G Idaho Environmental Restoration Program (ERP) subcontractors conducting radiological analyses on environmental samples.

Laboratories performing work in support of ERP projects are required to pass a review and must be granted approval prior to beginning analysis of samples. The review and approval process will be conducted by the ERP Sample Management Office (SMO) of EG&G Idaho. The ERP SMO will initiate and maintain an ongoing laboratory approval program to track the status of laboratories performing work under this SOW.

Individual sampling projects will be assigned to subcontractors by individual task orders issued under this SOW. Work for task orders issued under this SOW may not be sublet to any other laboratories. This includes any laboratories affiliated with the subcontractor in any way, including those possessing the same corporate name, unless all laboratories have undergone a review and been approved by the ERP SMO.

Section 4 of this document provides the requirements necessary for laboratories to follow in order to pass review and maintain active status. Should more than one laboratory be involved in the analysis of samples, each

laboratory performing analyses must undergo a quality and technical review and must comply with the quality assurance/quality control (QA/QC) requirements. In general, the objectives and requirements of this SOW conform with the basic requirements of "Quality Assurance Program Requirements for Nuclear Facilities", ASME NQA-1, 1989 ed. and "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans", EPA QAMS 005/80.

The data deliverables outlined in Section 5 of this document are required to ensure that the data from the subcontractor can be validated independently. Failure to provide the necessary data deliverables may result in rejection of the data, reanalysis of samples at the subcontractor's expense, and/or could ultimately result in loss of laboratory approval.

EG&G Idaho reserves the right to publish and enforce modifications to this SOW. Subcontractors will be informed of and will receive copies of any modifications. The subcontractor will not be held liable to follow modifications that are published while a project is in progress, but will be held liable for those addendums on future projects.

1.2 Responsibilities

The subcontractor shall have well-defined organizational responsibilities sufficient to maintain a successful operation and meet the needs of this SOW. As a minimum, the subcontractor shall designate and define the responsibilities of the following personnel to be involved in the performance of the EG&G Idaho contract. Personnel functions shall include, but are not limited to, the following:

1.2.1 Project Manager

The project manager is responsible for the overall performance of work on the EG&G Idaho contract and shall be the primary contact for EG&G project management personnel. The project manager shall be knowledgeable of all requirements concerning analysis of EG&G Idaho samples.

1.2.2 Laboratory Quality Assurance Coordinator

The laboratory QA coordinator is responsible for overseeing all aspects of the laboratory quality assurance plan (LQAP) and reporting laboratory performance relative to the requirements of the LQAP to management.

1.2.3 Sample Custodian

The sample custodian is responsible for receipt and control of EG&G Idaho samples (receipt, log-in, storage, and disposal).

1.2.4 Technical Staff

The subcontractor shall maintain a staff of qualified and trained personnel with the capabilities to perform all required analyses of EG&G Idaho samples.

The ERP SMO shall be the EG&G Idaho representative for all technical interfaces with the subcontractor. Questions or inquiries are to be directed to SMO personnel responsible for radiological analyses of ERP samples: Mr. David Anderson (208-525-5941, FTS 859-5941).

2. ANALYTICAL LABORATORY REQUIREMENTS

This section describes the requirements for analytical methods, standard operating procedures, and general and specific analytical requirements.

The samples to be analyzed by the subcontractor are from known or suspected waste sites at the Idaho National Engineering Laboratory (INEL). All samples are screened for activity levels prior to being shipped offsite. The sample label and/or tag will be marked with the results of such preshipment screenings. EG&G Idaho shall inform the subcontractor of any samples showing elevated activity levels. Laboratories performing radiochemistry analyses must be certified or licensed by the Nuclear Regulatory Commission (NRC) or a recognized federal, state, or local agency. EG&G Idaho will request information on the maximum radionuclide activity the subcontractor will accept, and will not ship any samples that have an activity level above the subcontractor's acceptable level. The subcontractor must be aware of the potential hazards associated with these samples. It is the subcontractor's responsibility to take all necessary measures to ensure the health and safety of its employees.

2.1 Analytical Methods

For radiochemical analysis of ERP samples, analytical methods shall be based on accepted radiological techniques. Guidelines for laboratory procedures and methods are presented in the latest revisions of the following documents:

- "Radiochemical Analytical Procedures for Analysis of Environmental Samples", No. EMSL-LV-0539-17, U.S. Environmental Protection Agency, Las Vegas, Nevada.
- "Prescribed Procedures for Measurement of Radioactivity in Drinking Water", No. EPA-600/4-80-032, U.S. Environmental Protection Agency, Cincinnati, Ohio.

- "Eastern Environmental Radiation Facility Radiochemistry Procedures Manual", No. 520/5-84-006, U.S. Environmental Protection Agency.
- "Standard Methods for the Examination of Water and Wastewater", 16th Edition, American Public Health Association, New York, New York.
- "Procedures for Radiochemical Analysis of Nuclear Reactor Aqueous Solutions", No. R4-73-014, U.S. Environmental Protection Agency.
- "EML Procedures Manual", No. HASL-300.
- "Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment", NRC Regulatory Guide 4.15.
- "Calibration and Usage of Germanium Detectors for Measurement of Gamma-ray Emission of Radionuclides", ANSI N42.14, American National Standards Institute.

The methodology used for a particular analysis must be specified by the subcontractor. Standard methods may be modified or alternative methods substituted only with the approval of the ERP SMO.

2.2 Facilities

The subcontractor shall have adequate facilities to accomplish the required work outlined by this SOW. As a minimum, the subcontractor shall have the following facilities available:

2.2.1 Sample Receipt Area

An adequate, contamination-free work space, provided with chemical-resistant bench tops for receiving and handling EG&G Idaho samples must be available. An exhaust hood will be used when deemed necessary for the health and safety of the laboratory personnel and to prevent contamination.

2.2.2 Sample Storage Area

The subcontractor shall have sufficient space to store sample residuals and final analytical preparations for 60 days after reporting results to EG&G Idaho.

2.2.3 Sample Preparation and Analysis Areas

Adequate, contamination-free work spaces, provided with chemical-resistant bench tops, operational exhaust hoods, a source of distilled or demineralized water, analytical balances located away from drafts or rapid temperature changes, and adequate safety equipment in the event of a chemical spill or radioactive contamination of personnel or equipment shall be provided.

2.2.4 Sample Counting Area

The subcontractor must have a dedicated, contamination-free, temperature controlled area for operation of radioactive counting instrumentation. The minimum required counting equipment is specified in Section 2.5, Specific Technical Requirements.

2.3 Standard Operating Procedures

The subcontractor shall have written standard operating procedures (SOPs) detailing each stage of the work performed in the laboratory. An SOP is defined as a written, step-wise description of laboratory operations, including examples of laboratory documents used. The SOPs shall accurately describe the laboratory activity and controlled copies of the written SOPs shall be available to the appropriate laboratory personnel. All activities in the laboratory pertaining to the analysis of ERP samples shall be performed from written, approved SOPs. Published methodology papers shall not be used as the direct instructional guideline for laboratory analyses.

The subcontractor shall provide complete, updated copies of its SOPs to the EG&G Idaho, ERP SMO within 45 days after the subcontract is awarded.

As a minimum, the subcontractor shall have mechanisms in place and written SOPs for the following activities:

- Sample receipt, handling, and storage
- Chain-of-custody (COC) procedures
- Analytical methods, including reference
- Data reduction, data review, and reporting
- Qualification and training of personnel
- Document and records control
- Preparation and traceability of laboratory standards
- Reporting nonconformance
- Corrective actions
- Equipment calibration and maintenance, including use of logbooks
- Internal audits and surveillances.

A more comprehensive description of the requirements for the QA/QC related procedures listed above can be found in Section 3 of this document.

2.4 General Technical Requirements

2.4.1 Sample Custodian

The subcontractor shall designate a sample custodian responsible for receiving all samples. In the event the sample custodian is not available to receive samples, a representative shall be assigned by the subcontractor to assume the sample receiving duties.

2.4.2 Sample Receipt

The condition of the shipping containers and sample containers shall be inspected and documented by the sample custodian or designated representative. The sample custodian or representative shall sign and date the EG&G Idaho COC forms accompanying the samples at the time of sample receipt. Upon receipt of the samples, the yellow copy of the COC form and the shipping document (Form EGG-361) shall be returned to EG&G Idaho at the address listed in Section 5, and the original shall be returned with the completed data package.

2.4.3 Sample Receipt Logbook

The sample custodian or representative shall maintain a bound logbook for documenting sample receipt.

2.4.4 Water Sample pH Check

The pH of water samples shall be checked and documented within five working days of sample receipt. If the sample pH is not < 2 , the laboratory shall add the necessary preservative (usually HNO_3 or HCl to a pH of < 2) and document this action. The sample must not be analyzed for a minimum of 16 hours following acidification. The sample pH must be verified by the analyst at the time of the analysis.

2.4.5 Discrepancies

The ERP SMO shall be notified of any discrepancies noted in sample condition or in paperwork received with the samples.

2.4.6 Lost Samples

The subcontractor shall immediately notify the ERP SMO representative (Mr. David Anderson, 208-525-5941, FTS 859-5941) orally of any lost or inadvertently destroyed samples, or of any loss of capability to analyze samples that may adversely affect analytical results or the ability to deliver analytical results data within the turnaround times specified. Written confirmation shall be provided within five business days of this oral report.

2.4.7 Sample Disposal

Sample residuals and analytical sample fractions may be returned to EG&G Idaho for disposal if the presence of radioactive materials in the samples is not within the permitted disposal capabilities of the subcontractor. The subcontractor shall state its sample return/disposal policy in its technical proposal. Sample residuals and fractions will be held by the subcontractor for a minimum of 60 days after reporting of sample results.

2.4.8 Sample Matrix

ERP samples shall consist of the following matrices:

- Groundwater
- Surface water
- Surface soil
- Soil borings

- Sludge
- Sediment
- Vegetation
- Liquid wastes of mixed or unknown matrix.

2.4.9 Sample Filtering

Aqueous samples may be filtered or nonfiltered. Filtering requirements will be defined in the project-specific task order. Any questions about sample filtering should be directed to the ERP SMO personnel identified in Section 2.4.6.

2.4.10 Sample Preparation

The subcontractor shall have the capability, if requested by EG&G Idaho, to dry, mill, sieve, and homogenize soil, sediment, and sludge samples prior to analysis. Requests for special preparation of samples will be outlined in the project-specific task order.

2.4.11 Variation of Procedures

Any deviations from written SOPs necessary for the analysis of ERP samples must be documented by the subcontractor and noted in the case narrative of the sample data report.

2.4.12 Counting Instruments

Counting instrumentation used for ERP sample analyses shall be state-of-the-art and must have the capability to detect the radionuclides of interest at the necessary activity levels.

2.4.13 Calibration and Maintenance Logs

An instrument calibration and maintenance log shall be maintained for each counting instrument.

2.4.14 Instrument Setup

Instrumentation shall be setup and calibrated according to the instrument manufacturer's instructions. Any changes or modifications shall be documented.

2.4.15 Counting Instrument Backgrounds and Source Checks

The subcontractor shall take instrument backgrounds and count source checks according to an established schedule. This schedule shall be documented by the subcontractor. This schedule shall conform to the minimum requirements put forth in Sections 3.7.5 and 3.7.6 of this document.

2.4.16 Sample Delivery Group

Samples shall be grouped together in sample delivery groups (SDGs) for analysis and reporting. Each SDG shall contain a maximum of 20 samples. All samples in a SDG shall be from the same sampling project. The samples in the SDG may be collected over a period of time and be batched together by the laboratory. Consideration must be given to the required turnaround times when batching samples for a SDG. SDGs shall be given the number of the lowest sample number in the SDG (considering both alpha and numeric designations).

2.4.17 Quality Control Samples

For each SDG, a set of QC samples shall be analyzed. The results from the QC samples shall be included in the report to the contractor. The specific QC samples to be run for each analysis type are outlined in Section 2.5. A definition and description of the various types of QC samples to be analyzed appears in the following sections.

For SDGs of three or less samples, only the laboratory blank and laboratory control sample (LCS) need to be analyzed (no duplicate sample). Preparation and identification of QC samples shall be recorded in a QC sample logbook.

2.4.17.1 Laboratory Control Samples.

- An LCS is an aliquot of deionized or distilled (DI) water or an equivalent matrix to the samples being analyzed that contains a known quantity of the analyte of interest. The LCS goes through all analysis steps and receives equal quantities of all reagents used in the analysis of the EG&G Idaho samples. The LCS has the same final form and counting geometry as the samples in the SDG that it is counted with.
- The subcontractor shall document the source material used to prepare LCSs. The source material used for control samples shall be traceable to NIST or other certified source.
- The activity level of the LCS shall be representative of the activity level seen in the samples.

2.4.17.2 Laboratory Blanks.

- A laboratory blank is an aliquot of DI water or an equivalent matrix to the samples being analyzed that contains none of the constituent of interest that goes through the all the analytical steps and receives equal quantities of all the reagents as the samples being analyzed.
- The laboratory blank shall use the same aliquot size as would typically be used for the matrix being analyzed. The blank shall have the same final form and counting geometry as the samples in the SDG that it is counted with.

2.4.17.3 Laboratory Duplicates.

- A duplicate is a laboratory generated split of one of the samples in the SDG.
- The sample from which the duplicate is taken shall be thoroughly homogenized. The duplicate shall utilize the same aliquot size and counting time as the original sample. The duplicate shall go through an identical analysis process as the original sample.
- For gamma analyses, the duplicate sample shall consist of a sample or samples from the SDG counted again on a different detector from the original count. This second count shall be for the same duration as the original count.

2.4.18 Required Detection Limits

Experimental parameters (sample aliquot size, counting efficiency, counting time, and instrument backgrounds) shall be optimized such that the required detection limits, shown in Table 1, are met for each analysis type. Circumstances may arise where the experimental parameters cannot be controlled to allow the required detection limit to be met. These cases shall be noted in the case narrative and/or in a minimum detectable activity report included as part of the data package. In addition, cases may arise where a more rapid or less expensive analysis may be requested. The detection limits for these analyses will be determined in the project-specific task order. The detection limits shown in Table 1 represent the most stringent conditions that will have to be met by the analytical laboratory.

Requirements for analysis of isotopes not shown on the target list will be negotiated or specified in a project-specific task order.

The subcontractor shall indicate if they have specific forms they prefer to use for analysis requests. These forms shall be provided to EG&G Idaho after contract award, but prior to beginning sample analysis.

Table 1. Required radiochemical detection limits

<u>Analysis</u>	<u>Water (pCi/L)</u>	<u>Soil or Other Solid Matrices (pCi/g)</u>
Gross Alpha	4	10
Gross Beta	4	10
Strontium	1	0.5
Tritium	400	-
Plutonium 238, 239/40	0.2	0.05
Uranium Isotopes	0.5	0.05
Americium 241	0.2	0.05
Thorium 228, 230, 232	0.5	0.05
Gamma Isotopes ^a	10	1

- a. Based on Cesium-137, all other gamma isotopes shall have a detection limit commensurate with its photon yield and energy as related to the Cs-137 detection limit. The gamma isotopes of interest for ERP samples are listed in Table 2.

Table 2. Gamma-emitting isotope target list

Mn-54	Ag-110m	Eu-152
Co-60	Sb-125	Eu-154
Zn-65	Cs-134	Eu-155
Ru-106	Cs-137	U-235
Ag-108m	Ce-144	Am-241

2.4.19 Calculation of Detection Limits

The subcontractor shall present evidence that the required detection limits listed in Table 1 can be met or exceeded.

2.4.20 Calculation Equations

The subcontractor shall provide the equations used for the calculation of its sample results and total propagated errors for all analyses requested either in its technical proposal or as part of the laboratory SOPs.

2.4.21 Signature List

A signature list showing all laboratory personnel working on EG&G Idaho samples and their responsibilities shall be provided to the ERP SMO prior to beginning ERP sample analysis. This list shall contain typed name, initials, title, responsibilities, and handwritten signature and initials. The subcontractor shall provide updated lists as necessary.

2.4.22 Requests for Data Review, Recounts or Reruns:

EG&G Idaho reserves the right to request that the subcontractor perform a review of previously reported results. This review shall consist of verification of data entry, data calculations, quality control results, or other factors that may have affected sample results. EG&G Idaho also reserves the right to request the recounting of a final analytical preparation or the complete reanalysis of a sample if, upon review of the data, there is doubt as to the accuracy or validity of the reported sample results. The subcontractor shall document its policies concerning reviews, recounts, and reruns.

If it is determined by the subcontractor that a correction needs to be made on a previously reported result, the corrected results and an explanation of the correction shall be reported in writing to EG&G Idaho.

2.4.23 Participation in Interlaboratory Comparison Sample Programs

The subcontractor is required to participate in the EML intercomparison program and, additionally, is encouraged to participate in the EPA, or other recognized interlaboratory comparison programs for radiological analyses. The

subcontractor shall analyze all samples provided for all radionuclides specified on the ERP target list presented in this SOW. The subcontractor shall maintain records of its performance in these programs and these records shall be part of the laboratory data package (see Section 5.1.5). Results from intercomparison programs shall be included in the laboratory QA/QC reports (see Section 3.11).

2.5 Specific Technical Requirements

2.5.1 Gross Alpha/Gross Beta Analysis

Counting instrumentation used for gross alpha/gross beta analysis shall consist of a low-background gas proportional counting system connected to a scaler or other recording instrumentation. The counting system shall demonstrate sufficiently low backgrounds and sufficient counting efficiencies to meet the necessary detection limits.

Counting instrumentation shall be calibrated using Am-241 as the alpha emitting source and either Cs-137 or Sr-90 as the beta emitting source. Calibration methods and traceability of the source material to an NIST standard or other certified standard must be documented. Efficiency curves shall be prepared using tap water residue (as per USEPA SW-846, Method 9310) to simulate the total range of precipitate weights that will be utilized on the counting planchets. All calibrations shall be entered into the detector calibration logbooks.

The sample aliquot analyzed for gross alpha analyses shall be regulated so that the density of the sample residue on the counting planchet is not greater than 5 mg/cm^2 (e.g., for a 1.5-inch planchet, the residue weight shall not be greater than 60 mg, and for a 2-inch planchet, the residue weight shall not be greater than 100 mg). If gross beta activity is determined using a separate planchet from the gross alpha analysis, the above restrictions do not apply to the gross beta counting planchet.

The following QC samples shall be run with each SDG: one laboratory blank and one laboratory control sample per SDG, and one laboratory duplicate for each ten samples in the SDG (e.g., 10 samples or less = one duplicate, more than 10 samples = two duplicates.).

2.5.2 Tritium Analysis

Counting instrumentation shall consist of a liquid scintillation counter designed for the detection of low energy beta particles with a scintillation cocktail mixture.

The liquid scintillation counter shall be calibrated by an accepted method using a tritium standard that is traceable to NIST or other certified source. The calibration method used shall be documented, along with the identification and traceability of the calibration standard. All calibrations shall be entered into a detector calibration logbook.

All samples, including QC samples and duplicates, must be distilled prior to counting.

The subcontractor shall identify the source of water used for laboratory blanks. The water used for preparing QC samples shall be shown to be free of tritium activity (by comparison to EPA blank water or other means). The identification of the water used for preparation of QC samples must be recorded.

The following QC samples shall be run with each SDG: one laboratory blank and one LCS per SDG, and one laboratory duplicate for every ten samples in the SDG (e.g., 10 samples or less = one duplicate, more than 10 samples = two duplicates.).

2.5.3 Alpha Spectroscopy Analysis

The alpha spectrometer shall consist of a surface barrier silicon detector connected to a multichannel analysis system. As a minimum, the detector system shall be calibrated for detection of the alpha particle energies from 4 to 6 meV. The system shall have the demonstrated capability (backgrounds, counting efficiencies) to meet the required detection limits.

The alpha spectrometer system shall be calibrated by an accepted method with traceable standards. The calibration procedure shall take into account the entire range of alpha energies expected to be encountered during analysis of ERP samples. The method of calibration and the identification of standards used shall be documented. All calibrations shall be entered into a detector calibration logbook.

Detectors used for counting of environmental level samples shall be segregated from detectors used for counting higher level samples.

The subcontractor shall provide a written explanation of the method of spectrum analysis used (computer software type, software revision and date last revised, or if manual integration is used, etc). This written explanation shall contain the parameters used to identify and quantify peaks along with measures taken for uncharacteristic spectra. If special integration or treatment of the spectrum is required for a sample analysis, a written explanation of actions taken shall be included in the case narrative of the laboratory report for that sample data group.

If a radioactive tracer is used to correct sample results for experimental losses of the constituent of interest, the tracer materials shall be traceable to NIST or other certified source. The activity level of the added tracer shall be consistent with the activity level of the samples.

The methodology used for alpha spectroscopy analysis of soil samples shall include a total dissolution of the soil prior to separation and quantification of the individual alpha isotopes.

The QC samples to be analyzed with each SDG are: one laboratory blank and one LCS per SDG, and one laboratory duplicate for every ten samples in the SDG (e.g., 10 samples or less = one duplicate, more than 10 samples = two duplicates.).

The subcontractor shall store the sample and background (or blank) alpha spectra from analysis of ERP samples. These spectra shall be kept as laboratory records. These records shall be made available to EG&G Idaho upon request.

2.5.4 Gamma Spectroscopy Analysis

The gamma spectrometer shall consist of a high purity germanium (HPGe) detector or equivalent. Sodium iodide (NaI) detectors are not suitable for ERP samples. The supporting instrumentation shall have multichannel capabilities and the instrumentation shall be such that the full range of gamma ray energies of the gamma-emitting isotopes shown on the ERP target analyte list (Table 2) can be detected and quantified.

The gamma spectrometer system shall be calibrated by an accepted method using reference standards traceable to NIST or other certified source. The calibration procedures shall be documented and all calibrations entered into a gamma calibration logbook with the identification number of standards used for the calibrations.

The calibration procedures for the gamma detectors shall take into account all sample geometries that will be used for counting ERP samples. The subcontractor shall designate the preferred geometries it customarily uses.

The methodology used to analyze the gamma spectrum shall be documented. If a commercially available software package is used, the source of the software, the program revision number, if applicable, and the year the software was purchased shall be documented. Documentation of revisions to software packages shall be maintained as controlled records. Any additional review or analysis of gamma data conducted prior to data reporting shall be documented.

For QC purposes, one duplicate sample shall be analyzed for each 10 samples in the SDG (e.g., 10 samples or less = one duplicate, more than 10 samples = two duplicates). A duplicate sample for gamma analyses is a laboratory selected sample from the SDG that is counted a second time on a different detector system. This repeat count shall be for the same duration as the original count and is to be reported as a duplicate result.

The gamma spectrum from each sample counted and the background spectrum subtracted shall be uniquely identified and stored by the subcontractor as laboratory records. These records shall be made available to EG&G Idaho upon request.

2.5.5 Strontium Analysis

Strontium analysis may consist of a Sr-90 only analysis, or a total Sr analysis, depending on contractor needs. The type of analysis required for a specific set of samples will be outlined in the project-specific task order.

Strontium samples shall be counted on a gas proportional counter as described in the gross alpha/gross beta analysis in Section 2.5.1. Sr- 85 tracer activity, if used, shall be counted on a gamma detection system. The Sr-85 activity may be counted on a NaI detection system if desired by the subcontractor.

Calibration of the detectors shall take into account the different beta detection efficiencies for Sr-89, Sr-90 and Y-90. The gamma detection system shall be calibrated for the Sr-85 tracer sample geometry. Calibration methods shall be documented, identification of standards used for calibrations shall be listed, and all calibrations shall be entered into the detector calibration logbooks.

The following QC samples shall be run with each SDG: one laboratory blank and one LCS per SDG, and one laboratory duplicate for every ten samples in the SDG (e.g., 10 samples or less = one duplicate, more than 10 samples = two duplicates).

3. QUALITY ASSURANCE AND QUALITY CONTROL REQUIREMENTS

This section describes the minimum QA/QC requirements that must be met by the subcontractor to obtain approval to perform analyses on ERP samples. The laboratory QA/QC program must cover all aspects of laboratory operation. Specific guidance on QA/QC program requirements can be found in the basic requirements of "Quality Assurance Program Requirements for Nuclear Facilities", ASME NQA-1, 1989 ed. and "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans", EPA QAMS 005/80, U.S. Environmental Protection Agency. This program must be in place and operational at the time of the pre-award, onsite evaluation conducted by EG&G Idaho personnel.

The (LQAP) shall address, as a minimum, the following areas:

3.1 Laboratory Organization and Personnel

The subcontractor shall present an overview of the laboratory organization, showing the personnel responsible for implementation of the quality program and the lines of communication between laboratory departments.

3.2 Personnel Qualification and Training

The subcontractor shall document the minimum qualifications necessary for each position in the laboratory, training programs used to train personnel, and documentation and maintenance of qualification and training files.

3.3 Chain-of-Custody (COC) Requirements

3.3.1 COC Procedure

The subcontractor shall have a procedure for documenting custody of samples throughout the laboratory analysis process from sample receipt to data reporting.

3.3.2 COC Documentation

The COC documentation shall contain signatures and dates of laboratory personnel showing sample receipt and transfer of custody of samples and/or paperwork pertaining to the samples.

3.3.3 COC Reporting

The COC document shall be associated with an SDG and shall list all EG&G Idaho and laboratory sample numbers contained in that SDG. If more than one COC is required for a sample data group, copies of all COCs shall be included in the final laboratory report.

3.4 Sample Receipt, Handling, and Storage

3.4.1 Sample Receipt

The subcontractor shall document the steps to be taken by the sample custodian upon sample receipt, including the screening of samples for radioactivity levels and the actions to be taken for any discrepancies found.

3.4.2 Sample Handling

The subcontractor shall document the handling requirements for samples, including samples containing radioactivity at elevated levels. The subcontractor shall also document the methods used to transport samples through the laboratory and to maintain sample security during the analysis process.

3.4.3 Sample Storage

The subcontractor must have sufficient methods and facilities to securely store the samples prior to analysis, and store sample residuals and final analytical preparations for a minimum of 60 days before disposal or return of the samples to EG&G Idaho.

3.5 Nonconformance and Corrective Actions

The subcontractor QA plan shall contain the procedures and personnel responsibilities for identifying a nonconformance, initiating a nonconformance report, identifying corrective actions, verifying corrective actions, and notifying the customer concerning results data and analysis schedules affected by nonconformances.

3.5.1 Nonconformance Notification

The subcontractor shall notify the ERP SMO as soon as possible when an out-of-control event occurs that might affect the timely analysis of ERP samples or the accuracy and quality of ERP sample results.

3.5.2 Nonconformance Documentation

All out-of-control events shall be documented in a nonconformance report as described in Section 3.5.3 and shall be submitted to the ERP SMO.

3.5.3 Nonconformance Report Format

Nonconformance reports (NCRs) shall contain the following information:

- When the out-of-control event was discovered
- The equipment affected by the out-of-control event
- The signature of the person who detected the out-of-control condition
- The effect of the out-of-control condition on the analysis of samples
- A description of any sample data that may have been affected by the out-of-control event

- Corrective actions to be taken, measures to prevent a recurrence of the problem, and effectiveness of the corrective actions
- A copy of the instrument control chart or other data that demonstrates the out-of-control condition.

3.5.4 Reporting Nonconformance and Corrective Actions to the Contractor

A copy of the NCR shall be included in the laboratory report for any SDGs that were affected by the nonconformance. The subcontractor shall demonstrate how corrective actions have solved the nonconformance and the steps taken to prevent recurrence of the problem.

3.6 Document Control

The subcontractor shall have documented procedures for writing, review, approval, and distribution of controlled documents, the use of controlled copies, and documentation for distribution of revisions.

3.6.1 Controlled Documents

Controlled documents shall include, but are not limited to; laboratory SOPs, the LQAP, and program/project directives.

3.6.2 Corrections to Controlled Documents

Changes or corrections to controlled documents shall be made according to a documented procedure such as a document revision request.

3.6.3 Laboratory Records

The subcontractor shall maintain files of laboratory records. These records shall include, but are not limited to; laboratory logbooks, COC records, computer data and spectra, and any other pertinent records concerning EG&G Idaho ERP sample analysis and results.

The subcontractor shall retain a copy of all data packages, calibration records, and other QA/QC-related records pertaining to the analysis of ERP samples for a period of five years or until instructed to dispose of the records, whichever is shorter. Laboratory records shall be traceable, retrievable, legible, and protected against damage, deterioration, or loss.

3.6.4 Corrections to Laboratory Records

All corrections to laboratory records shall be made by drawing a single line through the error and entering the correct information. The person making the correction shall initial and date the record at the point of the correction.

3.6.5 Entries to Laboratory Logbooks

All logbook entries shall be initialed and dated by the person making the entry at the time the activity is performed.

3.7 Control of Measuring and Test Equipment

The subcontractor shall have documented procedures for calibration of all equipment used for measurements in the laboratory (counters, balances, pipettes, thermometers, etc.), acceptance criteria for these calibrations, documentation of calibration results in logbooks, and corrective action procedures for out-of-control conditions.

3.7.1 Primary Instrument Calibrations

Primary calibrations of counting instrumentation shall be performed at least once per calendar year. Primary calibrations shall cover all sample geometries and all target radionuclides.

3.7.2 Calibration Traceability

Counting instrument calibration shall be performed using traceable standards. Traceability shall be maintained to NIST or other recognized standard agency.

3.7.3 Calibration Standards

The subcontractor shall provide a list of calibration standards used for counting instrument calibration to the ERP SMO within 45 days of contract award. This list shall include identification numbers and documentation of traceability.

3.7.4 Calibration Acceptance Criteria

The subcontractor shall have established acceptance criteria for calibrations and these criteria shall be documented in the specific instrument calibration logbooks.

3.7.5 Daily Check Sources

As a minimum, daily efficiency check sources shall be run on each detector used for counting EG&G Idaho ERP samples, with the exception of alpha spectroscopy detectors, which, as a minimum, shall have weekly check sources counted. The results of the check sources shall be compared to established QC criteria. The results of the check sources shall be maintained in an instrument-specific logbook. All logbook entries shall document the source identification, the initials of the person performing the check, the date of the check, the results of the check, and the status of the detector. Acceptance criteria for the check sources shall be documented in the logbooks.

3.7.6 Instrument Backgrounds

As a minimum, background checks shall be run weekly on each detector for gas proportional and gamma detectors and at least once per month on alpha spectroscopy detectors. Backgrounds may be taken more often if deemed necessary by the laboratory. Backgrounds for liquid scintillation detectors shall be taken each time a group of samples is counted. The frequency of backgrounds for each instrument shall be documented by the laboratory. The results of the background checks shall be maintained in an instrument-specific logbook. All logbook entries shall document the initials of the person performing the check, the date of the check, the background count detected and the detector status. Acceptance criteria for the background check shall be documented in the logbooks.

3.7.7 Control Charts

Results of check sources and background checks shall be recorded on control charts (see Section 3.8).

3.7.8 Equipment Maintenance

The subcontractor shall document required maintenance schedules, indicators of necessary maintenance, and documentation of maintenance in logbooks for all necessary laboratory equipment.

3.8 Requirements for Control Charts

3.8.1 Responsibility for Control Charts

Control charts shall be established and maintained by the subcontractor.

3.8.2 Control Chart Requirements

As a minimum, each control chart shall consist of a centerline, an upper and lower warning limit, and an upper and lower control limit. The subcontractor shall document the equations or methodology used for calculating the warning and control limits.

A minimum of 20 data points shall be obtained prior to the establishment of the warning and control limits. The subcontractor shall collect enough data points to establish the chart limits prior to beginning analysis of ERP samples. Data collected by the subcontractor during the previous calendar year may be used for the establishment of these limits.

3.8.3 Quality Control Requirements for Control Charts

The LQAP shall address the following items concerning control charts:

- The laboratory activities which will have control charts.
- The personnel responsible for maintaining and interpreting the control charts
- The time interval for updating control charts and control chart limits
- A definition of what constitutes an out-of-control situation on the control charts and the corrective actions to be taken.

3.9 Procurement of Materials and Services

The subcontractor shall have documented procedures for control of materials purchased for use in the laboratory analysis of ERP samples (e.g., quality specifications for reagents, receipt inspection procedure, etc.). Qualifications and specifications for any subcontracted services shall be documented.

3.10 Internal Audits and Surveillances

3.10.1 Audits

- Planned and scheduled audits shall be performed by the subcontractor to verify compliance with all aspects of the LQAP and to determine its effectiveness.
- Audits shall be performed in accordance with written procedures or checklists.
- Personnel conducting audits shall not have direct responsibility for performing or supervising the activities being audited, but will have a working knowledge of the operation.
- Audit results shall be documented, reported to management, and shall be reviewed by management.
- The subcontractor shall have a method for management to assess the adequacy and effectiveness of the QA program, which shall include provisions for reporting and distributing the results of these assessments.

3.10.2 Surveillances

- Surveillances shall be planned and performed to verify compliance to the quality requirements of this SOW and the QC requirements of the project-specific statements of work (SOWs).
- Surveillances shall be performed by persons who are not performing or directly supervising the work being inspected.
- Results from surveillances shall be documented and reported to management for appropriate corrective action.

3.11 Quality Assurance/Quality Control Reports

3.11.1 Scope of QA/QC Reports

The subcontractor shall generate QA/QC reports which present an evaluation of the performance of the laboratory in regards to its established QA/QC program. The format of the report is up to the subcontractor, but must meet the minimum requirements outlined in Section 3.11.3.

3.11.2 Frequency of QA/QC Reports

Reports shall be generated on a quarterly basis and must be received by the ERP SMO of EG&G Idaho within 30 business days of the end of each calendar quarter.

3.11.3 Content of QA/QC Reports

The contents of the report shall address, but not be limited to, the following items:

- **Introduction:** The introduction shall present an overview of the laboratory performance during the previous calendar quarter. This overview focuses on laboratory performance with regards to the laboratory QA/QC plan. It should include a discussion of any significant personnel changes or training programs involving technical or quality-oriented subjects that have taken place.
- **Quality Control Data, which includes:**
 - A summary of results from QC samples analyzed and instrument calibration and background checks taken during the quarter
 - Control charts generated or updated during the quarter
 - Trends or out-of-control events noted
 - Corrective actions taken for out-of-control events or trends
 - Effectiveness of previous corrective actions taken.

- **Laboratory Intercomparison Sample Data**, which includes:
 - A summary of results from inter-comparison program samples analyzed during the quarter
 - Sample results tables
 - Biases or trends noted
 - Corrective actions taken for biased results or trends noted
 - Effectiveness of previous corrective actions taken.

3.11.4 Quality Reports to Management

The subcontractor shall have a documented plan for reports to management concerning the status of quality programs in the laboratory.

3.12 Data Review and Approval

The subcontractor shall have an established and documented method for review and approval of sample results and QC data. A secondary review of all ERP data shall be conducted before release, and the signatures of both reviewers shall be included in the data report to the contractor.

3.13 Control of Software

3.13.1 Software Documentation

The point in the development of laboratory software where documentation is required, and the minimum documentation requirements for software shall be established by the subcontractor. Each computer program affecting the quality or reliability of analytical results shall be separately documented.

3.13.2 Software Testing

Verification of computer programs affecting the quality of analytical results shall be established using data for which the correct result is known. The verification process shall be documented.

3.13.3 Software Control

Methods shall be established and documented to ensure that changes to computer software affecting the quality of analytical results are properly controlled and approved. These methods shall prevent unauthorized use or changes to software.

3.13.4 Software Error Control

Methods shall be established to evaluate, control, and correct data entry errors or program problems that could affect the quality of analytical results.

3.14 Certifications from Outside Agencies

The subcontractor shall present all certifications from outside agencies (local, state, Federal) that provide indication of the quality and capabilities of the subcontractor.

4. LABORATORY APPROVAL REQUIREMENTS

The subcontractor must be approved by the ERP SMO laboratory approval process before performing analyses for EG&G Idaho. An ongoing laboratory approval program will be maintained to track the status of laboratories performing work under this SOW. The requirements for laboratory approval are outlined in the following subsections.

The approval process shall consist of four major elements:

- Review of the LQAP (Section 4.1)
- Analysis of performance evaluation samples (Section 4.2)
- Laboratory audit and inspection (Section 4.3)
- Regular review of laboratory data (results from ERP samples, intercomparison program samples, and blind performance evaluation samples).

4.1 Laboratory Quality Assurance Plan

The organization of the LQAP is up to the subcontractor. The LQAP should contain the QA/QC elements covered in Section 3 of this SOW. The subcontractor LQAP shall be submitted to the ERP SMO for review prior to the pre-award onsite audit. Implementation of the LQAP shall be verified by EG&G Idaho quality personnel at the onsite audit.

4.2 Performance Evaluation Samples

Prior to beginning analysis of ERP samples, each laboratory must analyze a set of performance evaluation (PE) samples that are representative of the expected ERP environmental samples.

Upon approval of the LQAP, the ERP SMO will send a set of PE samples to the laboratory for analysis. The PE sample package will contain instructions as to how the PE samples are to be analyzed and reported. Data deliverable requirements will be spelled out in the instructions.

Laboratory results from the PE samples will be evaluated by the ERP SMO. The laboratory must pass proficiency testing prior to approval for ERP sample analysis. The ERP SMO will respond to the laboratory with the results of the proficiency samples so that the laboratory can assess its performance and correct any deficiencies, if necessary.

As part of the ongoing laboratory approval program, blind performance evaluation samples will be periodically sent to laboratories as part of a routine sample set. The results from these analyses will be compiled and charted by the ERP SMO.

4.3 Laboratory Audit

The laboratory audit will be conducted after review of the LQAP, laboratory response to review comments, and completion of the proficiency testing. The audit will be performed by the ERP SMO. The scope of this audit will be implementation of the LQAP, inspection of laboratory facilities, verification of instrument calibrations, verification of analytical methodologies, tracking of the PE samples through the laboratory using laboratory documentation, and interviews with laboratory personnel. All findings and/or observations from the audit must be resolved prior to laboratory approval. A followup audit may be necessary in instances where there are a large number of deficiencies requiring corrective action. Followup audits will be scheduled as soon as possible after the last corrective action response is received from the laboratory.

4.4 Notification of Approval

The laboratory shall receive a written notification of approval upon satisfactory dispensation of all audit findings, acceptance of the LQAP, and successful completion of the PE samples.

4.5 Re-Approvals

Each laboratory will be scheduled to undergo a re-approval every 18 months. To be eligible for re-approval, the laboratory must be currently performing analyses for the ERP or be needed for future work on a project currently taking place.

The re-approval process is similar to the initial laboratory approval, except that it will include a review of data reports and/or monthly progress reports from the laboratory for the past calendar year.

5. LABORATORY REPORT AND DATA DELIVERABLES

The subcontractor shall provide reports and other deliverables as specified. The described sample data package for the level of analytical support required shall be delivered, in triplicate, to the EG&G Idaho Administrative Records and Document Control (ARDC) department at the following address:

Ms. Donna R. Kirchner
EG&G Idaho, Inc.
ERP ARDC
P.O. Box 1625
Idaho Falls, ID 83415-3904

The required content and form of each deliverable in the sample data package is described in this section. The deliverables necessary to meet the analytical support level required for each sampling project will be described in the individual project-specific task orders. The subcontractor shall have the capabilities to provide the results data described in Section 5.1.4 in computer readable form. Data, in computer readable form, shall be submitted in triplicate on three IBM or IBM-compatible, 3.5-inch diskettes and shall be delivered to the above ARDC address. Data on computer diskettes shall be in ASCII text files unless otherwise specified by EG&G Idaho.

Provisions may be made for EG&G Idaho to provide the subcontractor with computer templates of the results tables shown in Attachment B and data entry software for completing the tables.

The subcontractor shall perform the requested analyses on ERP samples within 30 days after taking custody of a sample. If circumstances arise that would not allow the laboratory to meet the required turnaround time, the ERP SMO must be notified. This notification must be received, in writing, at least ten (10) days prior to the required date so that alternative arrangements can be made for the analysis of the samples. Failure to provide the requested deliverables, to meet required turnaround times, or to notify

the ERP SMO in the event of unexpected delays may result in withdrawal of laboratory approval.

Section 5.2 describes the additional supporting documentation the subcontractor shall maintain on file as laboratory records. These records shall be made available to EG&G Idaho upon request and shall be available for audit.

5.1 Laboratory Reports

The format for the sample data package shall follow the outline described below. The report shall contain the items listed in Table 3.

Table 3 Radiological deliverables for analysis of environmental restoration program samples

Sample Data Package Contents

- Cover letter/letter of transmittal
 - Chain-of-custody form(s)
 - Request for analysis form(s)
 - Laboratory data package
 - Data reporting forms information (see Attachments A and B)
 - QA/QC summary
 - Internal QA/QC documentation
 - External QA/QC documentation
-

A detailed description of each item in Table 3 is provided below.

5.1.1 Cover Letter/Letter of Transmittal

The cover letter should contain the project name and/or number, a case narrative describing any problems encountered or procedure modifications made during sample analysis, a summary of the achieved detection limit of the analysis, an explanation for detection limits not met, and the signature of the person responsible for the data release.

5.1.2 Chain-of-Custody Forms

- Field COC form - The chain-of-custody form used for tracking the samples from field sampling to delivery at the laboratory, and the return of the results data package.
- Lab COC form - The chain-of-custody or internal tracking forms used for tracking the samples through the analysis process within the laboratory.

5.1.3 Request for Analysis Forms

The analysis request form is the form that is filled out during sampling activities or by the laboratory to show the analyses to be performed on each sample.

5.1.4 Results Data Package

The sample results data shall be reported in a format compatible to the EG&G Idaho data reporting forms attached. Instructions for formatting the data deliverables from the analysis of ERP samples is provided in Attachment A. The instructions provide the necessary format and the maximum number of characters for each data entry field. The forms on which the data will be entered at EG&G Idaho are shown in Attachment B.

- Cover Page - Contains project information (title, SCW number, case number, lab report number), field sample and laboratory sample number cross-references, and the signature of the person responsible for release of the data from the laboratory.
- Radioanalytical Analysis Results - Form I - Contains the required results data from the analysis of ERP samples. These results include field & laboratory sample identification, sample matrix, analysis type, sample result, total error of sample result, reporting units, analysis date, sample date, sample size, analysis yield when yield monitors or tracers are utilized, and detector identification.
- Radioanalytical Quality Control Results - Form II - Contains the required results data from the analysis of QC samples analyzed in conjunction with the ERP samples. This form contains results from the analysis of blanks, spikes, laboratory control samples and duplicates. These results include: QC sample identification, QC sample type (blank, LCS, duplicate), analysis type, sample result, total error of sample result, known value for laboratory control samples, total error of known value, reporting units, percent recovery of laboratory control samples, analysis date, analysis yield when yield monitors or tracers are utilized, and detector identification.

All EG&G Idaho sample results, QC sample results, and the associated total propagated uncertainties shall be reported in scientific notation. Results and the associated errors shall have the same number of significant figures. All total errors shall be reported as one standard deviation. The laboratory report shall also contain the signature of the technician performing the analysis and the persons responsible for reviewing the data.

5.1.5 Quality Assurance/Quality Control Summary

- Internal QA/QC documentation - - Documentation to show that the laboratory instrumentation was in control during the time of sample analysis.
 - Laboratory control charts - - A copy of the most recent laboratory control sample and instrument background control charts for each detector used for the analysis of the samples being reported. These control charts shall be up-to-date and cover the time period immediately proceeding and/or including the time of EG&G Idaho sample analysis.
 - Calibration verification - - A written checklist or other evidence that shows the date of the most recent primary calibration, source check count and, background count for each detector used with the set of samples being reported. The documentation shall contain the signature of the person responsible for the calibration and the calibration status of the detector [An example of a calibration checklist (Form III) is shown in Attachment B].
- External QA/QC documentation - - Results from interlaboratory comparison samples (EPA, EML, etc.) that the laboratory has analyzed which reflect the ability of the laboratory to analyze the radionuclides and sample matrices being reported.

5.2 Additional Supporting Documentation

The documentation described in this section shall be maintained on file at the laboratory. All supporting documentation records shall be traceable to the laboratory sample identification number, the ERP field sample identification number, the SDG number, or the laboratory report number. Additional supporting documentation shall consist of, but is not limited to, the following:

- Sample receipt, shipping, storage, and disposal records
- Laboratory COC records
- Certifications for standards which show the traceability to NIST or other accepted source
- Standards preparation sheets or logbooks which show all dilution calculations, preparer's signature, and dates of preparations
- Instrument maintenance and operational logbooks which show all calibrations, repairs, out-of-control conditions, samples analyzed, signatures, and dates
- Laboratory benchsheets and logbooks which reference analysis type, sample numbers, analysts' initials, and dates
- Sample and background spectra from gamma spectroscopy which are traceable to the sample result
- Sample and background spectra from alpha spectroscopy which are traceable to the sample result
- The raw data from all radiochemical analyses necessary to hand calculate all sample results and total propagated uncertainties.

ATTACHMENT A

INSTRUCTIONS FOR DATA REPORTING FORMATS

Instructions for Cover Page Data

Instructions for Form I Data, Radioanalytical Analysis Results

Instructions for Form II Data, Radioanalytical Quality Control Results

Instructions for Form III Data, Instrument Calibration Checklist

INSTRUCTIONS FOR COVER PAGE DATA

- Project Title: Title of project as specified in the project-specific statement of work (SOW) (maximum 60 characters).
- Lab Name: Name of laboratory performing analyses, a 6 character unique laboratory code assigned by EG&G Idaho after contract award.
- Case No.: Five-character site identification code. Designated in the project-specific SOW.
- Report No.: Laboratory generated report number for the data package (maximum 12 characters).
- Method Type: Code for the type of analysis performed on the samples reported in this data package. Analysis method codes are listed in Table 1 (3 characters).

Table 1. Analysis method type codes for radioanalytical report forms

<u>Code</u>	<u>Description</u>
ALS	Alpha spectroscopy
GMS	Gamma spectroscopy
GRA	Gross alpha
GRB	Gross beta
LSC	Liquid scintillation
SRR	Strontium isotopes by radiochemistry
SRT	Total strontium by radiochemistry
OTR	Other radiochemical analyses (e.g., C-14, I-129, I-131)
NRM	Nonroutine method (e.g., ICP mass spectroscopy)

(OTR and NRM analyses must be defined in the comments)

- SDG No.: The SDG number assigned by the laboratory to the data package (maximum 12 characters).
- Field Sample No.: A unique sample identifier, generated by EG&G Idaho, and defined in the approved sampling and analysis plan (maximum 12 characters).
- Lab Sample ID No.: A unique alphanumeric identifier assigned to each sample by the analysis laboratory (maximum 12 characters).

Comments:

Comments concerning method types not defined in Table 1 (OTR or NRM). Any other pertinent information the laboratory feels is necessary to include (maximum 254 characters).

Data Release:

Signature, typed or printed name, and title of person authorizing release, and date of report package release (date format = mm/dd/yy) (25 characters each for typed name and title, 8 for date).

INSTRUCTIONS FOR FORM I DATA
RADIOANALYTICAL ANALYSIS RESULTS

Date: Date of report package preparation (date format = mm/dd/yy) (8 characters).

Lab Name: Name of Laboratory performing analyses, a unique 6-character laboratory code assigned by EG&G Idaho after contract award.

Case No.: Five-character site identification code designated in the project-specific SOW.

Report No.: Laboratory generated report number for the data package (maximum 12 characters).

SDG No: The SDG number assigned by the laboratory to the data package (maximum 12 characters).

Field Sample No.: A unique sample identifier, generated by EG&G Idaho, and defined in the approved sampling and analysis plan (maximum 12 characters).

Lab Sample ID No.: A unique alphanumeric identifier assigned to each sample by the analysis laboratory (maximum 12 characters).

Sample Matrix: Matrix of samples analyzed. See Table 2 for matrix codes to be used for reporting sample results (6 characters maximum).

Table 2. Table of valid sample matrix codes

<u>Code</u>	<u>Description</u>
NWATER	Nonfiltered groundwater or surface waters
FWATER	Filtered groundwater or surface waters
SOIL	Soils analyzed as received
MSOIL	Soils that have been milled and sieved
SLUDGE	Sludge samples
SEDMNT	Sediment samples
VEGETA	Vegetation samples
OTHER	Other matrices are defined in comments

Anal Type: The isotope being analyzed. Isotopes are to be entered in the format shown in the following examples: Am-241, Cs-137, Pu-238, alpha, beta (maximum 6 characters).

Sample Value: Sample result obtained, decay corrected to sample collection date and time, and background corrected if necessary. Result shall be reported as a real number (even if negative) in scientific notation (using the format x.xxE+xx). Less than (<) numbers or nondetect is not acceptable (maximum 8 characters).

Sample Error: The one standard deviation total propagated uncertainty of the sample result (format = x.xxE+xx) (maximum 8 characters).

Units: The reporting units in which the sample result and total error are given. Units to be used are pCi/L for liquid samples and pCi/g dry weight for solid matrices. Total uranium, if requested, may be reported in ug/L or ug/g (maximum 5 characters).

Anal Date: Date on which the counting of the sample was completed (date format = mm/dd/yy) (8 characters).

Sample Date: Date on which the sample was collected (date format = mm/dd/yy) (8 characters).

Sample Size: Size of the sample aliquot taken for analysis. Report in liters (L) for liquids and grams (g) for solid matrices (format = xxxx.xxxx) (maximum 9 characters).

Yield: The chemical yield or radioactive tracer yield of the analysis reported as a percent (format = xx.x%) (maximum 5 characters).

Detector ID: Lab identification code for the counting or measuring instrument used for the sample analysis (maximum 12 characters).

Comments: Contains definitions of any abbreviations used in the form which are not in the instructions. References matrices which are not defined in Table 2 (matrix OTHER). Any other pertinent information the laboratory feels is necessary (maximum 254 characters).

DQF: Data qualifier flag assigned to the result during data validation. Left blank by the analytical laboratory.

ASL: Analytical support level achieved by the sample delivery group reported. Determined during data validation. Left blank by the analytical laboratory.

NOTE: NA is to be entered if an item is not applicable.

INSTRUCTIONS FOR FORM II DATA
RADIOANALYTICAL QUALITY CONTROL RESULTS

Date: Date of report package preparation (date format = mm/dd/yy) (8 characters).

Lab Name: Name of Laboratory performing analyses (6-character lab code assigned by EG&G Idaho after contract award).

Case No.: Five-character digit site identification code designated in the project-specific SOW.

Report No.: Laboratory generated report number for the data package (maximum 12 characters).

SDG No: The SDG number assigned by the laboratory to the data package (maximum 12 characters).

QC Sample ID: The laboratory generated identification number of the quality control sample analyzed (maximum 12 characters).

Sample Type: Type of quality control sample analyzed. Sample type codes are shown in Table 4 (3 characters).

Table 3. Sample type codes for quality control samples

<u>Code</u>	<u>Description</u>
DUP	Duplicate sample
BLK	Blank sample
LCS	Laboratory control sample

Anal Type: The isotope being analyzed. Isotopes are to be entered in the format shown in the following examples: Am-241, Cs-137, Pu-238, alpha, beta (maximum 6 characters).

Sample Value: Sample result obtained, decay and background corrected as necessary. Result shall be reported as a real number (even if negative) in scientific notation (using the format x.xxE+xx). Less than (<) numbers or nondetect is not acceptable (8 characters).

Sample Error: The one standard deviation total propagated uncertainty of the sample result (format = x.xxE+xx) (8 characters).

Known Value: The known activity in the laboratory control sample. Shall be recorded with the same number of significant figures as the sample value (format = x.xxE+xx). For blank or duplicate samples, enter NA. The comments section will note the source or preparation identification number used for laboratory control samples (8 characters).

Known Error: The one standard deviation error associated with the known value (format = x.xxE+xx) (8 characters).

Units: The reporting units in which the sample value, sample error, known value, and known error are given. Units can be the same units as the samples analyzed or the QC data may be reported in dpm/L, dpm/g or dpm/sa as long as the sample value and the known value are in the same reporting units (maximum 6 characters).

Spike Yield: The percent recovery of the laboratory control sample activity. Determined by dividing the sample value by the known value. Reported as a percentage (xx.x%). For blanks and duplicates, put NA (maximum 5 characters).

Anal Date: Date on which the counting of the sample was completed (date format = mm/dd/yy) (8 characters).

Chem Yield: The chemical yield or radioactive tracer yield of the analysis reported as a percent (xx.x%) (maximum 5 characters).

Detector ID: Laboratory identification code for the counting or measuring instrument used for the sample analysis (maximum 12 characters).

Comments: Contains definitions of any abbreviations used in the form that are not in the instructions, references any matrices that are not defined in Table 2 (e.g., matrix OTHER), and any other pertinent information the laboratory feels is necessary (maximum 254 characters).

Flag: Quality control flag assigned to the QC sample result during data validation. Left blank by the analytical laboratory.

NOTE: NA is to be entered if an item is not applicable.

INSTRUCTIONS FOR FORM III DATA
INSTRUMENT CALIBRATION CHECKLIST

Project Title: Title of project as specified in the project-specific SOW (maximum 60 characters).

Lab Name: Name of laboratory performing analyses, a 6-character unique laboratory code assigned by EG&G Idaho after contract award.

Case No.: Five-character site identification code. Designated in the project-specific SOW.

Report No.: Laboratory generated report number for the data package (maximum 12 characters).

Method Type: Code for the type of analysis performed on the samples reported in this data package. Analysis method codes are listed in Table 1 (3 characters).

Table 4. Analysis method type codes for radioanalytical report forms

Code	Description
ALS	Alpha spectroscopy
GMS	Gamma spectroscopy
GRA	Gross alpha
GRB	Gross beta
LSC	Liquid scintillation
SRR	Strontium isotopes by radiochemistry
SRT	Total strontium by radiochemistry
OTR	Other radiochemical analyses (e.g., C-14, I-129, I-131)
NRM	Nonroutine method (e.g., ICP mass spectroscopy)

(OTR and NRM analyses must be defined in the comments)

Detector ID: The unique laboratory identification number for the detector used to count the samples (maximum 12 characters).

SDG No.: The SDG number assigned to this data package (maximum 12 characters).

QC Checks:

The date, status flag, source identification number and background identification number for the most recent QC checks for the detector (date format = mm/dd/yy) (source identification number = the laboratory assigned identification number for the source used to check the detector status - maximum 12 characters).

Comments:

Comments concerning method types not defined in Table 1 (OTR or NRM). Any other pertinent information the laboratory feels is necessary to include (maximum 254 characters).

Data Release:

Signature, typed or printed name, and title of person confirming detector status, and date of status confirmation (date format = mm/dd/yy) (25 characters each for typed name and title).

ATTACHMENT B
DATA REPORTING FORMS

Cover Page, Radioanalytical Analyses Data Package

Form I, Radioanalytical Analysis Results

Form II, Radioanalytical Quality Control Results

Form III, Instrument Calibration Checklist

ENVIRONMENTAL RESTORATION PROGRAM

COVER PAGE

RADIOANALYTICAL ANALYSES DATA PACKAGE

Project Title: _____
Lab Name: _____ Case No.: _____
Report No.: _____ Method Type: _____
SDG No: _____

SAMPLE NUMBERS

Field Sample No.	Lab Sample ID No.	Field Sample No.	Lab Sample ID No.
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Comments: _____

Release of the data contained in this data package has been authorized by the laboratory manager or the manager's designee, as verified by the following signature:

Signature: _____ Name: _____

Title: _____ Date: _____

FORM III

INSTRUMENT CALIBRATION CHECKLIST

Project Title: _____

Lab Name: _____ Case No: _____

Report No: _____ Method Type: _____

Detector ID: _____ SDG No: _____

Quality Control Checks:

<u>Date</u>	<u>Status</u>	<u>Action</u>
_____	_____	Efficiency Source Check - Source ID # _____
_____	_____	Background Check - Bkgd ID # _____
_____	_____	Primary Calibration Check - Source ID # _____

Status Flags: I = parameter is in control
Q = parameter is in control but outside warning limits
O = parameter is outside of control limits

Comments: _____

Signature: _____ Name: _____

Title: _____ Date: _____

**Quality Assurance/Quality Control Program of the
Radiation Measurements Laboratory
for Gamma Spectroscopy and
Direct Gross Alpha/Beta Counting**

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QUALITY ASSURANCE/QUALITY CONTROL PROGRAM
FOR GAMMA SPECTROSCOPY AND DIRECT GROSS ALPHA/BETA COUNTING

1.0 INTRODUCTION

The Radiation Measurements Laboratory (RML) or its predecessors have been in existence since 1951 at the Idaho National Engineering Laboratory (INEL) and is operated for the Department of Energy (DOE) by EG&G Idaho, Inc. In addition to conducting research and development, the RML provides nuclear science support and services to many INEL facilities and programs. The RML specializes in quantitative and qualitative ionizing radiation measurements and neutron dosimetry. It is a goal of the RML to advance the state-of-the-art in ionizing radiation measurements, radiation instrumentation and analysis methods.

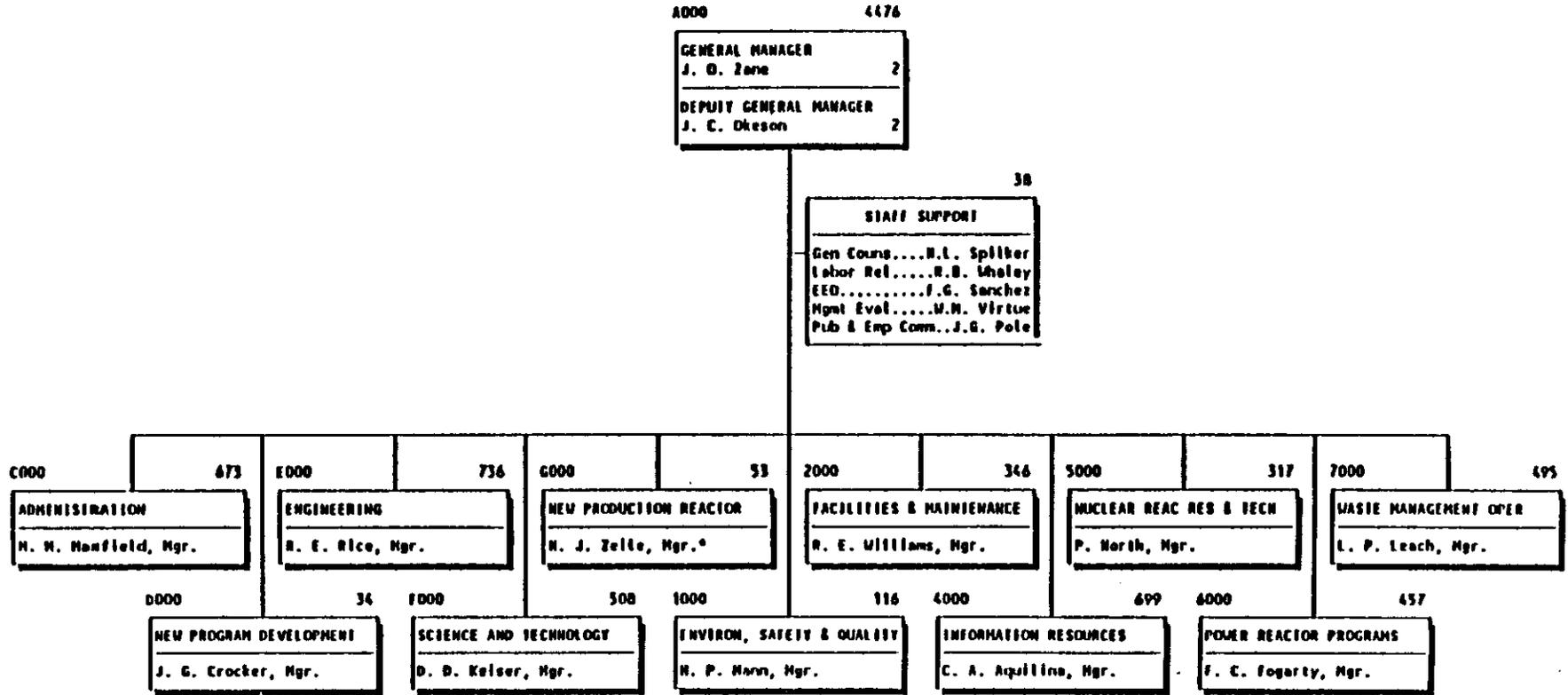
The RML, which is part of the RML/Radiochemistry Unit, is comprised of Operations, Data Management, Radiation Instrumentation, Software Development, and the technical staff. Inclusion of each of these disciplines within the Unit allows the RML to provide services and support for gamma-ray and gross alpha/beta measurements, neutron dosimetry, electronic design/development and software engineering. The RML/Radiochemistry Unit is also comprised of the Radiochemistry and Operational Dosimetry Sections which provide support to the RML and other organizations. This document does not address the QA/QC programs of Radiochemistry or Operational Dosimetry, as they are described elsewhere.

The purpose of this manual is to describe the quality control (QC) and quality assurance (QA) programs used by the RML to assure a quality product in the field of gamma-ray spectroscopy and direct gross alpha/beta counting. As a result of new DOE Orders resulting from national laws and government regulations, there has been increased emphasis on the verification of the quality of a laboratory's analytical results through a formal quality program. To demonstrate and document the quality of the data reported to our customers, the RML has developed a formalized QA/QC program. This program will result in improved operations, improved data quality and more defensible results. Quality Assurance and Control is a major thrust of the RML in its quest for excellence in radiation measurements.

2.0 ORGANIZATION STRUCTURE

The following flow charts show the Company (EG&G Idaho, Inc.) structure, the Department (Science & Technology) structure, the Group (Chemical Sciences) structure, and the Unit (RML/Radiochemistry) structure.

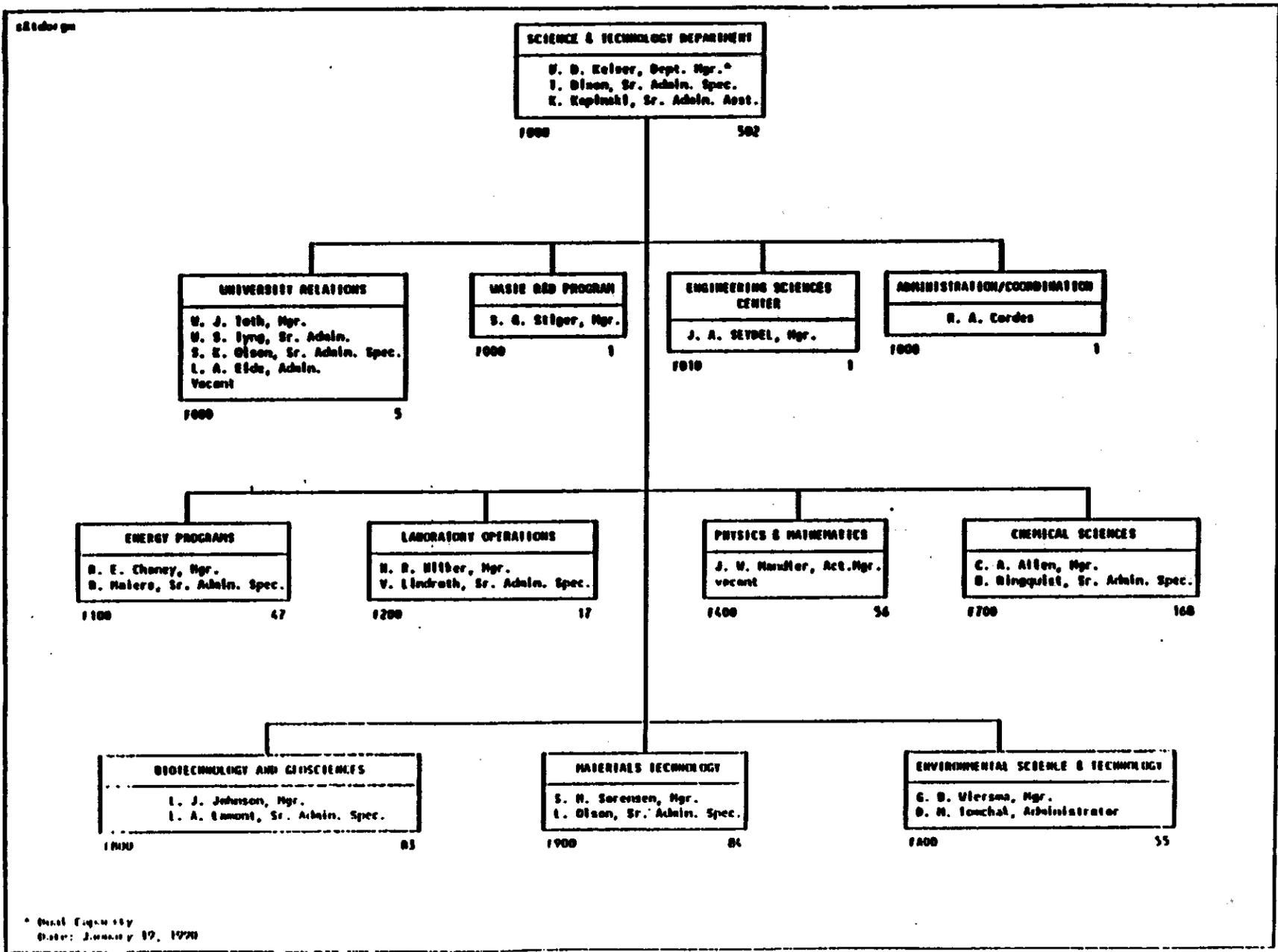
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*Dual Capacity

Contractor.....EGIG Idaho, Inc.
 Location.....Idaho falls, Idaho 83415
 Operations Office...DOE-Idaho falls, Idaho 83401
 Contract Number....DE-AC07-761D01570

Approved: *J. O. Zane*
 Total Employees.....4476
 Effective Date.....January 1990



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CHEMICAL PROCESSING

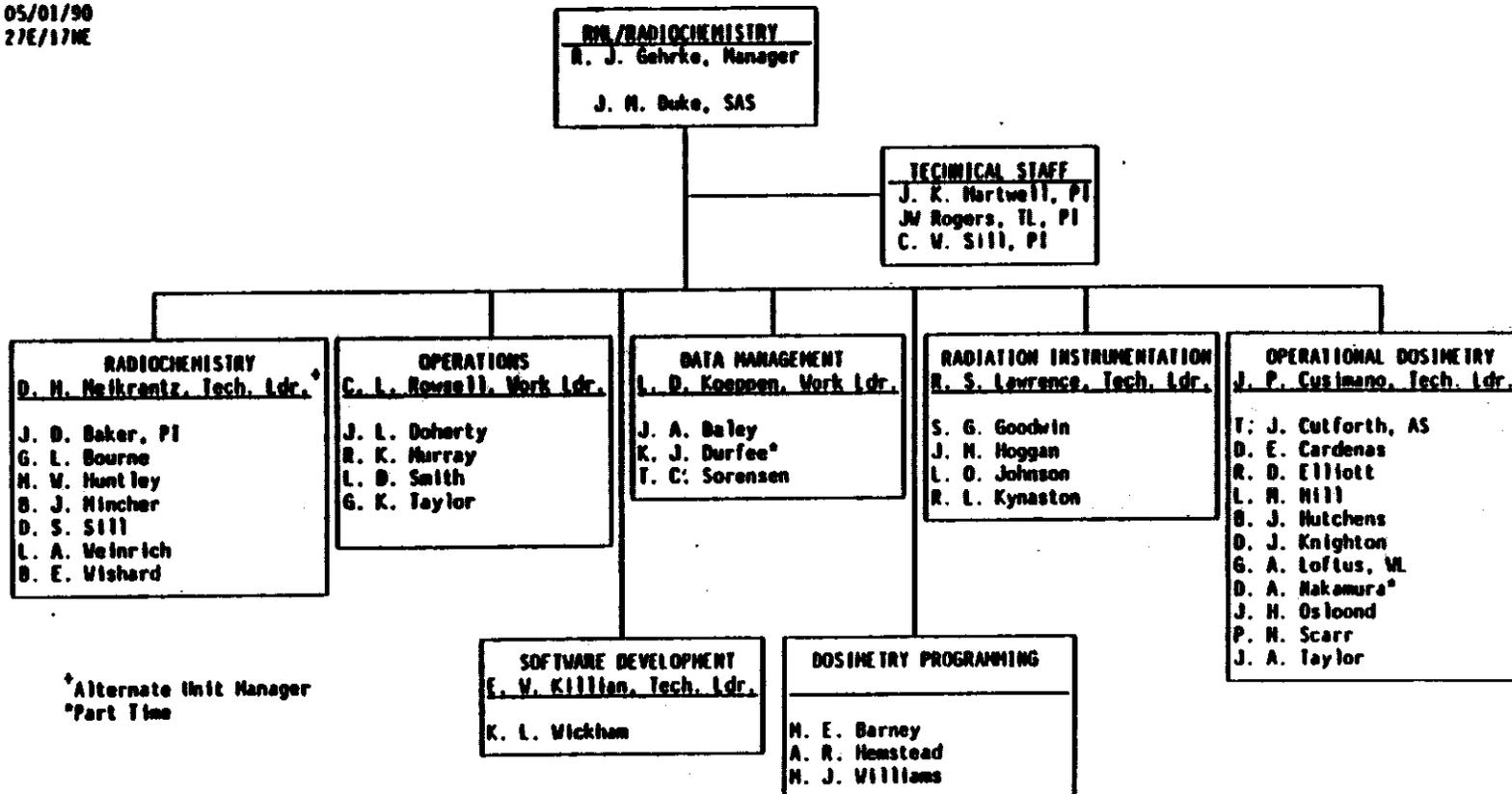
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Smith, D. L. **	

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3.0 RML ORGANIZATIONAL PERSONNEL

<u>Personnel</u>	<u>Title</u>	<u>Responsibilities</u>	<u>Years Experience</u>	<u>Degree Attained</u>
R. J. Gehrke	Unit Manager	Manager	23	M.S. Physics
R. S. Lawrence	Eng. Spec.	Tech. Ldr.-Rad. Inst.	32	B.S. EE
JV Rogers	Sci. Spec.	Principal Investigator	31	B.S. Physics
R. L. Kynaston	Sr. Eng.	Rad. Instrumentation	30	None
C. L. Rowell	Sr. Sci.	Work Leader-Operations	28	Industrial B.S. Techn.
E. W. Killian	Sci. Spec.	Tech. Ldr.-Software Dev.	21	M.S. Math
J. K. Martwell	Sci. Spec.	Principal Investigator	20	M.S. Nuclear Chem.
J. N. Hoggan	Sr. Eng.	Rad. Instrumentation	19	Assoc.
S. G. Goodwin	Sr. Eng.	Rad. Instrumentation	19	Assoc.
L. D. Koeppe	Scientist	Work Ldr.-Data Mgmt	15	None
D. N. Thompson	Assoc. Sci.	Operations	9	B.S. Biology
K. J. Duffee	Sr. Op. Tech.	Data Management	6	None
D. V. McBride	Assoc. Sci.	Operations	5	None
B. E. Oates	Sr. Tech.	Operations	5	None
R. K. Murray	Sr. Tech.	Operations	3	Assoc.
T. C. Sorensen	Sr. Tech.	Operations	3	B.S. Communications
K. L. Vickham	Scientist	Software Development	1	B.S. Physics
C. Casey	Assoc. Sci.	Data Management	1	M.S. Nuclear Chem.

The RML has 271 years of combined experience related directly or indirectly to radiation measurements. Staff members have attained their experience through radiation measurement related research and/or routine counting and analysis. Senior staff members are active in the measurement and/or the evaluation of basic nuclear decay data and maintain a high level of competence through their scientific activities, their professional contacts, and their membership and active participation in technical societies, visiting other laboratories and surveying the literature. Seminars, group training, individual on-the-job training, literature and close communication between staff members keeps RML personnel abreast of the state-of-the-art in radiation measurements. RML Operations personnel are strongly encouraged to complete a comprehensive on-the-job training and certification program (Appendix A) which is intended to demonstrate an in-depth understanding of the radiation measurements being performed with an appreciation for the importance of high quality results. Only certified operators or trainees under the direction of a certified operator are authorized to count and analyze samples for radionuclide content. RML Operations and Data Management personnel follow documented procedures during the counting/analysis and reporting process.

The RML section is organized into three functional sections: (1) Operations, (2) Data Management, and (3) Technical Staff. The Operations section is responsible for the accumulation of high quality data, the analysis performed by the RML computers and a review of the results, especially those which do not require a formal QA review (this review is performed by the work leader or his designated alternate). The Data Management section is responsible for compiling, evaluating, verifying,

reporting and archiving of data and results of analyses that require formal quality assurance and reporting methods (e.g., effluent and environmental samples). The Technical Staff is consulted when any analyses results are questionable and cannot be properly verified and/or - evaluated by Operations or Data Management. A senior staff member or a designated alternate performs the final review of all formally reported data and signs the approved section on the report.

4.0 DEFINITIONS

The following definitions are given to convey the precise meaning of certain terms used in this manual which may have other meanings outside this context.

Quality Assurance. A network of activities that assures that the customer's needs are met (i.e., conformance to requirements) and that the results of analyses are correct within the associated uncertainties. These activities include evaluating the customer's needs, designing these needs into the service rendered, monitoring the quality of results by inspection and by the injection of QC samples and certifying that the personnel performing the service are qualified. This is accomplished through a planned and systematic set of actions, training, controls and documentation so as to provide confidence and reliability in the official results issued to the customer.

Quality Control. Quality control is determined from a sample prepared by an independent party, from material that is traceable to the National Institute of Standards and Technology (NIST). This QC sample shall be treated as any other routine sample submitted for analysis. Upon receipt of the RML QC results, the independent party determines whether the measured values and their uncertainties are within the acceptance criteria of the actual known values. When this is the case the analyzing laboratory is "in control" and when this is not the case it is "out of control".

Standard. A radioactive source whose activity is accurately known. It is either a National Institute of Standards and Technology (NIST) Standard Reference Material (SRM) (i.e., primary standard) or one whose activity was determined by a direct comparison with a NIST SRM (i.e., secondary standard). Whenever the matrix of a standard has been changed or a standardization transferred, the steps involved must be clearly delineated and the uncertainties associated with each step propagated with that in the original standard to assure traceability to a primary standard. Each additional step weakens the traceability link and increases the uncertainty assigned to the standard.

Calibration/Standardization. Often the terms standardization and calibration are used interchangeably without distinguishing the subtle differences. It is a method of setting up an instrument with or without the use of standards and the determination of a set of conditions, materials, equipment, procedures, etc. that are used to obtain a qualitative or quantitative determination of radioactivity.

Limit of Detection (L_D). [Also referred to as the lower limit of detection (LLD).] The minimum level at which a given analytical procedure may be relied upon to produce a detection with a certain measure of confidence. The RML has adopted L. A. Currie's method of defining detection limits (L_D). Currie's method of reporting a detection limit is that level at which there is 95 percent confidence that an activity will be detected above the background level. The detection limit (L_D) is expressed by Currie as follows:

$$L_D = k^2 + 2L_C = 2.71 + 4.65 \sqrt{B}$$

where:

$k = 1.645$, the value of the standard normal deviate (95% confidence level),

$L_C = k/\sqrt{2/B}$ the net number of counts which must be exceeded before a sample can be said to contain any activity above the background level (critical level),

$B =$ background counts.

Precision. The term precision refers to a measure of the variability of the data presented (also called reproducibility or repeatability). Precision for gamma spectroscopy is determined by the length of time the sample is counted and the measured intensity of the photopeaks including the associated uncertainties (Poisson counting statistics and how well the photopeak was fit to a gaussian function).

Precision can be determined by making multiple measurements of a sample under the same counting and analysis conditions. Precision is then the mutual agreement among individual measurements and is expressed as a standard deviation as follows:

$$\sigma_{n-1} = \sqrt{\frac{\sum(x-\bar{x})^2}{n-1}}$$

where:

$n =$ number of measurements

$x =$ measured value

$\bar{x} =$ measured mean value.

Accuracy. Accuracy is the degree of agreement of a measurement with accurately known standard reference materials from NIST (primary standard) or NIST traceable activity (secondary standard).

Blank Sample. A sample prepared in the same matrix and physical form as unknown samples but with no added activity. This sample is often used to determine detector system background and can also be used as a QC sample.

Official Results. Those results which have been thoroughly evaluated, verified and completely QA'd by the analyst. The results are reported and transmitted to the customer by Interoffice Correspondence (letter), Internal Technical Reports or formal computer generated reports. The official results are QA checked and signed by the analyst compiling the report and approved and signed by a senior staff member or a designated alternate.

Preliminary Results. Those results which are transmitted to the customer with or without a cover letter and are stamped or designated "Preliminary". These results have been partially or completely analyzed but have not been completely evaluated, verified, QA'd or formally approved and are subject to change. Preliminary results are only transmitted to a customer when there is a customer need for quick results to help investigate a problem or to help meet customer time constraints.

Summary Results. Results for which only the computer analysis summary printout has been requested by the customer. These data are generally checked, edited, and signed by the analyst. The summary data, depending on the sensitivity, may also be evaluated, verified and approved by the Data Management Section. These data will normally not have an attached cover letter and will normally be provided only to customers who have demonstrated their ability to RML personnel to correctly understand the data. The RML will not be responsible for misidentification or misinterpretation of the summary results.

5.0 RML QUALITY ASSURANCE PROGRAM

The RML successfully participates in five routine quality control programs listed below:

1. RML internal quality control program
2. Environmental Monitoring Programs - EG&G Idaho, Inc.
3. Environmental Monitoring Systems Laboratory Program - EMSL-Las Vegas, EPA
4. Radiological Environmental Sciences Laboratory - DOE, INEL
5. Neutron Fluence Standards Program - NIST (NBS)

The above listed programs routinely send radioactive sources of known but undisclosed values to the RML for qualification and quantification. At the conclusion of any QC exercise the RML receives documentation from the program stating the calibration values, the RML submitted values and

whether the comparison agreed or disagreed within limits established by the individual program.

The purpose of the quality program is to assure that quality data is produced and to demonstrate the competence and reliability of the RML and the skill of its staff.

5.1 RML Internal QC Program

The RML performs both QA and QC checks routinely to verify proper operation and calibration of equipment and analysis programs. The QC and background checks performed are as follows:

<u>QC Check Performed</u>	<u>Required Frequency</u>
1. Gamma-ray energy calibration for Ge detectors	Daily
2. Calibration source check for Ge detectors	Monthly
3. Instrument/ambient background checks on Ge detectors	Monthly and/or before and after each set of environmental samples
4. Calibration source check for alpha/beta counter	Weekly
5. Instrument/ambient backgrounds checks on alpha/beta counters	Biweekly and before and after each environmental sample and before and after each set of effluent samples

The above listed QC and background checks performed are evaluated, recorded, archived and formally reported in the RML annual QA report. Whenever problems are encountered that place a counting system out of control they shall be investigated and corrected before results from that counting system are reported. In certain circumstances it is permissible to report results from a system found out of control when the uncertainties on the results have been increased to reflect the level of accuracy achieved with the counting system. Under these circumstances the customer should be made aware of the fact that the accuracy of the results have been degraded.

5.1.1 Gamma-ray Energy Calibration for Ge Detectors

The gamma-ray spectrum data analyses slots are energy calibrated daily to determine the relationship between photopeak channel positions and actual photopeak energies. A ^{228}Th (or ^{232}U parent) source spectrum is used to establish an energy calibration which produces

values of the coefficients (A, B, C) for a quadratic energy equation, $E = A + B(x) + C(x^2)$, and the coefficients (Z, Y) for a peak width equation, ($W = Z + Y(x)$). The computerized process finds the location of the 2614 keV γ -ray and from its position calculates the gain. With this gain, the calibration program locates four other full energy gamma-ray peaks and measures the peak position for all five photopeaks and performs a least-squares fit of the resulting channel positions to their known energies to obtain the energy equation coefficients. The same least-squares fitting process is repeated using channel positions and the full width at half maximum (the peak position and width results from fitting the spectral data with a Gaussian function) to determine the coefficients of the width equation. A printed table (Appendix B) is produced which shows the values for the coefficients and the difference between the known values and the values calculated with the fitted equation. The printed energy calibration results are recorded and archived for one year. The energy and width calibration coefficients are automatically stored with each analyzed sample spectrum. Each sample spectrum with its associated calibration information is stored on computer disk and ultimately archived on magnetic tape.

5.1.2 Calibration Source Check for Ge Detectors

The performance of each RML Ge or Ge(Li) gamma-ray spectrometer is checked monthly to verify the full-energy-peak efficiency reproducibility and the energy resolution at low, medium and high energies using a ^{152}Eu "point" source standard.

At present, the RML uses a ^{152}Eu source (PTB 397-76) to perform the checks. The ^{152}Eu ($T_{1/2} = 13.4$ yr.) source emits strong gamma rays ranging from 122 keV to 1408 keV. The standard is counted in a point source geometry for a duration which will produce peak areas with uncertainties of $<2\%$. The accumulated spectrum is analyzed with the RML "GAP" computer analysis program with activity results printed in disintegrations/second (DPS). The results of the weighted average (mean) ^{152}Eu activity and the 122 keV, 779 keV and 1408 keV photopeaks are evaluated to verify that they are within three estimated standard deviations of the known value. The RML is considered "IN CONTROL" if the measured weighted average (mean) activity is ≤ 2 estimated standard deviations from the known value, and "IN CONTROL - WARNING" if the mean activity is >2 estimated standard deviations but <3 estimated standard deviations from the known value, and "OUT OF CONTROL" if the mean activity is ≥ 3 estimated standard deviations from the known value (Appendix C). The same criteria (<2 std. dev. and 3 std. dev.) is applied to the 122 keV, 779 keV and 1408 keV measured gamma-ray peaks to evaluate the low, medium and high energy regions (Appendix C). However, the RML is not considered completely out of control if only one of these gamma-rays is out of agreement with the known value. The out of agreement energy region will be investigated and corrected in a timely manner.

The results of the monthly ^{152}Eu measurements for all detectors are recorded, plotted, archived and formally reported in the RML annual QA report.

5.1.3 Instrument/Ambient Background Checks on Ge Detectors

Instrument or blank sample background counts, typically of 16 hour counting duration, are accumulated on each Ge gamma-ray spectrometer monthly and/or before and after each set of environmental samples. Background photopeaks and their associated counting rates are evaluated to determine the level of stability of the background radiation and to assure that no low-level contamination of the detector system has occurred.

Each background spectrum is stored on the VAX 750 computer disk and also on magnetic tape.

Subtraction of background photopeak counting rates from the sample spectral data can be accomplished in a variety of ways depending on the application. With each background correction, the net peak-area counting rates of the most current stored background spectrum are subtracted from those counting rates associated with each corresponding photopeak found in the sample spectrum. If the energy of a photopeak found in the sample spectrum agrees within 1 keV of the photopeak found in the background spectrum, then the background area counting rate is subtracted from the area counting rate of the corresponding photopeak in the sample spectrum.

It is also possible, at the discretion of the analyst, to apply a concurrent background subtraction method. This method is particularly useful for very weak radioactive samples for which the differentiation of sample activity from ambient background "equivalent activity" is very difficult. This method applies the channel and background fitting parameters (expressed in energy units) used for the photopeak(s) analyzed in the sample spectrum to the same exact energy region (converted to channels) of the background spectrum. This technique is actually an overlay or a mapping of the background spectrum regions to the corresponding regions of the sample spectrum. Normally, an average of the four most current background spectra are used when this method is chosen for sample analysis.

Environmental samples, which are in large sets, are processed in a batch analysis mode which uses the concurrent background subtraction method. In the batch mode, the analyst selects the background spectra to use. Typically the analyst chooses the two background spectra that were counted immediately before and after the set of environmental samples, plus two to four previous background spectra. The analysis program uses the weighted average peak area counting rates of the background results with any outliers removed.

Background spectral results are recorded, archived and formally reported in the RML annual QA report.

5.1.4 Calibration Source Check for Low Background Alpha/Beta Counter

The Tennelec low-background gas-proportional alpha-beta counter is performance checked weekly to verify its proper operation and calibration.

The RML uses both a ^{90}Sr (IPL-119-07-3) and a ^{137}Cs (IPL-119-07-4) source to verify the proper response for the beta channel and a ^{241}Am source (RML #1) for the alpha channel. The sources are each counted for 10 minutes and the resulting counting rates are recorded in an RML logbook.

The ^{137}Cs check source shall be counted at the end of each bimonthly set of environmental air filters to verify that the proper calibration was maintained during the sample counting period. The ^{137}Cs source counts/10 minutes are entered into an RML PC program after each set of air filters and the counts (decay corrected) are evaluated by the PC program to verify that they are within two statistical standard deviations of the running average. Values greater than ± 2 standard deviations from the running average are flagged and investigated.

The ^{137}Cs check source results are recorded (Appendix D), archived and formally reported in the annual RML QA report.

5.1.5 Instrument (Blank Sample) Background Checks on the Alpha/Beta Counter

Alpha and beta background counting rates (counts/10 minutes) shall be determined biweekly and before and after each individual environmental air sample. Empty sample planchets are used when measuring the background counting rates. The biweekly background results are recorded in an RML logbook. The alpha and beta background counting rates determined before and after each individual environmental air sample are entered into an RML PC program that evaluates and verifies that the average is within two statistical standard deviations of the running average. Background averages greater than ± 2 standard deviations from the running average are flagged and investigated.

The alpha and beta background results are recorded (Appendix D), archived and formally reported in the RML annual QA report.

5.2 Environmental Monitoring QC Program

The RML supports many EG&G Idaho waste management programs, including environmental monitoring efforts. Samples of water, soil, air, vegetation and small mammals are routinely collected by Environmental Monitoring Program (EMP) personnel and counted/analyzed by the RML. To assure the accuracy, precision and stated limits of detection (Appendix N), the EMP submits quality control (QC) samples at least once yearly with a set of routine samples.

The QC samples are counted, analyzed and reported in the same manner as the routine samples. The measured QC results reported by the RML are evaluated by the EMP and also by an independent party. The results are then made known to the RML Unit Manager and the RML Data Management Section (an example of the QC results are in Appendix E). The results of the QC check are also evaluated by the RML to verify that the results, within stated uncertainties, agree with the known value in order to determine "IN CONTROL" or "OUT OF CONTROL" status (Appendix F). The RML evaluation also checks for ongoing biases or changes in the accuracy of the reported results. Any measurements outside of stated uncertainties are promptly investigated to determine the cause and corrected in a timely manner. When QC measurement results are outside stated uncertainties, no sample results will be reported to the customer until either the problem has been identified and corrected or appropriately increased uncertainties are assigned and so indicated to the customer.

The QC results are recorded, archived and formally reported in the RML annual QA report.

5.3 Environmental Monitoring Systems Laboratory (EMSL) Intercomparison Program - EPA

The RML has participated in the Environmental Protection Agency (EPA) Las Vegas cross-check program since 1985. The EMSL routinely sends samples of various geometries to the RML for counting and analysis (Appendix G). Each sample is counted and analyzed three separate times and the results of each analysis are reported to EPA via mail or the computer phone-in program.

The measured QC results reported by the RML are evaluated by EMSL and a tabulation of results of all participating laboratories is later issued to the RML.

The results of the EPA QC checks are evaluated by the RML upon receipt, and any measurement results that did not meet EPA requirements (flagged) are investigated and corrected.

The QC results are recorded (Appendix H), archived and formally reported in the RML annual QA report.

5.4 INEL-RESL Interlaboratory Comparison Program

The RML participates in the Department of Energy (DOE) INEL Intercomparison Program administered by the Radiological Environmental Sciences Laboratory (RESL). RESL sends samples of various geometries to the RML for counting and analysis. The results of each analysis are reported to RESL via letter or the phone-in program after completion.

The measured QC results reported by the RML are evaluated by RESL and a tabulation of results are issued to the RML. The results of the QC checks are carefully evaluated by the RML and any measurements that were not within quoted RML accuracies are investigated and corrected.

The QC results are recorded (Appendix I), archived and formally reported in the RML annual QA report.

5.5 NIST (NBS) - Neutron Fluence Standards Program

The National Institute of Standards and Technology (NIST) produces neutron fluence standards which are available to laboratories which determine neutron fluences by measuring the radioactivity of neutron monitors irradiated in neutron-fields. The neutron fluence standards consist of NIST standardized neutron dosimeters which are irradiated in standardized neutron fields at NIST to a known neutron fluence. After irradiation the fluence standard is sent to a laboratory (RML) to have the induced radioactivity measured. The measuring laboratory then reports its observed activity to NIST. The results from the measuring laboratory are then reduced to reaction cross sections for the reactions based on the NIST known fluence rate. Finally the deduced cross sections from the measuring laboratory are compared with the NIST measured cross sections for the standard neutron field in which they were irradiated (Appendix O). The RML has measured NIST fluence standards for $^{58}\text{Ni}(n,p)$, $^{54}\text{Fe}(n,p)$, $^{46}\text{Ti}(n,p)$ and $^{238}\text{U}(n,f)$ reactions. The RML participates in this program based on customer requirements.

6.0 LABORATORY FACILITIES AND EQUIPMENT

The RML counting laboratory is a modern fully equipped radiation measurements laboratory with Ge, Si(Li) and NaI(Tl) x-ray and gamma-ray spectrometers, gamma ionization chambers, and alpha/beta proportional counters. The radioanalytical chemists in the RML/Radiochemistry Unit supplement the RML radioanalysis capabilities and have alpha spectrometers, alpha/beta proportional counters and liquid scintillation counting and analyzer systems. The instrumentation is primarily located in the RML, but some systems are located in other laboratories located nearby.

The RML is air conditioned to provide an evenly controlled temperature between 68° and 72° to maintain instrument stability. A positive pressure is maintained inside the RML, with respect to the rest of the building, to reduce the entry of natural radioactive gases and aerosols. The walls have been treated with a paint impermeable to gas to reduce the release of naturally occurring radon gases from the cinder block and cement surfaces. The RML laboratory is monitored by Health Physics weekly for possible contamination and/or direct radiation problems. Samples brought into the RML counting laboratory are kept behind shields before and after counting. Environmental samples are prepared and stored in separate facilities (outside the RML) designated for low activity samples. After

samples have been counted they are returned to the customers, discarded, or removed to one of the designated storage areas.

The gamma-ray spectral analyses are performed on the RML VAX computer, which has 8 megabyte memory, two 456 megabyte hard disks, a plotter, two line printers, one laser printer and two magnetic tape drives. The computer and instrumentation electrical power is regulated and conditioned to maintain stability. The RML laboratory and equipment is protected by a Halon fire protection system. The following is a list of the radiation detection instrumentation used by the RML:

1. Ten Germanium spectrometers (2-40% Ge).
2. One automatic sample changer (Ge).
3. Four in-field (remote) Ge spectrometers.
4. One Si(Li) x-ray detector.
5. Three thin window coax Germanium detectors.
6. One NaI(Tl) detector.
7. One guard-ring low-background alpha/beta gas proportional counter.
8. Four end window proportional counters.
9. Two gamma ionization chambers.
10. One high range gamma Victoreen R-meter.
11. One 2π proportional counter.

7.0 GERMANIUM GAMMA-RAY SPECTROMETER SYSTEM CALIBRATIONS

The RML Ge detectors and associated electronics are setup and calibrated in accordance with the applicable requirements stated in the American National Standards Institute (ANSI) standard N42.14, "Calibration and Use of Germanium Detectors for Measurements of Gamma-ray Emission of Radionuclides".

The gamma-ray full energy peak efficiency curves and tables are measured from the emission rates of gamma-rays from standards obtained from reputable metrology laboratories (e.g., NIST, Analytix, Amersham, etc.). The standards are of the same type and geometry as the samples. RML efficiency curves typically span a useable energy range from 60 keV to 3000 keV and are established for a wide variety of geometries. The efficiency curves are normally determined interactively by a specialized VAX computer program that analyzes the Reference Standard spectrum, generates a table of experimental results from the analysis, fits a basic polynomial curve to the experimental efficiency data, allows interactive editing and refinement of the curve (efficiency versus energy) by displaying the curve on the work-station monitor screen (i.e., Megatek) in three different formats. The formats are displayed as a full scale log/log plot of efficiency vs. energy, linear plot of the low energy region (<400 keV) of efficiency correction factor vs. energy, and a linear plot that displays the energy region above 200 keV in the form of efficiency times energy (function $Y = \text{EFF}(\text{ENERGY}^{-\text{slope}})$ vs. energy.

This latter efficiency plot allows a more sensitive view of the efficiency curve as a function of energy and can be interactively edited to refine the final efficiency curve. A complete description of this utility program can be found in "An Operator's Guide to VAXGAP". RML Procedure DM-12: "Efficiency Curve Generation on the RML VAX-11/750" describes the computerized methods of generating efficiency curves and tables. Appendix J presents a typical computer generated efficiency curve showing the three formats.

The option to generate efficiency curves by hand also exists; however, this method shall be used only by senior radiation measurements experts. Data points used to form an efficiency table are taken from a hand-drawn curve and manually entered into the VAX computer. The VAX displays the curve determined by the manually entered values. The curve can be edited and refined by adding, deleting or changing data point values until the analyst is satisfied with the curve shape and results. In no case shall a curve be arbitrarily changed in such a way as to ignore the measured efficiency values. The curve and a computer-generated table are saved on the VAX computer.

The RML has calibrations for the following standardized geometries:

1. Water - 60 ml and 540 ml poly bottles, 1 liter and 4 liter Marinelli beakers.
2. Air - 2" and 4" dia. particulate filters, charcoal and AgX cartridges.
3. Gas - 15200 cc pressurized sample container for noble gases.
4. Soil - 100 cm³ and 500 cm³ plastic vials and squat jars.
5. Vegetation - 500 cm³ plastic squat jars.
6. Small Mammals - 500 cm³ squat jars.
7. Point Source - Sample size depends on intensity and source-to-detector distance.
8. Others - Special arrangements can be made.

8.0 RML GROSS ALPHA/BETA DETECTION SYSTEM CALIBRATION

The RML Tennelec low-background gas proportional alpha/beta detection system was initially set up and tested by the manufacturer. The detector operating voltages are determined by running a plateau of counts/minute versus high voltage on both alpha and beta modes annually. The detector efficiency for alpha was established with a ^{241}Am reference standard and the beta efficiency was established with a ^{137}Cs reference standard. A description of the calibration and operating procedure can be found in RML Procedure RML-5: "RML Gross Alpha-Beta Counting System". Efficiencies for air filters and dried liquids have also been determined from standards prepared by Radiochemistry.

9.0 RML SAMPLE ANALYSES REQUEST, CUSTODY AND TRACKING

Samples to be analyzed by the RML/Radiochemistry Unit should be accompanied by a "RML/Radiochemistry Analyses Request/Custody Form" (see Appendix K). This is a dual purpose form that informs the RML what type of analyses is to be performed, including all the pertinent information necessary to analyze the sample, and serves as a sample custody/tracking device. A copy of the form will be available to each section performing analyses. Customers that have their own unique request, custody and tracking forms must have them reviewed by the RML prior to sending samples, to verify that it can be satisfactorily used in the RML system. The facility requesting analyses should assign a unique ID to its sample (≤ 12 characters), which carries through each analyses process. In addition, the RML records the sample and tracking information on their "Sample and Counting Information" log (Appendix L). These RML logsheets contain all the sample information used in the gamma-ray analysis, the unique RML ID assigned, the sample tracking ID and who the sample was forwarded to for additional analyses.

Radioactive samples above 10CFR20 Appendix C delivered to the RML shall have a radiation/contamination label on the sample as well as the activity levels stated on the request/custody form. Radioactive samples should be coordinated with RML Operations, Data Management or technical staff personnel prior to collection and delivery so that proper standardized geometries can be utilized and to determine methods for sample handling and to identify where samples should be stored. Radioactive samples arriving from areas outside TRA are delivered to the MTR HP office unless the sample activity is below levels requiring shipment papers. These latter samples can be delivered directly to RML personnel. Samples of higher activity that are sent with shipment papers need to be checked at the MTR HP office for direct radiation and also for external contamination.

The RML will not accept samples for routine analysis that have a gamma radiation reading >200 mr/hr at 6 inches and/or any external contamination present. Samples that exceed these requirements require that special arrangements be made with RML Operations personnel prior to delivery for handling and analysis.

The custody of a sample is transferred to the RML after it has been accepted by a member of the RML Operations Section. It is recorded on the accompanying Sample Analyses Request/Custody Form. The analyses request section of the form is reviewed by RML Operations personnel to verify that all required information associated with the sample is provided. The RML reserves the right to return a sample to the customer if the proper information is not provided.

When a sample is ready to be counted/analyzed, the appropriate sample information from the Analyses Request/Custody Form is transcribed on the RML Sample and Counting Information Log Sheet. The RML assigns a unique identification number and records the unique sample identification number assigned by the customer. The Sample and Counting Information Log also contains the sample name, collection date/time, counting date/time, spectrometer system used, sample volume/weight, source-to-detector distance used, efficiency table number, analyses requested, etc. When the RML has completed the gamma analyses, the gamma analysis section on the Analyses Request/Custody Form is signed/dated as completed. The sample and a copy of the Analyses Request/Custody Form are forwarded to the appropriate radiochemist if further analyses are requested. The name of the radiochemist and the date the sample is forwarded is recorded on the Analyses Request/Custody Form to aid in sample tracking.

10.0 RML MEASUREMENT, ANALYSIS, REPORTING PROCEDURES AND METHODS

The RML counts and analyzes approximately 800-1000 samples for gamma-ray emitting radionuclides per month in a variety of geometries and matrices. The different types of samples counted, analyzed, QA'd and reported by the RML are done in accordance with documented procedures. A list of these procedures is shown in Appendix M. All procedures for RML Operations, RML Data Management, and miscellaneous documents are kept in the Document Control Center in the Data Management office. Procedures are reviewed annually.

Gamma-ray spectral analyses are generally performed with computer analysis programs on the VAX-11/750 computer. The analysis program used is generally dictated by the sample type and/or the analysis required or requested. The analysis method (program) utilized by the analyst is normally stated in the RML procedure that is being used to analyze a particular sample. All computer analysis routines have been thoroughly tested and QA checked to insure that they give the correct results. Available computer analysis programs are described in "An Operator's Guide to VAXGAP: A Gamma-Ray Spectrum Analysis Package for a VAX Computer" or in specific procedures. A description of the analytical models and algorithms for gamma-ray spectrometry can be found in "VAXGAP: A Code for the Routine Analysis of Gamma-Ray Pulse-Height Spectra on a VAX Computer". The computer libraries used for a gamma-ray analysis are normally stated in the specific procedures. The libraries perform the functions of identification of radionuclides, gamma-ray interference corrections and directing peak fitting to specific gamma-ray energies of interest.

Sample counting, analysis and reporting are typically handled in a four-step process. First, sample and analysis information is verified on the Analyses Request/Custody Form and recorded in the Sample and Counting Information Log by the Operations Section. Second, the sample is counted in the proper geometry and analyzed by the Operations Section. Third, computer spectral analysis results requiring a formal QA of the data and results are carefully re-examined and verified by the Data Management Section. Large sets of samples (e.g., environmental and some effluent samples) that require computer generated reports are batch analyzed, examined and evaluated by the Data Management Section. Analysis results are checked to verify the correctness of the input parameters and to scrutinize questionable spectral results. Questionable results are those results that do not satisfy requirements in RML Procedure "DM-1: Evaluation and Verification of Data for Radionuclide Identification/Selection", -or that of the analyst. Individual photopeak fits can be re-examined and evaluated with the aid of computer spectral graphics techniques. Sample analysis results are checked against the quoted RML detection limits (Appendix N). Gamma-ray summary results and routine reports are computer generated and are reported by either the Operations or Data Management Section depending on the sample origin. Normally, routine reactor support analysis results are reported by the Operations Section. Effluent, environmental, QA/QC data and many non-routine sample results are reported by the Data Management Section. Results transmitted to most customers are sent in the form of a letter, Internal Technical Report or formal computer-generated reports. All results reported by letter, Internal Technical Report or formal computer-generated reports are approved by a senior staff member or a designated alternate (radiation measurements expert).

The criteria for examining, evaluating and verifying the correctness of the counting, analysis and reporting of data is either described in the procedures specific to the sample type and the operation performed or is based on the experience of the senior staff. The criteria for the final approval is primarily based on the experience, knowledge and insight of the senior staff.

The uncertainties reported by the RML are expressed as one estimated standard deviation unless otherwise specified. Summary results that originate directly from the computer analysis (VAXGAP) show only the uncertainties in the determination of the photopeak parameters (i.e., peak position, area and width). A description of how the photopeak fitting process determines the uncertainties associated with the peak parameters can be found in "VAXGAP: A Code for the Routine Analysis of Gamma-Ray Pulse-Height Spectra on a VAX Computer" (EG&G-2533). Environmental data and sample data of non-routine nature are reported with a total uncertainty. The total uncertainty reported by the RML typically includes the uncertainty in the peak parameters defining the net area, sample geometry and detector efficiency. These uncertainties are propagated in quadrature and are expressed as one estimated standard deviation. If and when other uncertainties are identified and quantified, they will be included in the calculation of the total uncertainty. The process used to

define and propagate the uncertainties is stated in the data report or letter. The following equation describes how the total uncertainty is propagated:

$$\sigma_T = \sqrt{\sigma_p^2 + \sigma_E^2 + \sigma_G^2 + \dots + \sigma_n^2}$$

where

- σ_T = Total uncertainty - one estimated standard deviation (sigma).
- σ_p = Uncertainty associated with peak parameters defining net area.
- σ_E = Uncertainty associated with peak efficiency.
- σ_G = Uncertainty associated with sample geometry/matrix.
- σ_n = Uncertainties of any other identified/quantified parameters (e.g., flow rate measurements).

The number of significant figures quoted for the measured values in the data report is determined by the uncertainty. If the first digit of the standard deviation is a "one", then two digits in the standard deviation are reported. The measured activity value must reflect the same number of decimal places as the standard deviation [e.g., (3.11 ± .13)E-10 or (4.7 ± 1.4)E-10]. If the first digit of the standard deviation is "other than a one", then one digit in the standard deviation is reported. The measured activity value must reflect the same number of decimal places as the standard deviation [e.g., (1.7 ± .4)E-10 or (7 ± 3)E-10]. This technique is not applied to computer-generated reports at this time. Only reports manually generated include this method.

11.0 COMPUTER SECURITY

In order to ensure that appropriate administrative, technical, physical and personnel safeguards and procedures are maintained on the RML computer systems when processing sensitive unclassified information an Assistant Computer Protection Program Manager (ACPPM) has been appointed by the Safeguards and Security Division's Computer Protection Program Manager. Presently, the ACPPM for the RML computers is C. L. Rowsell. The responsibilities of the ACPPM are described in the Computer Protection Program Procedures Manual and include, but are not limited to, implementation of a Contingency Plan for use during disaster recovery situations. This plan is presently under development.

RML QUALIFICATION CHECKLIST

NAME _____ DATE _____

SectionInitials

I. RECEIVING SAMPLES

- A. Is familiar with and understands the use of RML "analyses request" forms. _____
- B. Is familiar with the radiological checks that are necessary prior to receiving samples in the RML. _____
- C. Understands storage locations for incoming samples. _____

II. SAMPLE PREPARATION and HANDLING

- A. Is familiar with radiological control procedures. _____
- B. Knows how sample information and data is recorded and saved. _____
- C. Knows how to prepare standard liquid samples for counting. _____
- D. Knows how to prepare various point-source type samples for counting. _____
- E. Knows how to prepare Continuous Air Monitor (CAM), High Volume (HV) and charcoal air filters for counting. _____
- F. Knows how to prepare gas samples for counting. _____
- G. Knows how to prepare soil samples for counting. _____
- H. Knows how to use the RML analytical balances. _____
- I. Knows how to store and/or dispose of various sample types after counting/analyses. _____

Section

III. OPERATION OF RML COUNTING and ANALYSES EQUIPMENT

A. Gamma Spectrometers:

1. Knows how to operate all RML Ge(Li) detector systems. --- ..
2. Knows how to operate the NaI(Tl) system. --- ..
3. Knows how to operate the Hot Cell/RML gamma scanner system (Not required for general qualification). --- ..
4. Knows how to operate the ILF/RML-east environmental counting/ analysis system (Not required for general qualification). --- ..
5. Knows how to operate the portable germanium detector multi-channel analyzer system (Not required for general qualification). --- ..
6. Knows how to set up and operate the remote "real time" on line monitors (STACK, RBHT, PCS). --- ..

B. Miscellaneous Counting Equipment:

1. Knows how to operate the Gas-Proportional Alpha-Beta thin window smear counter. --- ..
2. Knows how to operate the Four-Channel Gas Proportional Alpha-Beta thin window automatic counter. --- ..
3. Knows how to operate the Flux Monitor Wire Scanners. --- ..
4. Knows how to operate the Liquid Scintillation Spectrometer. --- ..
5. Knows how to operate the TENNELEC low background Alpha-Beta counting system. --- ..
6. Knows how to operate the High Pressure Ionization Chamber. --- ..
7. Knows how to operate the Hi-range Gamma Ionization Chamber. --- ..
8. Knows how to operate the X-ray Fluorescence system (Not required for general qualification). --- ..
9. Knows how to operate the Alpha Spectrometer System (Not required for general qualification). --- ..

10. Knows how to operate the KAPL Hydrica Foil Counting System. _____

C. DATA ACQUISITION and COMPUTER ANALYSES EQUIPMENT:

1. Knows how to operate various data acquisition equipment _____
2. Knows how to operate various RML computer systems. _____

D. SAMPLE DATA

1. Knows how to interpret the results of the analysis. _____
2. Knows how to properly report the data. _____

APPENDIX B

THORIUM CALIBRATION-RML VAX-750 29-MAR-1989 08:26:54.17

DETECTOR SYSTEM: A1

ZERO= -1.6114

ENERGY= 0.1390+ 0.37052(X)+ 1.42138E-08(X)**2

WIDTH= 2.613+ 7.1444E-04(X)

ERROR MATRIX: 9.825920E-06 1.285314E-11 2.518408E-19 -9.992973E-09 1.285765E-12 -1.633015E-15

CHANNEL	ENERGY	CAL. ENG	D-ENG	WIDTH
645.240	238.624	238.624	0.000	3.10
1575.057	583.174	583.173	0.001	3.83
2323.525	860.530	860.539	-0.009	4.27
4174.605	1620.700	1620.708	-0.008	5.47
7055.493	2614.476	2614.475	0.001	7.79

C-99

APPENDIX C

RM QUALITY CONTROL DATA SHEET

GAMMA W/ASIRIWNIS

(TU 15Z P1W-39Z /G)

RM INTERNAL QA PROGRAM

MARCH

INJECTION	RM SAMPLE	ID	SAMPLE	EO-152	KNOWN ACTIVITY (DPS)	RM ACTIVITY (stat)	% ERR	RM UNCERTAINTY (DPS)	RM/RKNOW	RATIO	QC	REVISIONS	COMMENTS
AL (Pg. 8)	001490019	3/14/89	MEAN	2.79E+05	2.82E+05	0.25	6.35E+03	1.01	1				
				2.79E+05	2.82E+05	0.53	6.41E+03	1.01	1				
				2.79E+05	2.73E+05	0.60	6.32E+03	0.98	1				
				2.79E+05	2.80E+05	1.12	7.20E+03	1.03	1				
				2.79E+05	2.79E+05	1.408							

RM UNCERTAINTY is the total uncertainty resulting from the statistical, sample geometry(1%) and detector efficiency(2%). These uncertainties have been propagated in quadrature and are expressed as one estimated standard deviation.

NOTE (QC REVISIONS) 1 = "IN CONTROL" (< or = 2 standard deviations from the known) 1w = "IN CONTROL - warning" (>2 std.dev., <3 std.dev. from the known) 0 = "OUT OF CONTROL" (> or = 3 standard deviations from the known)

Criteria of 1 or = 3 standard deviations is from the Conference on Quality Assurance for Environmental Measurements sponsored by the ASTM, EPA and NBS - 1985 Proceedings ("Quality Assurance for Environmental Measurements") by Taylor/Stanley pg 400

APPENDIX D

TENNELEC BACKGROUND AND QA CHECK
1988
10-MINUTE COUNTS

	AVERAGE			STANDARD DEVIATION			RUNNING AVERAGE		
	ALPHA	BETA	CS-137 STD	ALPHA	BETA	CS-137	ALPHA	BETA	CS-137
1ST JAN	4.5	29.0	99785	1.2	5.7		4.5	29.0	99785
2ND JAN	3.3	29.8	99752	1.3	7.2	17	3.9	29.8	99789
1ST FEB	4.1	32.2	100098	1.8	8.5	156	4.0	29.9	99878
2ND FEB	4.8	27.3	100066	1.5	7.8	158	4.1	29.2	99925
1ST MAR	3.5	27.3	99538	1.7	5.3	209	3.9	28.8	99648
2ND MAR	3.8	29.4	99484	1.3	4.9	234	4.0	29.1	99787
1ST APR	4.4	29.6	99865	2.1	4.2	218	4.0	28.9	99738
2ND APR	3.2	27.9	98511 *	0.7	8.5	472	3.9	28.7	99637
1ST MAY	3.3	29.8	100194	1.6	3.5	478	3.8	28.5	99669
2ND MAY	2.3	29.4	99231	1.3	4.5	475	3.7	28.2	99652
1ST JUN	2.5	26.3	99535	0.8	8.3	454	3.5	28.0	99642
2ND JUN	1.9	28.7	99339	0.9	3.9	443	3.4	27.9	99617
1ST JUL	3.8	27.9	99840	2.0	8.7	422	3.4	27.8	99611
2ND JUL	3.2	28.4	99319	1.2	4.5	433	3.4	27.8	99694
1ST AUG	1.8	20.5	99384	1.4	3.4	411	3.5	27.5	99666
2ND AUG	3.6	24.8	99492	1.4	5.9	399	3.5	27.3	99630
1ST SEP	4.0	32.0	99334	1.7	21.2	392	3.5	27.5	99575
2ND SEP	3.1	32.4	99436	1.4	14.9	382	3.5	27.5	99567
1ST OCT	3.3	29.9	99729	1.2	12.3	374	3.6	27.6	99575
2ND OCT	3.3	28.3	99344	1.2	10.3	368	3.5	28.0	99564
1ST NOV	4.5	27.1	98703 *	1.8	4.7	403	3.5	27.9	99523
2ND NOV	3.6	27.2	98646 *	1.5	6.6	434	3.5	27.9	99483
1ST DEC	3.8	25.6	99160	1.3	6.0	430	3.5	27.8	99469
2ND DEC	3.8	25.0	99089	1.2	5.5	427	3.5	27.7	99453
RUN AVG	3.5	27.7	99453	1.4	7.3	356	3.7	28.2	99652
STD DEV	0.7	2.3	427						

NOTE: * INDICATES A VALUE OUT OF STATISTICAL RANGE (2 sig) OF AVG RUNNING AVG.

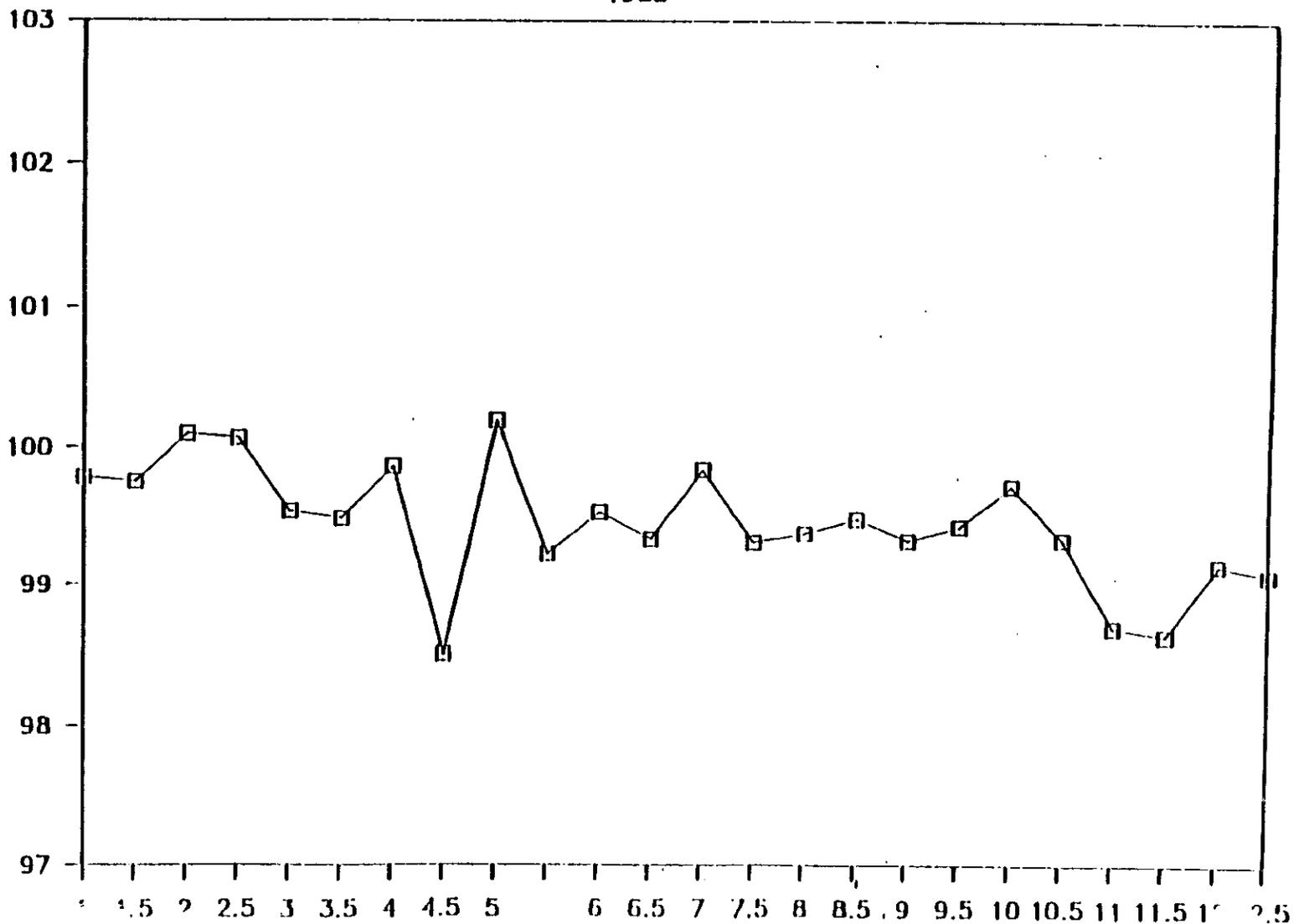
CS-137 STD. DECAY CORRECTED TO REFERENCE DATE 4/1/85.

TENNELEC CS-137 STANDARD

1988

C-104

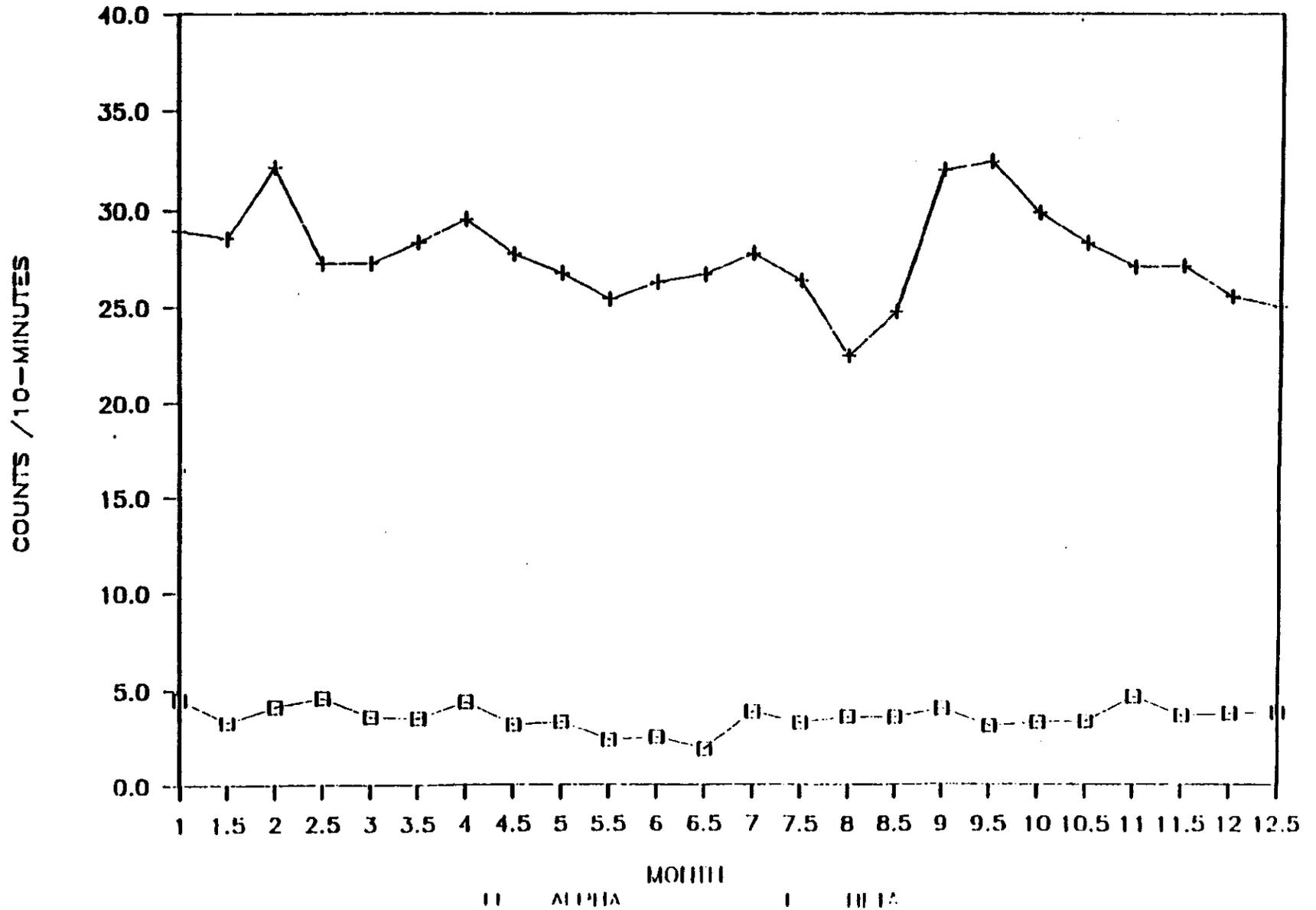
COUNTS / 10-MINUTES
(Thousands)



TENNELEC BACKGROUND DATA

1988

C-105



APPENDIX E
ENVIRONMENTAL MONITORING QC PROGRAM

C-107

SAMPLE PREPARATION DATE	SAMPLE ID	RADIO NUCLIDE	NUMBER PREVIOUS AGREEMENTS	NUMBER PREVIOUS DISAGREEMENT	STD CONC. ($\mu\text{Ci/g}$)	LAB MEAS. ($\mu\text{Ci/g}$)	LAB 1 SIGMA ($\mu\text{Ci/g}$)	LAB RESOL.	RATIO LAB/STD	AGREEMENT CRITERIA		ACCUMULATIVE NUMBER TIMES	
										LOWER	UPPER	AGREE	DISAGREE
2/2/89	DBR00502	Mn-54			1.45E-05	1.55E-05	1.1E-06	14	0.91	0.60	1.66	1	0
		Co-60			1.24E-05	1.12E-05	8E-07	14	0.90	0.60	1.66	1	0
		Cs-137			2.03E-05	1.86E-05	1.3E-06	14	0.92	0.60	1.66	1	0
		Ce-144			1.73E-04	1.52E-04	1.1E-05	14	0.88	0.60	1.66	1	0
		Am-241			1.110E-04	9.91E-05	7.4E-06	13	0.89	0.60	1.66	1	0
2/2/89	DBR00501	Mn-54			1.15E-06	1.06E-06	9E-08	12	0.92	0.60	1.66	1	0
		Co-60			8.98E-07	7.70E-07	6.9E-08	11	0.86	0.60	1.66	1	0
		Cs-137			9.33E-07	7.96E-07	7.3E-08	11	0.85	0.60	1.66	1	0
		Ce-144			4.9E-06	4.60E-06	3.7E-07	12	0.94	0.60	1.66	1	0
		Am-241			3.56E-06	3.27E-06	4.1E-07	13	0.95	0.60	1.66	1	0

Appendix F

RM QUALITY CONTROL DATA SUMMARY

GAMMA MEASUREMENTS

ENVIRONMENTAL MONITORING PROGRAM

----- (SOIL) -----

ESPID	NM SAMPLE ID	SAMPLE PREP. DATE	RADIO-NUCLIDE	KNOWN ACTIVITY (uCi/gm)	RM ACTIVITY (uCi/gm)	RM UNCERTAINTY (uCi/gm)	RM/KNOWN RATIO	QC RESULTS	COMMENTS
BBR08S01	A5020789012	02/02/89	Mn-54	1.15E-06	1.06E-06	8.00E-08	0.92	I	NONE
			Co-60	8.98E-07	7.70E-07	6.90E-08	0.86	I	
			Cs-137	9.33E-07	7.96E-07	7.30E-08	0.85	I	
			Ce-144	4.90E-06	4.60E-06	3.70E-07	0.94	I	
			Am-241	5.56E-06	5.27E-06	4.10E-07	0.95	I	
BBR08S02	A6020789013	02/02/89	Mn-54	1.65E-05	1.55E-05	1.10E-06	0.94	I	NONE
			Co-60	1.24E-05	1.12E-05	8.00E-07	0.90	I	
			Cs-137	2.03E-05	1.86E-05	1.30E-06	0.92	I	
			Ce-144	1.73E-04	1.52E-04	1.10E-05	0.88	I	
			Am-241	1.11E-04	9.91E-05	7.40E-06	0.89	I	
BBR08S03	A5020789024	02/02/89	None	BLANK	ND	ND			

RM UNCERTAINTY is the total uncertainty resulting from the statistical, sample geometry(5%) and detector efficiency(5%). These uncertainties have been propagated in quadrature and are expressed as one estimated standard deviation.

NOTE QC RESULTS I = "IN CONTROL" (< or = 2 standard deviations from the known)
 Iw = "IN CONTROL -warning" (>2 std dev., <3 std dev. from the known).
 O = "OUT OF CONTROL" (> or = 3 standard deviations from the known).

Criteria of + or - 3 standard deviations is from the Conference on Quality Assurance for Environmental Measurements sponsored by the ASTM, EPA and NBS - 1985 Proceedings ("Quality Assurance for Environmental Measurements") by Taylor/Stanley - pg 400

To: U.S. Environmental Protection Agency
 Environmental Monitoring Systems Laboratory
 Nuclear Radiation Assessment Division
 Radioanalysis Branch
 Quality Assurance Group
 P.O. Box 93478
 Las Vegas, Nevada 89193-3478

APPENDIX G

2/13/89

Please include our laboratory in the cross-check studies we have indicated below.
 All samples are to be shipped to:

Contact Person Robert J. Gehrke
 Title Unit manager
 Laboratory Radiation Measurements Laboratory / EG&G Idaho Inc.
 Address Idaho National Engineering Laboratory
 Address(cont.) P.O. Box 1625, Idaho Falls, Idaho 83415
 Telephone No. (208) 526-7155
 NRC License and/or State License Type(s) Government National Lab.
 Number(s) DE-AC07-76-01570

Note: When requesting participation in a study containing either nuclear by-products or special nuclear materials, a copy of the NRC license(s) must accompany the request.

Please indicate the desired frequency of participation.

Frequency Desired .Frequency Desired
Please make the following changes for us. We are half- $T_{1/2}$ = 0.5 $T_{1/2}$ annually

WATER:		WATER: (continued)
Gamma	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Mixed Alpha, Beta, Gamma (Blind Performance Sample) <input type="checkbox"/> <input type="checkbox"/>
Iodine-131	<input checked="" type="checkbox"/> <input type="checkbox"/>	
Gross Alpha, Gross Beta	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	MILK:
Tritium	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Strontium, Gamma <input type="checkbox"/> <input type="checkbox"/>
Radium-226, Radium-228	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
Plutonium-239	<input checked="" type="checkbox"/> <input type="checkbox"/>	AIR FILTER:
Strontium-89, Strontium-90	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Gross Alpha, Gross Beta, Cesium-137, Strontium-90 <input checked="" type="checkbox"/> <input type="checkbox"/>
Natural Uranium	<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>	

I certify this Laboratory is authorized to receive the samples requested.

Signature Robert J. Gehrke Date 2/13/89
 Title unit manager

APPENDIX H

ENL-17 INTERCOMPARISON TEST RESULTS
LABORATORY CA
1988

EXPERIMENTAL SIGMA = standard deviation of the three laboratory results.
PRECISION = expected laboratory precision (95% determination).
SR-PC = guard ring proportional counter.
SI-SP = germanium gamma-ray spectrometer.
S-SI = surface barrier silicon alpha spectrometer.
LSC = liquid scintillation counter.

NOTE: * indicates outside laboratory control program.

LIS DATA	SAMPLE DATA	TEST DATA	NUCLIDE	RML RESULT	EXPERIMENTAL SIGMA	AVERAGE
DETECTOR: SR-PC	TEST DATE: 010888	KNOWN VALUE: 30.00	Sr-89	NO DATA PROVIDED		
CHEMISTRY: YES	SAMPLE: LIQUID	PRECISION: 5.00				
ANALYST: CHM	VOLUME: 2 l	UNITS: dCi/l				
		KNOWN VALUE: 15.00	Sr-90	14.0	15.0	15.00
		PRECISION: 1.50				
		UNITS: dCi/l				
DETECTOR: SR-PC	TEST DATE: 010888	KNOWN VALUE: 4.00	GROSS ALPHA	2.0	3.00	4.00
CHEMISTRY: NO	SAMPLE: LIQUID	PRECISION: 5.00				
ANALYST: CHM	VOLUME: 700 ml	UNITS: dCi/l				
		KNOWN VALUE: 5.00	GROSS BETA	2.0	4.0	5.00
		PRECISION: 5.00				
		UNITS: dCi/l				
DETECTOR: SI-SP	TEST DATE: 010888	KNOWN VALUE: 85.00	Cs-137	85.0	85.0	85.00
CHEMISTRY: NO	SAMPLE: LIQUID	PRECISION: 5.00				
ANALYST: RML	VOLUME: 4 l	UNITS: dCi/l				
		KNOWN VALUE: 94.00	Cs-134	97.0	99.0	97.00
		PRECISION: 9.40				
		UNITS: dCi/l				
		KNOWN VALUE: 105.00	Ru-106	102.0	98.0	100.00
		PRECISION: 10.50				
		UNITS: dCi/l				
		KNOWN VALUE: 54.00	Cs-134	55.0	55.0	55.00
		PRECISION: 5.00				
		UNITS: dCi/l				
		KNOWN VALUE: 94.00	Cs-137	95.0	97.0	96.00
		PRECISION: 5.00				
		UNITS: dCi/l				

APPENDIX I

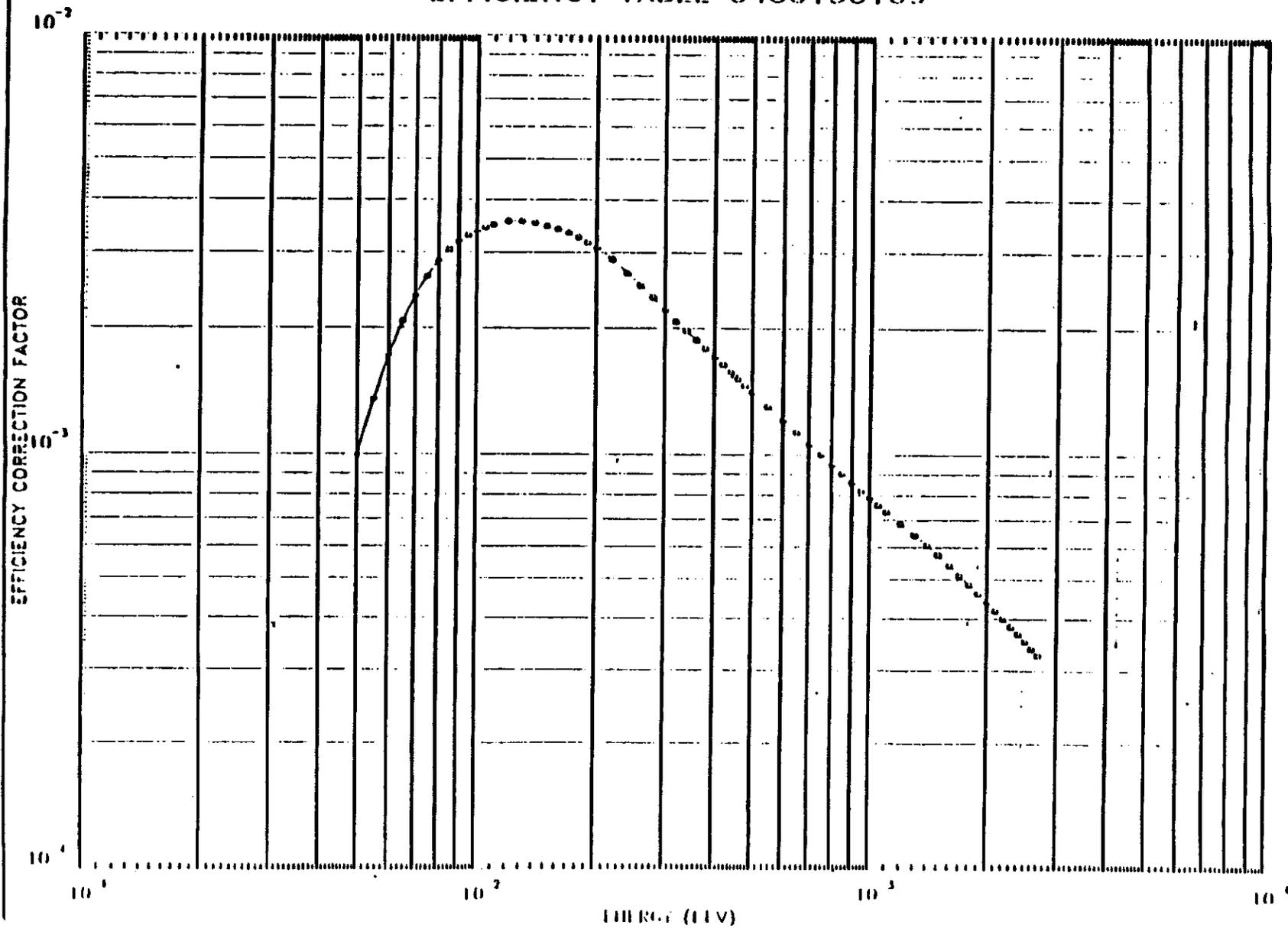
RESL
INELDA INTERCOMPARISON TEST RESULTS
CYBER ANALYSIS

NOTE: Ratio of LAB/KNOWN results for "KNOWN" activity equals 1.000.

TEST DATA		NUCLIDE OR ENERGY	RML RESULT	RML TOT UNC.	RATIO RML/KNOWN	"RML" RATIO UNC.	KNOWN ACTIVITY	KNOWN TOT UNC.	"KNOWN" RATIO UNC.
TEST NO.:	23	Cr-51	1.16E-01	4.00E-03	0.984	0.046	1.16E-01	4.00E-03	0.048
SAMPLE:	LIQUID	Mn-54	3.96E-03	1.90E-04	0.986	0.055	6.05E-03	2.80E-04	0.065
ORIGIN:	RESL	Co-58	1.28E-02	4.00E-04	0.986	0.049	1.30E-02	5.00E-04	0.054
REF. DATE:	111887	Fe-59	2.52E-02	8.30E-04	0.987	0.057	2.55E-02	1.20E-03	0.067
UNITS:	uCi/g	Co-60	1.07E-02	3.00E-04	0.987	0.041	1.08E-02	3.00E-04	0.039
		Zn-65	3.24E-02	1.00E-03	0.977	0.047	3.32E-02	1.20E-03	0.051
		Cs-134	2.50E-02	8.00E-04	1.022	0.057	2.45E-02	1.10E-03	0.063
		Cs-137	2.04E-02	6.00E-04	0.992	0.042	2.06E-02	6.00E-04	0.041
		Ce-141	2.04E-02	6.00E-04	0.945	0.049	2.16E-02	9.00E-04	0.059
		Ce-144	1.76E-02	6.00E-04	0.960	0.050	1.83E-02	7.00E-04	0.054

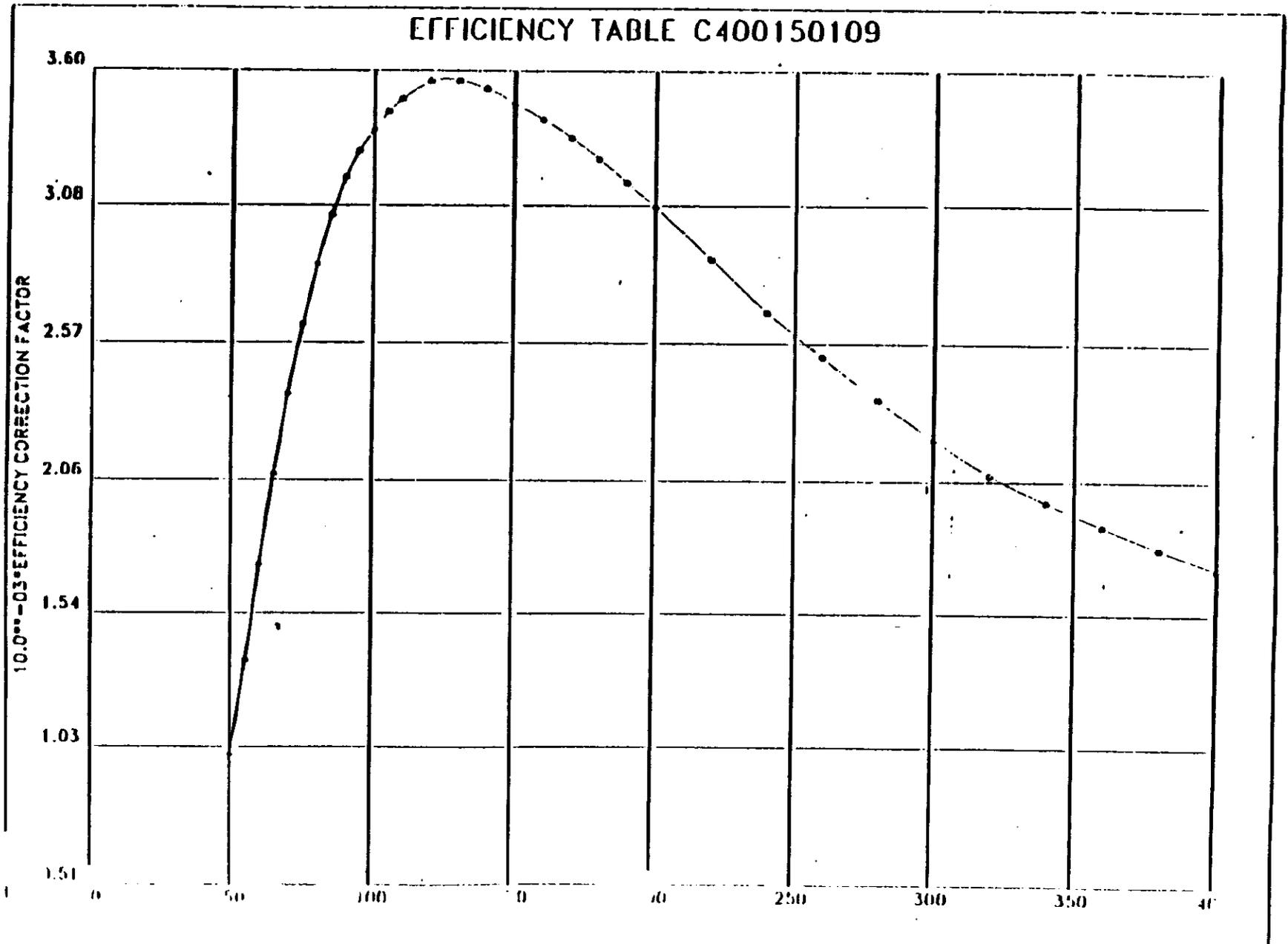
APPENDIX J

EFFICIENCY TABLE C400150109

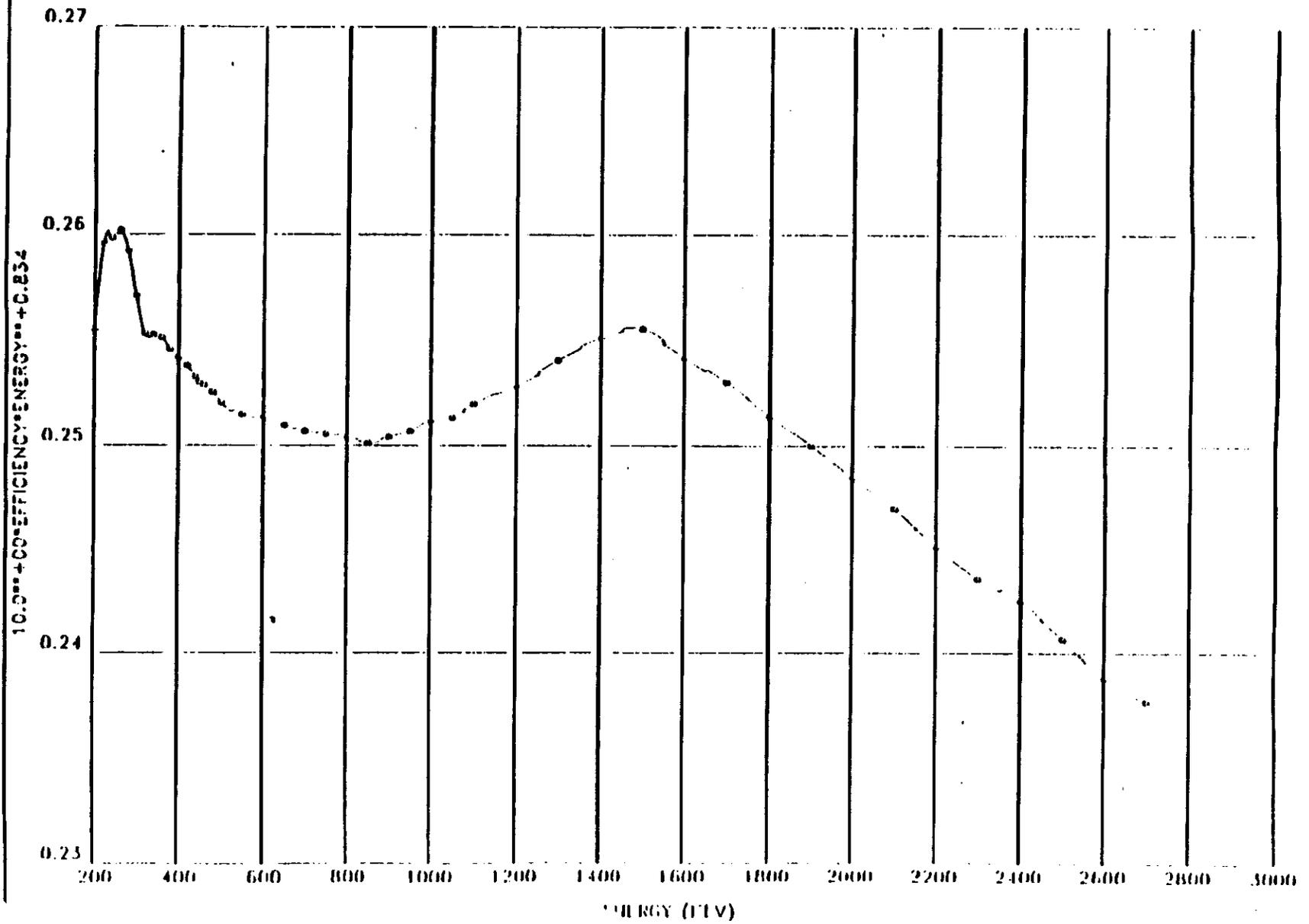


C-117

C-118



EFFICIENCY TABLE C400150109



C-119

RML/RADIOCHEMISTRY ANALYSIS REQUEST/CUSTODY FORM
PHONE: 6-4177 / 6-4182

ONE SAMPLE PER SHEET!

SAMPLE NAME OR DESCRIPTION: _____

FACILITY/AREA SAMPLE ID #: _____

REQUESTING FACILITY: _____ SEND RESULTS TO: _____

SUBMITTED BY: _____ EXT.: _____

REQUESTOR, PLEASE CHECK
TYPE OF ANALYSES DESIRED:

- _____ Isotopic gamma scan
- _____ Gross alpha/beta
- _____ Strontium beta
- _____ Tritium
- _____ Actinide
- _____ Other _____

R * _____ *
M * DATE RECEIVED: _____ *
L * INITIAL: _____ *
/ * _____ *
C * DATE _____ *
H * COMPLETED INITIAL _____ *
E * _____ Gamma _____ *
M * _____ A/Beta _____ *
* _____ Sr-90 _____ *
U * _____ H-3 _____ *
S * _____ Actinide _____ *
E * _____ Other _____ *
* _____ *
O * FORWARDED TO: _____ *
N * DATE: _____ *
L * _____ *
Y *****

REQUESTOR, PLEASE FILL IN APPROPRIATE INFORMATION BELOW:

- Activity (mr/hr): _____
- Sample On (time & date): _____
- Sample Off (time & date): _____
- Collection time (hrs): _____
- No. of cans in envelope: _____
- Stack flow (cfm): _____
- Filter flow (cfm): _____
- Filter fraction (%): _____
(Area used)
- Effluent volume (gal.): _____
(Total gal. discharged)

REMARKS: _____

RADIATION MEASUREMENTS LABORATORY - SAMPLE AND COUNTING INFORMATION

Sample: NAME _____ Transferred Analyzed
 ESPID or S.T. # ID _____ ID _____ CODE _____
 Sample/Filter (In Time) _____ Date _____ Irradiation Time (HRS) _____
 Sample Count Started: Time _____ Date _____ Count Time (MIN) _____
 Detector # _____ Distance (cm) _____ Sample Volume _____ Volume Units _____
 Eff. Corr. Factor _____ Efficiency Table _____ Analyst _____
 Additional Analyses Requested: _____ Remarks: _____
 No. of CAMS _____ None _____
 Stack Flow (CFM) _____ Gross Alpha _____
 Filter Flow (CFM) _____ Gross Beta _____
 Coll. Time (HRS) _____ Sr _____
 Filter Frac. (%) _____ H-3 _____
 Reactor Power (MW) _____ _____
 Effluent Volume (GAL) _____ Stored _____
 Date Received _____ Dumped or _____
 _____ Disposed of _____
 Sample Forwarded to _____ Date _____

Sample: NAME _____ Transferred Analyzed
 ESPID or S.T. # ID _____ ID _____ CODE _____
 Sample/Filter (In Time) _____ Date _____ Irradiation Time (HRS) _____
 Sample Count Started: Time _____ Date _____ Count Time (MIN) _____
 Detector # _____ Distance (cm) _____ Sample Volume _____ Volume Units _____
 Eff. Corr. Factor _____ Efficiency Table _____ Analyst _____
 Additional Analyses Requested: _____ Remarks: _____
 No. of CAMS _____ None _____
 Stack Flow (CFM) _____ Gross Alpha _____
 Filter Flow (CFM) _____ Gross Beta _____
 Coll. Time (HRS) _____ Sr _____
 Filter Frac. (%) _____ H-3 _____
 Reactor Power (MW) _____ _____
 Effluent Volume (GAL) _____ Stored _____
 Date Received _____ Dumped or _____
 _____ Disposed of _____
 Sample Forwarded to _____ Date _____

Sample: NAME _____ Transferred Analyzed
 ESPID or S.T. # ID _____ ID _____ CODE _____
 Sample/Filter (In Time) _____ Date _____ Irradiation Time (HRS) _____
 Sample Count Started: Time _____ Date _____ Count Time (MIN) _____
 Detector # _____ Distance (cm) _____ Sample Volume _____ Volume Units _____
 Eff. Corr. Factor _____ Efficiency Table _____ Analyst _____
 Additional Analyses Requested: _____ Remarks: _____
 No. of CAMS _____ None _____
 Stack Flow (CFM) _____ Gross Alpha _____
 Filter Flow (CFM) _____ Gross Beta _____
 Coll. Time (HRS) _____ Sr _____
 Filter Frac. (%) _____ H-3 _____
 Reactor Power (MW) _____ _____
 Effluent Volume (GAL) _____ Stored _____
 Date Received _____ Dumped or _____
 _____ Disposed of _____
 Sample Forwarded to _____ Date _____

APPENDIX M

* RNL PROCEDURES *

RNL - OPERATIONS
.....

PROCEDURE TITLE	NUMBER	VERSION	ISSUE DATE	DISTRIBUTION
ATR LOOP RADIOISOTOPE ANALYSIS.	RNL-1	1	05/02/88	RNL, DM
SUBSURFACE SOIL RADIOANALYTICAL MEASUREMENTS AT IRC-LABCS.	RNL-2	1	06/10/88	IRC, DM
SOIL, VEGETATION AND MAMMAL SAMPLE MEASUREMENTS.	RNL-3	1	10/16/88	RNL, DM
AIR MONITOR FILTER SAMPLE MEASUREMENTS.	RNL-4	1	10/20/88	RNL, DM
GROSS ALPHA-BETA COUNTING.	RNL-5	1	10/25/88	RNL, DM
RNL LIQUID SAMPLE COUNTING/ANALYSIS.	RNL-6	1	10/25/88	RNL, DM
EBERLINE PING-2A CALIBRATION.	RNL-7	1	10/25/88	RNL, DM
RNL FOUR-CHANNEL ALPHA-BETA COUNTING AND ANALYSIS SYSTEM.	RNL-8	1	10/25/88	RNL, DM
RNL ANALYSIS OF X-RAY EMITTING RADIOISOTOPE IN ATR STACK EFFLUENT GAS SAMPLE.	RNL-9	2	11/21/88	RNL, DM
RADIATION MEASUREMENTS LABORATORY TRAINING.	RNL-10	1	10/25/88	RNL, DM
PREPARATION OF STANDARD SOURCE AND CALIBRATION OF FULL ENERGY PEAK EFFICIENCY FOR AIR FILTERS.	RNL-11	1	03/28/89	RNL, DM

* RML PROCEDURES *

RML - DATA MANAGEMENT

PROCEDURE TITLE	NUMBER	VERSION	ISSUE DATE	DISTRIBUTION
EVALUATION AND VERIFICATION OF DATA FOR RADIONUCLIDE IDENTIFICATION/SELECTION.	DM-1	2	04/19/89	RML, DM
RHMIS AIRBORNE EFFLUENT REPORT.	DM-2	2	04/27/89	DM
ATR STACK EFFLUENT REPORT.	DM-3	2	04/21/89	DM
RHMIS LIQUID EFFLUENT REPORT.	DM-4	2	04/27/89	DM
TRA RBHT EFFLUENT REPORT.	DM-5	2	04/20/89	DM
ATR OPERATIONAL HISTORY INFORMATION.	DM-6	1	06/15/89	DM
ENVIRONMENTAL AIR SAMPLE ANALYSIS AND REPORT.	DM-7	1	03/01/88	DM
GROSS ALPHA-BETA AIR SAMPLE ANALYSIS AND REPORT.	DM-8	1	09/01/88	DM
SOIL, VEGETATION AND MAMMAL SAMPLE ANALYSIS AND REPORT.	DM-9	1	09/09/88	DM
RML AND SPING-3A ACTIVITY COMPARISON QA CHECKS.	DM-10	2	10/07/88	DM
WATER AND ASSOCIATED FILTERED MATERIAL ANALYSIS AND REPORT.	DM-11	1	10/14/88	DM
EFFICIENCY CURVE GENERATION	DM-12	1	03/06/89	DM

* MISCELLANEOUS RML DOCUMENTS *

DOCUMENT TITLE	NUMBER	VERSION	DATE	DISTRIBUTION
CONTINGENCY PLAN FOR BACKUP OF THE VAX 750	GEH-44-87	N/A	07/01/87	DM
VAXGAP: A CODE FOR THE ROUTINE ANALYSES OF GAMMA-RAY PULSE-HEIGHT SPECTRA ON A VAX COMPUTER.	EG&G-2533	N/A	05/xx/88	RML, DM
BI-MONTHLY STATUS OF AUDIT FINDINGS FROM OUTSIDE ORGANIZATIONS	LPL-68-88	N/A	08/29/88	DM
OPERATORS GUIDE TO "VAXGAP": A GAMMA-RAY SPECTRUM ANALYSIS SPECTRUM ANALYSIS	ST-CS-027-88	N/A	09/12/88	RML, DM
CALIBRATION AND USE OF GERMANIUM DETECTORS FOR MEASUREMENTS OF GAMMA-RAY EMISSION OF RADIONUCLIDES.	ANSI N42.14	N/A	09/25/88	DM
CLOSURE OF DOE ID EFFLUENT AND ENVIRONMENTAL AUDIT	GEH-95-88	N/A	10/25/88	DM
RECORDS MANAGEMENT PLAN (DOE 1324.2A)	DOE 1324.2A	N/A	01/06/89	DM
RML QUALIFICATION CHECKLIST	N/A	N/A	01/25/89	DM
RML GROSS ALPHA AND GROSS BETA DETECTION LIMITS FOR ENVIRONMENTAL MONITORING	LDK-16-89	N/A	03/01/89	DM

OLD PROCEDURES

RML SOIL SAMPLE ANALYSIS ROUTINES	SOIL-1	N/A	05/18/82	RML, DM
RML AIR FILTER SAMPLE ANALYSIS ROUTINES	AIR-1	N/A	05/18/82	RML, DM
RML LIQUID SAMPLE ANALYSIS ROUTINES	LIG-1	N/A	07/07/83	RML, DM
RML PDP-11/44 SYSTEM TRA HOTCELL SCANNER REMOTE SYSTEM	11/44-9	N/A	08/06/84	RML, DM
RML PDP-11/44 TRA RETENTION BASIN REMOTE SYSTEM	11/44-8	N/A	08/06/84	RML, DM
RML PDP-11/44 SYSTEM DISK ASSIGNMENTS AND BACKUP	11/44-7	N/A	08/06/84	RML, DM

APPENDIX N

Estimated MRL Detection Limits for Environmental Surveillance Program Samples^{a)}

Nuclide	16hr. count time Air Filters ^{b)} ↓				16hr. count time Surface Water ^{c)}				2hr. count time Soil		16hr. count time Dry Veget. ↓		16hr. count time Veg. or Humus in Water	
	High Vol.		Low Vol.		Filtrate		Filtered		450ml Jar		450ml Jar		450ml Jar	
	pCi/cc	pCi	pCi/cc	pCi	pCi/cc	pCi	pCi/cc	pCi	pCi/g	pCi	pCi/cc	pCi	pCi/cc	pCi
Sc-46	5E-10	12	5E-10	3	0.006	25	4E-4	1.5	0.3	210	0.07	30	0.07	30
Cr-51	80E-10	200	100E-10	60	0.06	250	80E-4	30	3.0	2100	0.7	300	0.7	300
Mn-54	5E-10	12	5E-10	3	0.006	25	4E-4	1.5	0.3	210	0.07	30	0.07	30
Co-57	8E-10	20	16E-10	10	0.03	120	13E-4	5	0.9	600	0.2	90	0.3	140
Co-58	5E-10	12	5E-10	3	0.006	25	4E-4	1.5	0.3	210	0.07	30	0.07	30
Fe-59	8E-10	20	8E-10	5	0.01	40	6E-4	2.5	0.6	400	0.15	60	0.15	60
Cu-60	8E-10	20	10E-10	6	0.006	25	8E-4	3	0.3	210	0.09	40	0.09	40
Zn-65	16E-10	40	20E-10	12	0.012	50	15E-4	6	0.6	400	0.2	80	0.20	80
Nb-94	5E-10	12	5E-10	3	0.006	25	4E-4	1.5	0.3	210	0.07	30	0.07	30
Nb-95	5E-10	12	5E-10	3	0.006	25	4E-4	1.5	0.3	210	0.07	30	0.07	30
Zr-95	12E-10	30	10E-10	7	0.010	40	10E-4	4	0.6	400	0.15	60	0.15	60
Ru-103	6E-10	16	6E-10	4	0.006	25	5E-4	2	0.3	210	0.07	30	0.07	30
Nu-106	80E-10	200	100E-10	60	0.06	250	80E-4	30	2.0	1400	0.7	300	0.7	300
Ag-110m	5E-10	12	5E-10	3	0.008	30	4E-4	1.5	0.3	210	0.07	30	0.07	30
Sb-124	12E-10	30	10E-10	7	0.016	60	10E-4	4	2.0	1400	0.4	150	0.2	90
Sb-125	8E-10	20	10E-10	6	0.010	40	8E-4	3	0.6	400	0.15	60	0.15	60
Cs-134	5E-10	12	5E-10	3	0.006	25	4E-4	1.5	0.3	210	0.07	30	0.07	30
Cs-137	8E-10	20	8E-10	5	0.008	30	6E-4	2.5	0.3	210	0.09	40	0.09	40
Ce-141	5E-10	12	6E-10	4	0.008	30	5E-4	2	0.3	210	0.07	30	0.07	30
Ce-144	30E-10	80	30E-10	20	0.06	240	25E-4	10	1.5	1100	0.4	150	0.4	150
Eu-152	12E-10	30	15E-10	8	0.015	60	10E-4	4	1.5	1100	0.4	150	0.2	90
Eu-154	6E-10	16	6E-10	4	0.015	60	5E-4	2	0.6	400	0.15	60	0.15	60
Eu-155	24E-10	60	25E-10	15	0.030	120	20E-4	8	2.0	1400	0.4	150	0.5	200
Hf-181	5E-10	12	5E-10	3	0.006	25	4E-4	1.5	0.3	210	0.07	30	0.07	30
Ta-182	16E-10	40	16E-10	10	0.014	60	13E-4	5	0.9	600	0.2	90	0.2	90
Ig-203	5E-10	12	5E-10	3	0.005	20	4E-4	1.5	0.3	210	0.07	30	0.07	30
Am-241	30E-10	80	30E-10	20	0.040	160	25E-4	10	2.0	1400	0.3	140	0.3	140

Gross Alpha -----> 3.3E-9 1.9
 Gross Beta -----> 9.5E-9 5.3
 - stipulated March 1989 (LDK-16-89)

C-129

R. J. Gahrke
April 7, 1989
LDK-27-89
Attachment

TABLE I
ESTIMATED RML DETECTION LIMITS FOR SUBSURFACE SOIL SAMPLES

<u>Radionuclide</u>	<u>Subsurface Soil (70 cm³) (pCi/g)</u>
Sc-45	0.4
Cr-51	4.0
Mn-54	0.4
Co-58	0.4
Fe-59	0.8
Co-60	0.4
Zn-65	0.8
Nb-94	0.4
Nb-95	0.4
Zr-95	0.8
Ru-103	0.4
Ru-106	3.0
Ag-110m	0.4
Sb-124	3.0
Sb-125	0.8
Cs-134	0.4
Cs-137	0.4
Ca-141	0.4
Ce-144	2.0
Eu-152	2.0
Eu-154	0.8
Eu-155	3.0
Hf-181	0.4
Ta-182	1.5
Hg-203	0.4
Am-241	3.0

APPENDIX 0

RESULTS OF NEUTRON FLUENCE STANDARD COUNTING BASED ON REDUCTION TO MEASURED CROSS SECTION

Reporting Laboratory: Idaho Nuclear Engineering Laboratory (INEL)

A. Measured Activity at EOI and Derivation of Average Reaction Rate

I.D.		Dosimetry Reaction	Observed Activity @EOI		Number of Nuclei = Yield ^(c) NY	Decay Constant λ (s ⁻¹)	Decay Correction Factor ^(c) C	Average Reaction Rate ^(d) <R>
Fluence Standard	Irrad.		Reported Format ^(a)	Standard Format λ ^(b)				
Fe-Ni-A	Ti/Fe-2	⁵⁴ Fe(n,p) ⁵⁴ Mn	4.407E+50	2.222E-03	2.000E-20	2.567E-08	0.9957	1.242E-15
Fe-Ni-A	Ti/Fe-2	⁵⁸ Ni(n,p) ⁵⁸ Co	1.830E-02	8.22 E-04	1.250E-21	1.112E-07	0.9810	1.721E-15
Ni-C	U/Fe-1	⁵⁸ Ni(n,p) ⁵⁸ Co	5.209E-02	1.495E-03	1.98 E-21	1.153E-07	0.9810	1.994E-15
Ti-B	U/Fe-1	⁵⁶ Ti(n,p) ⁵⁶ Sc	6.362E-00	1.944E-03	3.07 E-20	9.570E-08	0.9839	1.974E-15
UN-51	U/Fe-3	²³⁸ U(n,f) ¹³⁷ Ba	9.141E-01	7.49 E-04	1.34 E-20	2.035E-07	0.9474	5.40 E-15
UN-51	U/Fe-3	²³⁸ U(n,f) ¹³⁷ Ba	4.564E-01	3.82 E-04	1.10 E-20	1.252E-07	0.9672	5.35 E-15
UN-51	U/Fe-3	²³⁸ U(n,f) ¹⁴⁰ Ba	2.364E+02	1.92 E-05	1.27 E-20	6.273E-07	0.8492	5.29 E-15
UN-51	U/Fe-3	²³⁸ U(n,f) ¹³⁷ Ba-La	2.341E-02	1.92 E-05	1.27 E-20	6.273E-07	0.8492	5.29 E-15
UN-51	U/Fe-3	²³⁸ U(n,f) ¹³⁷ Cs	3.311E+01	2.71 E-02	1.27 E-20	7.160E-10	0.9998	5.56 E-15

B. Derivation of Observed Cross Section and Comparisons with Published Experimental Values, and with Calculated Values for Neutron Dosimetry Standardization.

I.D.		NBS Average Fluence Rate <R>=e/T	Cross Section Deduced from Reported Data <R>/<A>	Experimental Value (NBS Compendium)	Ratio:	Calculated	Ratio:
Fluence Standard	Reaction				Deduced Experiment	↑ Cross Section ^(f)	Deduced Calculated
Fe-Ni-A	⁵⁴ Fe(n,p)	1.553E+10	82.5 mb	81.7 mb	1.010	81.0	1.019
Fe-Ni-A	⁵⁸ Ni(n,p)	1.553E+10	111.4	111	1.004	105.0	1.060
Ni-C	⁵⁸ Ni(n,p)	1.798E+10	110.9	111	0.999	105.0	1.056
Ti-B	⁵⁶ Ti(n,p)	1.713E+10	11.5	11.8	0.975	11.2	1.027
UN-51	²³⁸ U(n,f)Ba	1.712E+10	314.5	312	1.008	305.2	1.030
UN-51	²³⁸ U(n,f)Zr	1.712E+10	312.2	312	1.001	305.2	1.023
UN-51	²³⁸ U(n,f)Ba	1.712E+10	308.5	312	0.989	305.2	1.011
UN-51	²³⁸ U(n,f)Ba-La	1.712E+10	308.4	312	0.988	305.2	1.010
UN-51	²³⁸ U(n,f)Cs	1.712E+10	324.8	312	1.041	305.2	1.064

(a) Quantity reported (with gamma attenuation correction included): observed dps of reaction product at EOI per mg of foil.

(b) Free-field dps of reaction product at EOI = (Reported Format) * (foil mass)/(1+v_{sc}). The scattering correction, (1-v_{sc}), is given in the test report. A ²³⁵U fission correction (2.2%) is included for the ²³⁸U fluence standard (UN-51).

(c) Number of reaction isotope atoms in foil = fission yield when appropriate.

(d) Specified in the test report. For an uninterrupted irradiation of length T at a constant fluence rate, C is equal to [(1 - exp(-λT))/λT].

(e) Average reaction rate: <R> = e/<A> = A/(λNTY), where <A> is the NBS certified fluence divided by the length of the irradiation T as specified in the test report. As a measured quantity, <R> may be identified with the "saturation activity" per nucleus as employed in most ASTM standards, notably E51.

(f) Value calculated with ²³⁵U fission spectrum shape and dosimetry cross sections from ENDF/B-V.

Appendix D

Environmental Restoration Department Program Directive 5.7, “Chain-of-Custody Record”

EG&G Idaho, Inc. PROGRAM DIRECTIVE ENVIRONMENTAL RESTORATION	Title: CHAIN-OF-CUSTODY RECORD	No.: PD 5.7 Page: 1 of 11 Date: 12/04/92
	Approved:  Manager, ER	Legend = Change
Reviewed by: Original signatures appear on DRR# ERD-709, release date 12/03/92.		

INFORMATION ONLY

1. PURPOSE AND SCOPE

This Program Directive (PD) establishes policy, procedures, and responsibilities for the chain-of-custody (COC) for all samples collected during field sampling activities for Environmental Restoration (ER).

2. ACRONYMS/DEFINITIONS

- COC -- Chain of Custody
- DOE -- U.S. Department of Energy
- ER -- Environmental Restoration
- PD -- Program Directive
- QA -- Quality Assurance

COC Form: Record to document the transfer of sample custody.

COC Procedure: Procedure to document sample custody from the time each sample is collected until analysis is complete and any residue is disposed.

Characterization Plan: An abbreviated Sampling and Analysis Plan; Sampling and Analysis Plan [(PD 5.2) (Reference 1)]; Monitoring, Analysis, and Testing Plan; or Groundwater Monitoring Plan.

Custody: A sample is considered in custody if it:

- Is in one's possession
- Is in one's view after being in possession
- Was in possession and is now locked up
- Is in a designated secured area.

Evidence: Anything offered at the time of a legal proceeding as a means of ascertaining the truth. In investigations involving hazardous wastes, physical and documentary evidence is collected to determine if the site poses a potential threat to human health or the environment and/or if the site complies with applicable regulations.

<p style="text-align: center;">PROGRAM DIRECTIVE</p>	<p>Title: CHAIN-OF-CUSTODY RECORD</p>	<p>No.: PD 5.7 Page: 2 of 11 Date: 12/04/92</p>
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2. ACRONYMS/DEFINITIONS (continued)

Nonradioactive sample: A portion of environmental media (air, soil, or water) or waste that has been screened for radiological activity, and is found to be less than 100 counts per minute above background beta-gamma and no detectable alpha by direct surveys; and less than the limits presented in Chapter 2 of the EG&G Idaho Radiological Control Manual. All samples will be considered radioactively contaminated until screened by a Radiological Control Technician.

Properly Sealed Shipping Container: Any shipping container that has two custody seals applied to opposite sides of the shipping container top, over which is placed clear plastic tape, and is taped shut, preferably with fiberglass tape.

Sample: Any physical evidence collected from an environmental measuring or monitoring activity.

Sample Custodian: Person who is responsible for sample custody.

Sampler: Person who collects samples.

3. POLICY

Implementation of this PD meets the requirements of the Resource Conservation and Recovery Act [Section 3007(a)(2)], the Comprehensive Environmental Response, Compensation, and Liability Act (Section 104), and the Federal Facility Agreement and Consent Order. An ER COC Form (EG&G Form 114) (Appendix A) is the preferred form to be used to track sample custody from the time of collection through laboratory analysis until it reaches its final destination. Every person who transfers custody of samples is responsible for timely and accurate completion of the COC form.

Under the current U.S. Department of Energy - Headquarters waste shipping moratorium, all samples shipped offsite for analysis must go to Nuclear Regulatory Commission or Agreement State licensed facilities.

4. PROCEDURES

Sample Custodian

- .1 Completes information required for each sample to be shipped on the COC form. Records and identifies all samples to be shipped on COC form, as indicated in Appendix A.

NOTE: Quality assurance (QA) samples (e.g., field blanks, field duplicates, equipment rinsates, spiked matrices,

<p align="center">PROGRAM DIRECTIVE</p>	<p>Title: CHAIN-OF-CUSTODY RECORD</p>	<p>No.: PD 5.7 Page: 3 of 11 Date: 12/04/92</p>
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4. PROCEDURES (continued)

Sample Custodian
(continued)

trip blanks) should not be indicated in the remarks portion of the COC form. QA samples must be submitted blind to the laboratory performing the analyses. The Administrative Record and Document Control document number of the Characterization Plan should be included on the COC form. The ER Statement of Work number under which the samples will be analyzed must be entered on each COC form.

- .2 Signs, dates, and notes the time on the COC form when transferring custody of the samples.
- .3 Retains the green copy or photocopy of the COC form in the working project file. Sends the pink carbon copy of the COC form to the Field Data Coordinator.
- .4 Ensures that an original COC form accompanies each shipment container.

Either

.5a When shipping nonhazardous, nonradioactive samples onsite, arranges delivery of samples to receiving location;

or

.5b When shipping nonhazardous, nonradioactive samples offsite, completes a Request for Shipment of Materials (Form EG&G-176) (Appendix B) and arranges delivery of shipment to Shipping and Receiving;

or

.5c When shipping hazardous and/or radioactive samples onsite or offsite, completes a Request for Shipment of Materials (Form EG&G-176) and a DOE OffSite Radioactive Material ShipmentRecord (Form ID F 5480.1A) (Appendix C); arranges for a qualified transporter (an equipment operator) to deliver shipment to receiving location or Shipping and Receiving.

<p style="text-align: center;">PROGRAM DIRECTIVE</p>	<p>Title: CHAIN-OF-CUSTODY RECORD</p>	<p>No.: PD 5.7 Page: 4 of 11 Date: 12/04/92</p>
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4. PROCEDURES (continued)

Sample Custodian

NOTE: Every person who transfers custody of samples is responsible for timely and accurate completion of the COC form, except the following personnel when handling a properly sealed shipping container: a qualified transporter (an equipment operator) who has signed the ID F 5480.1A form accompanying the shipment; Shipping and Receiving personnel who receive the shipping container prior to delivery to a transport carrier; and transport carrier personnel (e.g., express carriers). In each case, COC can be tracked by the documentation required for shipment [e.g., Forms EG&G-176, ID F 5480.1A, and EG&G-361 ("Shipping Document") (Appendix D), and transport carrier shipping papers].

.6 Instructs shipping personnel to complete the Shipping Document (Form EG&G-361) with: (a) number of coolers shipped, (b) project title, and (c) the COC form numbers present in the coolers shipped.

Field Team Leader

.7 Ensures laboratory COC requirements are followed as stated in ER PD 5.5 Appendix A (Reference 2).

Field Data Coordinator

.8 Logs in and files COC forms for future retrieval.

5. REFERENCE/BIBLIOGRAPHY

1. Environmental Restoration, Program Directives, 5.2, "Preparation of Sampling and Analysis Plans."
2. Environmental Restoration, Program Directives, 5.5, "Obtaining Laboratory Services."

EG&G Idaho, Inc., Quality Program Plan for the Environmental Restoration Program, QPP-149.

PROGRAM DIRECTIVE	Title: CHAIN-OF-CUSTODY RECORD	No.: PD 5.7 Page: 5 of 11 Date: 12/04/92
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5. REFERENCES/BIBLIOGRAPHY (continued)

Environmental Restoration, Program Directives, 4.8, "Characterization Process in the Environmental Restoration Program."

Environmental Restoration, Program Directives, 5.6, "Conducting Audits."

**ENVIRONMENTAL RESTORATION PROGRAM
CHAIN OF CUSTODY FORM**

00002

Page _____ of _____

Sampler/Field Team Leader (Printed)					Sampler/Field Team Leader (Signature)					Project Name									
Laboratory Shipped To:										Characterization Plan No					Statement of Work No				
Sample No	Sample Date	Sample Time	Comp	Grab	Sample Location	Aqueous	Solid	Rad	Metals	Volatiles	Sem. Volatiles					Preservative	Remarks (Depth)		
																	\$SAMPLE		
Special Instructions:																			
Cooler Numbers:																			
Relinquished by: (Sig)			Date	Time	Received by: (Sig)			Date	Time	Relinquished by: (Sig)			Date	Time	Received by: (Sig)			Date	Time

D-9

DISTRIBUTION: Original & Yellow: Accompany shipment to laboratory Pink: Forward to Administrative Records and Document Control Green: Retained by Project File

APPENDIX A
EXAMPLE OF A CHAIN-OF-CUSTODY FORM

PROGRAM DIRECTIVE	Title: CHAIN-OF-CUSTODY RECORD
	No.: PD 5.7 Page: 6 of 11 Date: 12/04/92

**PROGRAM
DIRECTIVE**

Title: CHAIN-OF-CUSTODY RECORD

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**APPENDIX B
REQUEST FOR SHIPMENT OF MATERIALS**



FORM EG&G-178
(Rev. 04-90)

REQUEST FOR SHIPMENT OF MATERIALS

Ship From		Ship To	
Charge No. _____	Org. No. _____	Attn: _____	RA# _____
Requestor: _____	Phone: _____	Company: _____	<input type="checkbox"/> Collect
Approved By: _____	Date: _____	Address: _____	<input type="checkbox"/> Prepaid
Date Needed at Destination: _____		City: _____	State: _____
Air Freight: Yes _____	No _____	Purchase Order No.: _____	Zip: _____
		No. of Boxes: _____	Weight (Approx): _____

Description of Materials (include complete part number and serial number)
If material is hazardous, it must be accompanied by a DOE-ID hazardous material form

Line Items	Quantity	Unit
SAMPLE		
OBTAIN LATEST REVISION OF FORM FROM FORMS MANAGEMENT OFFICE		

Detailed Reason For Shipment

Current Location of Material: _____

"Consistent with the Government Self-Insurance Policy, (DOE 101-40.104) funds shall not be expended to insure property against loss, damage or destruction in transit."

Additional Information Required (for premium transportation only)

Premium Transportation Consists of Air Freight Over 100 lbs., Special Vans, Exclusive Use Vehicles

Justification for Services: _____

Mode of Transportation: _____

Size of Shipment: _____

Authorized By: _____ Date: _____

Approved By: _____ Date: _____

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APPENDIX B (continued)

INSTRUCTIONS FOR FORM EG&G-176

1. The requestor is responsible for initiating the Request for Shipment of Materials form. Provide instructions to the consignee as to the identification, use and disposal of the material. Provide charge numbers for labor to cover efforts involved in the inspection of packaging, preservation and shipment of the materials. Insure proper paperwork, packaging, and data accompany the shipment. All shipments are shipped from CFA 601.
2. If a shipment involves hazardous materials, it is the requestors responsibility to insure that the proper containers and forms are used. The DOE-ID hazardous material shipping form is required in addition to the form 176.
3. Traffic is responsible for inspection of materials for shipment from the INEL and to adhere to requirements furnished by the requestor.
4. Traffic is responsible for coordinating the shipment of materials, making shipping arrangements, completing bills of lading for shipments originating at the INEL and releasing shipments originating outside the INEL.
5. After Request for Shipment is approved, Traffic shall complete shipping arrangements, prepare the bill of lading and a form EG&G-361, Shipping Document, and ship the material.

For those shipments requiring Premium Transportation,
please complete "ADDITIONAL INFORMATION REQUIRED"
at the bottom of the front page in detail

SAMPLE

**OBTAIN LATEST REVISION
OF FORM FROM
FORMS MANAGEMENT OFFICE**

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APPENDIX C
US DOE OFF-SITE RADIOACTIVE MATERIAL SHIPMENT RECORD



US DOE OFF-SITE RADIOACTIVE MATERIAL SHIPMENT RECORD

Shipment From: Log No.

SAMPLE

References:
DOE 5480.1A Chap III.
49 CFR 100-199

Originator	To <u> </u>	Charge No. <u> </u> Collect <input type="checkbox"/> Prepaid <input type="checkbox"/>	
	OBTAIN LATEST REVISION OF FORM FROM FORMS MANAGEMENT OFFICE	Carrier(s) <u> </u>	
Originator	Consignee is Authorized to Receive Shipment <input type="checkbox"/>	Sole Use <input type="checkbox"/> INEL Long Haul <input type="checkbox"/> Other <input type="checkbox"/>	Health and Safety
	Material <u> </u>	Consignee Notified <input type="checkbox"/> Date <u> </u>	
	DOT identification No. <u> </u>	Chemical Form: <u> </u>	
	Physical Form: Solid <input type="checkbox"/> Liquid <input type="checkbox"/> Gas <input type="checkbox"/>	Weight <u> </u> Vol. <u> </u>	
	Type of shipment <u> </u>	Container Used (describe): <u> </u>	
	Principal Nuclides) <u> </u>	Packaging: Industrial <input type="checkbox"/>	
	Curies (Ci) <u> </u>	DOT Spec. <u> </u>	
	Limited Quantity <input type="checkbox"/>	Type A <input type="checkbox"/> B <input type="checkbox"/> B(U) <input type="checkbox"/> B(M) <input type="checkbox"/>	
	Rad. Article <input type="checkbox"/>	C of C No. <u> </u>	
	Greater than: <u> </u>	Size <u> </u>	
A ₁ <input type="checkbox"/> A ₂ <input type="checkbox"/>	Weight <u> </u>		
A ₁ <input type="checkbox"/> A ₂ <input type="checkbox"/>	Transport Index <u> </u>		
Highway Route Controlled <input type="checkbox"/>	Other <u> </u>		
LSA <input type="checkbox"/>			
Empty <input type="checkbox"/>			
Total Curies <u> </u>			
Seal No.(s) <u> </u>			
FISSILE MATERIALS: Not Applicable <input type="checkbox"/> Fissile Shipment <input type="checkbox"/> Fissile Exempt <input type="checkbox"/>			
Fissile Materials: U <u> </u> gms Pu <u> </u> gms Other <u> </u> gms			
Fissile Exempt <input type="checkbox"/> Class I <input type="checkbox"/> Class II <input type="checkbox"/> Trans. Index <u> </u>			
Class III <input type="checkbox"/> Controls: <u> </u>			
(No more than <u> </u> packages may be loaded on any vehicle or storage location)			
ACCOUNTABLE NUCLEAR MATERIALS: Not Applicable <input type="checkbox"/> Applicable <input type="checkbox"/>			
DOE/NRC F 741 No. <u> </u> Remarks: <u> </u>			
	LABELS		
	Tie-downs Adequate <input type="checkbox"/> Remarks: <u> </u>		None Required <input type="checkbox"/> White I <input type="checkbox"/>
	Radiation: (surface) <u> </u> mrem/hr (3 feet) <u> </u> mrem/hr		Yellow II <input type="checkbox"/>
	Contamination: (Averaged over any 300 cm ² Package Surface)		Yellow III <input type="checkbox"/>
	Beta-Gamma <u> </u> dis/min/100 cm ²		Pelegro <input type="checkbox"/>
	Alpha <u> </u> dis/min/100 cm ²		Empty <input type="checkbox"/>
	Additional Surveys: Vehicle <input type="checkbox"/> Driver <input type="checkbox"/> Other <u> </u>		Other(s) <u> </u>
	Remarks: <u> </u>		
Signatures	Loader: <u> </u> Date <u> </u>		VEHICLE PLACARD(s)
	Seal Applicator: <u> </u> Date <u> </u>		None Required <input type="checkbox"/>
	Safety Insp.: <u> </u> Date <u> </u>		Radioactive <input type="checkbox"/>
	Criticality Safety: <u> </u> Date <u> </u>		Highway Route Controlled <input type="checkbox"/>
	Rad. Surveyor: (Package(s)) <u> </u> Date <u> </u>		Other(s) <u> </u>
	(Driver and Vehicle) <u> </u> Date <u> </u>		
	(Fissile and/or Accountable Nuclear Material only)		
	Safeguards Rep.: <u> </u> Date <u> </u>		
Security Rep. <u> </u> Date <u> </u>			
This is to certify that the above-named materials are properly classified, described, packaged, marked, and labeled, and in proper condition for transportation according to the applicable regulations of the Department of Transportation and DOE <input type="checkbox"/>			
Originator: <u> </u> Date <u> </u> Area Supervisor <u> </u> Date <u> </u>			
Trans	Carrier Rep. <u> </u> Date <u> </u>		
	Traffic Agent <u> </u> Organization <u> </u> Date Released <u> </u>		

(DIRECTIONS ON REVERSE SIDE)

APPENDIX C (continued)

INSTRUCTIONS FOR COMPLETION OF ID F 5480.1A

GENERAL

1. All entries must be completed with either the appropriate information or the abbreviation of "not applicable" (N/A).
2. Where a selection is made from several choices in a group (e.g., Mode of Transport), that selection negates the need to use N/A for the remainder.
3. Each section of the form (Originator, Health and Safety, Signatures, etc.) must be completed in accordance with 1. above.
4. The individual signing authenticates the accuracy and validity of all information pertinent to the activity.

SPECIFIC

Most of the selections are self-explanatory; however, the following brief explanations may be helpful:

1. Originator

- a. Materials shipped - use proper shipping name(s) in accordance with 49 CFR part 172 (para. 172.101).
- b. Physical Form. —
 - A₁ - Special Form - solid or encapsulated as defined in 49 CFR Para. 173.403(a).
 - A₂ - Radioactive materials that do not qualify as Special Form and are generally dispersable. This designation is defined in 49 CFR Para. 173.403(b).
- c. Packaging -

Industrial - used for less than A₁ or A₂ quantities and in accordance with 49 CFR 173.421.
C of C - Certificate of Compliance issued for Type B containers.
B(M) and B(U) - packaging used for international shipments as defined in 49 CFR 173.401(ee) and (ff), respectively.
- d. Fissile - (49 CFR 173.451)
 - (1) Fissile Materials: Uranium-233, Uranium-235, Plutonium-238, Plutonium-239, Plutonium-241, Neptunium-237, and Curium-244.
 - (2) Fissile exempt - less than 15 grams or in accordance with 49 CFR 173.453.
 - (3) Transport Index - used for Fissile Class II in accordance with 49 CFR 173.403(bb) or Cert. of Comp.
 - (4) Fissile Class III - require listing controls and maximum number of these pkgs. permitted for the transport vehicle or storage location.
- e. Accountable Nuclear Materials indicate the presence of any of the following materials: Uranium, Plutonium, Californium, Neptunium, Thorium, Tritium, Berkelium, Americium, Lithium (enriched), Deuterium, and Curium.
 - (1) ID Facilities: Applicable to materials greater than two nanocuries per gram matrix.
 - (2) NRF and ANL-W: Applicable to any quantity of accountable nuclear material.
- f. Type of shipment
 - (1) Limited Quality - as defined in 49 CFR 173.421.
 - (2) LSA - Low Specific Activity - as defined in 49 CFR 173.425.
 - (3) Radioactive Article - as defined in 49 CFR 173.422.
 - (4) A₁ and A₂ - as defined in 49 CFR 173.403(a) and (b), respectively.
 - (5) Greater than A₁ or A₂ - a quantity of radioactivity in excess of A₁ or A₂, but less than "Highway Route Controlled".
 - (6) Highway Route Controlled - as defined in 49 CFR 173.403(l).

SAMPLE

2. Health and Safety

Safety Inspection - to be performed in accordance with ID 5480.1 Chapter III, Part C.

3. Signatures

All entries must be filled (either with the appropriate name or N/A.)

4. Transportation (Trans.)

- a. Driver or carrier representative, assumes custody and responsibility for shipment.
- b. Traffic agent represents final release authorization from INEL.

**OBTAIN LATEST REVISION
OF FORM FROM
FORMS MANAGEMENT OFFICE**

PROGRAM DIRECTIVE	Title: CHAIN-OF-CUSTODY RECORD	No.: PD 5.7 Page: 11 of 11 Date: 12/04/92
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APPENDIX D
SHIPPING DOCUMENT



Number 50

SHIPPING DOCUMENT

Date Returned _____ Return for Credit Ship for Analysis
 EG&G Idaho, Inc., Order No. _____ Other Material for Repair or Exchange
 EG&G Idaho, Inc., Charge No. _____ Explain Below Required Accounting Action
 Vendor's RMA No. _____ Method of Shipment _____ Collect Prepaid

Vendors and Person Contacted for Return _____ Material Shipped to _____

SAMPLE

Description of Material Being Shipped _____

**OBTAIN LATEST REVISION
OF FORM FROM
FORMS MANAGEMENT OFFICE**

Detailed Reason for Return _____

Signature of Person Shipping Material

Signature of Person Receiving Material

• SHIPPING ADDRESSES

EG&G Idaho Inc. For U.S. O.O.E.
765 Lindsay Blvd.
Idaho Falls, Idaho 83415
EG&G Idaho, Inc. For U.S. O.O.E.
CF-601/Order No. _____
Idaho National Engineering Laboratory
Scoville, Idaho 83415
MAIL & PARCEL POST
EG&G Idaho, Inc. For U.S. O.O.E.
P.O. Box 1625
Order No. _____
Idaho Falls, Idaho 83415

ATTENTION - REPAIR ORDERS: Please advise estimated repair cost and delivery date. DO NOT proceed with repairs until you have received authorization to do so. Material should be returned by same method received. Excess transportation cost will be charged to shipper unless authorized. Telephone 208-526-2444 for further information.

BILLING INSTRUCTIONS
Mail Invoice in Duplicate
To: ACCOUNTS PAYABLE SECTION
P.O. Box 1625
Idaho Falls, Idaho 83415

Appendix E

Environmental Restoration Standard Operating Procedure 11.3, “Chain-of-Custody, Sample Handling, and Packaging”

INFORMATION ONLY

ENVIRONMENTAL RESTORATION DEPARTMENT

DOCUMENT APPROVAL COVER SHEET

Document Number: 11.3

Revision: -0-

Title: CHAIN-OF-CUSTODY, SAMPLE HANDLING, AND PACKAGING

Prepared by: *G. Henduair*

Date: 4-16-92

Reviewed by: *Alvin Nelson, Jr. for J.P. Shea*
J.P. Shea, Chairman
ERD Independent Review Committee

Date: 4-16-92

Approved by: *Lou C. Van Deusen*
L.C. VanDeusen, Manager
Site Remediation Group

Date: 4-23-92

Approved by: *R.L. Norland*
R.L. Norland, Manager
Buried Waste Program (WAG 7) Group

Date: 4/24/92

Field Changes Authorized by DRR No. _____

ENVIRONMENTAL STANDARD OPERATING PROCEDURES MANUAL	TITLE: CHAIN-OF-CUSTODY, SAMPLE HANDLING, AND PACKAGING NUMBER: 11.3 ISSUE DATE: 04/03/92
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1. PURPOSE AND SCOPE

This instruction establishes the requirements for documenting and maintaining environmental sample chain-of-custody in order to ensure the integrity of such samples from the time they are acquired until they are received at the destination laboratory. When specifically invoked by technical work plans, sampling and analysis plans, field sampling plans, and/or QA project plans (QAPjPs), this procedure shall apply to all types of environmental samples and shall remain applicable from the time of sample acquisition until custody of the sample is transferred to the destination laboratory. Laboratory chain-of-custody controls shall be as specified within EG&G-approved laboratory QA program plans and pertinent standard operating procedures (SOPs).

2. PROCEDURE

2.1 Prerequisites

2.1.1 Quality Assurance

This procedure is consistent with the general requirements of Program Directive (PD) 5.7, "Chain-of-Custody Record" (EG&G, 1991a); it will normally be invoked in the context of an investigation-specific QAPjP, and will be subject to periodic systems audits in compliance with the procedures referenced therein. Activities conducted in compliance with this procedure may also be audited as part of quality program audits performed under the auspices of the ERD Quality Program Plan (QPP-149; EG&G 1991b).

2.1.2 Health and Safety

All activities conducted in compliance with this procedure are subject to the applicable controls of investigation-specific Health and Safety Plans (HASPs) and safe work permits; the latter are required on a daily or weekly basis, depending on the significance of the safety hazards associated with the investigation.

2.1.3 Training

Training of personnel in the use of this procedure shall be conducted and documented in compliance with the applicable requirements of QPP-149 (EG&G 1991b) and Program Directive (PD) 1.3, "Employee Training" (EG&G, 1991c), at the direction of the Project Manager.

2.1.4 Change Control

Modifications of this procedure that may be required to suit the needs of a particular project or to respond to unforeseen field conditions shall be processed as a temporary Document Revision Request (DRR) in compliance with Section 2.4 of Standard Operating Procedure (SOP) 11.1, "Preparation of Environmental Standard Operating Procedures" (EG&G, 1991d). Permanent changes shall be processed in compliance with Section 2.3 of SOP 11.1.

2.2 Materials and Equipment

Materials and equipment required to implement this procedure include:

- a. sample labels, tags, and custody seals (see Figure 1);
- b. chain-of-custody forms (Form EG&G-114; see Figure 2);
- c. radiological properties labels (if required) (see Figure 3);
- d. sample packing and shipping materials, which (as applicable to the sample matrix, container type, and/or required analysis) may include:
 - insulated sample shuttles or coolers;
 - "blue"/water/or dry ice;
 - vermiculite or bubble-wrap;
 - laboratory-prepared trip blanks (if volatile organic compounds are parameters of interest);
 - DOT material hazard labels;
 - clear and regular plastic strapping tape;
 - resealable plastic bags;
 - plastic garbage bags;
 - duct tape;
 - address/return address labels;

- "this side up" labels;
 - airbill forms, as required;
 - indelible marking pens; and
 - scissors or pocket knife.
- e. Requests for Shipment of Materials forms (Form EG&G-176; see Figure 4)
- f. U.S. Department of Energy (DOE) Off-Site Radioactive Material Shipment Record forms (as required) (Form ID F 5480.1A; see Figure 5); and
- g. EG&G Shipping Document forms (Form EG&G-361; see figure 6).

2.3 Procedure Description

2.3.1 Summary

This procedure addresses the general chain-of-custody requirements of NEIC Policies and Procedures (EPA, 1986). Environmental samples must be tracked, handled and transported in a manner such that sample integrity and identification (to the location and interval at which they were obtained, sample type, and type of analysis requested) is maintained. Field Team Members assigned specific custodial responsibilities for environmental samples must maintain proper storage and custody of samples from the time of collection until they are transported to the laboratory. If custodial responsibilities are transferred to other Field Team Members, chain-of-custody forms shall be completed, signed, and dated as noted in Section 2.3.5. Sample identification and integrity shall be ensured through the application of seals and labels (see Figure 1) to the sample containers at the time of sample acquisition and shipment. Field Team Members shall initiate chain-of-custody forms (see Figure 2) which shall accompany samples from the collection site, to the cognizant EG&G shipping authority, and onward to the destination laboratory; the forms shall provide documentation of all custody transfers throughout the period of transport. Seal integrity and the legibility of sample labels and accompanying chain-of-custody forms and/or sample analysis request forms shall be verified upon receipt of samples at the destination laboratory, as a condition of the laboratory services procurement. Unacceptable samples

shall be identified by the laboratory and referred to the EG&G Project Manager and ERD Sample Management Office for evaluation and appropriate disposition.

2.3.2 Labeling, Sealing, Field Screening, and Storage Pending Off-Site Transport

At the time of collection, all samples shall be labeled and stored in the custody of the assigned Field Team Member. Container caps shall be checked for tightness and resealed as necessary. Caps may be over-wrapped with parafilm at the Field Team Leader's discretion except for samples designated for volatile organics analyses. Examples of standard seals and labels are provided in Figure 1. Bagged samples may be identified by wire-attached paper tags to which standard labels have been applied. If field radiation screening is required by governing project plans, additional radiological properties labelling by Health Physics (HP) personnel shall be required as specified in applicable screening procedures. Sample storage arrangements prior to releasing custody must meet the custody requirements defined in Section 3.

2.3.3 Sample Packaging

All samples shall be properly packaged for shipment by the assigned Field Team Member in order to protect them from damage or degradation in transit to the cognizant EG&G shipping authority and the analytical laboratory. Environmental samples shall be placed in jars, bottles, or other containers as required by governing sampling procedures and project plans, and shall be shipped in insulated sample coolers. Individual environmental sample containers shall be protected with bubble wrap or shall be placed in plastic bags filled with vermiculite prior to placement in the cooler. Where cool temperatures are required as a preservative, samples shall be shipped in insulated coolers containing sealed frozen "blue ice" packages, water ice, or dry ice packages sufficient to keep the samples at or below 4° Centigrade, but above freezing. [Note: At the Field Team Leader's direction, where critical volatile organics samples are involved, a distilled/deionized (DDI) water temperature blank may be included with this shipment. When such an option is selected, the laboratory shall be requested to verify blank temperature upon receipt.] Additional packing material shall be added to fill any remaining void space in the interior of the shipping cooler; in all cases, direct contact between individual sample containers and the interior surface of the sample cooler shall be avoided. A label containing the shipping address and telephone number of the

destination laboratory and the return address of the cognizant Project Manager shall be affixed to the top of each shipping cooler.

Environmental rock core sample boxing, marking, and labeling shall be in compliance with SOP 11.16, "Rock Core Sampling" (EG&G, 1992a) and governing project plan requirements.

2.3.4 Chain-of-Custody Form Initiation

The assigned Field Team Member shall complete the chain-of-custody form (see Figure 2) that initiates sample transfer. The following information shall be entered on the form:

- a. identification of the project and sampling site, and the control number of the governing sampling and analysis plan (SAP) or other project plan;
- b. the sample identification number;
- c. the date and time of sample collection;
- d. the analysis required, as stated in the governing project plan (Note: depending on plan requirements and the conditions of the laboratory procurement agreement, the laboratory's own sample analysis request forms may need to be completed and appended to the chain-of-custody form);
- e. the destination laboratory, as specified in governing project plans (in the "remarks" or "special instructions" block) and the applicable EG&G Statement of Work (SOW) number;
- f. the date by which the laboratory must acknowledge receipt, along with the telephone and/or facsimile number of the ERD Field Data Coordinator or other appropriate representative (if appropriate, in the "special instructions" block); and
- g. dated signatures by any interim sample custodians responsible for accompanying the samples to the cognizant EG&G shipping authority, and/or the shipping representative receiving custody from the Field Team Member (in the appropriate "received by" block);

2.3.5 Transport of Samples to the EG&G Shipping Authority and Final Sample Examination

The Field Team Member is responsible for accompanying the samples to the cognizant EG&G shipping authority; custodial responsibilities may be relinquished to another Field Team Member provided that the transfer is documented on the chain-of-custody form. Prior to the physical transfer of samples to the cognizant EG&G shipping authority, the assigned Field Team Member shall ensure that:

- a. all required labels are attached and properly completed;
- b. that the chain-of-custody form is properly filled out;
- c. that sample analysis request forms are included (where required by individual laboratory agreements for services);
- d. that there are no indications of sample container leaks or other questionable conditions that may affect the integrity of the sample;
- e. that all required radiation screening has been performed;
- f. that the cooler is temporarily sealed pending completion of chain-of-custody paperwork as discussed in Section 2.3.7;
- g. that potentially hazardous and/or radioactive samples are clearly labeled and identified as such; and
- h. that applicable DOT material hazard labels are affixed to cooler and the cooler is properly sealed, if necessary.

Samples that do not meet the requirements for initial transfer shall be repackaged or removed from the cooler and referred to the Field Team Leader for evaluation and disposition.

2.3.6 Transfer of Custody

To document the initial transfer of samples, the Field Team Member relinquishing custody and the EG&G shipping representative

ENVIRONMENTAL STANDARD OPERATING PROCEDURES MANUAL	TITLE: CHAIN-OF-CUSTODY, SAMPLE HANDLING, AND PACKAGING NUMBER: 11.3 ISSUE DATE: 04/03/92
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accepting custody shall sign, date, and note the time of transfer on the chain-of-custody form. The original and the yellow copy of the chain-of-custody record shall accompany the samples to the analytical laboratory along with any sample analysis request forms, and shall be placed inside sealed clear plastic envelopes and taped inside the top of the sample shipping cooler. If final radiation screening at the shipping authority requires sample removal, the samples shall be repackaged by or under supervision of the assigned Field Team Member in compliance with Section 2.3.3. The container shall then be re-sealed (see the facsimile seal in Figure 1) and overwrapped with clear plastic strapping tape to prevent tampering. The custody seal number shall be recorded in the sampling logbook in compliance with applicable sampling SOPs and SOP 11.2, "Field Log Books" (EG&G, 1992b).

The green copy of the chain-of-custody form shall be retained by the Field Team Member, and the pink copy forwarded to the ERD Field Data Coordinator who shall track the chain-of-custody form to ensure timely receipt of samples at the destination laboratory. Copies of all attached information shall be distributed with the chain-of-custody form.

2.3.7 Other Shipping Paperwork Requirements

The Field Team Member shall prepare Request for Shipment of Materials (Form EG&G-176; see Figure 4) and a U.S. DOE Off-Site Radioactive Material Shipment Record (Form ID F 5480.1A; see Figure 5) for the transferred samples and provide them to the cognizant EG&G shipping authority. Shipping personnel must be properly certified and are responsible for completion of the Shipping Document (Form EG&G-3611; see Figure 5) documenting the number of sample containers shipped, the project designator or title, and the numbers of the chain-of-custody forms included in the shipment.

2.3.8 Receipt at the Destination Laboratory

As a condition of the service procurement agreement with the destination laboratory, the laboratory's receiving technician shall inspect the transferred samples to ensure that:

- a. the seals are intact;
- b. all labels are legible;
- c. sample analysis request forms are provided

ENVIRONMENTAL STANDARD OPERATING PROCEDURES MANUAL	TITLE: CHAIN-OF-CUSTODY, SAMPLE HANDLING, AND PACKAGING NUMBER: 11.3 ISSUE DATE: 04/03/92
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Custody - refers to the physical responsibility for sample integrity, handling, and/or transportation. Custody responsibilities are effectively met if the samples are:

- a. in the responsible individual's physical possession;
- b. in the responsible individual's visual range after having taken possession;
- c. secured (i.e., sealed) by the responsible individual so that no tampering can occur; or
- d. secured or locked by the responsible individual in an area in which access is restricted to authorized personnel.

4. REFERENCES

EG&G, 1991a; Environmental Restoration Program Directive PD 5.7, "Chain-of-Custody Record"; EG&G Idaho, Idaho Falls, Idaho.

EG&G, 1991b; *Quality Program Plan for the Environmental Restoration Division*, QPP-149; EG&G Idaho, Idaho Falls, Idaho.

EG&G, 1991c; Environmental Restoration Program Directive PD 1.3, "Employee Training"; EG&G Idaho, Idaho Falls, Idaho.

EG&G, 1991d; Standard Operating Procedure 11.1, "Preparation of Environmental Standard Operating Procedures"; EG&G Idaho, Idaho Falls, Idaho.

EG&G, 1992a; Standard Operating Procedure 11.16, "Rock Core Sampling"; EG&G Idaho, Idaho Falls, Idaho.

EG&G, 1992b; Standard Operating Procedure 11.2, "Field Log Books"; EG&G Idaho Falls, Inc. Idaho Falls, Idaho.

EPA, 1986; *NEIC Policies and Procedures*; EPA 300/9-78-001-R; U.S. Environmental Protection Agency, National Enforcement Investigations Center, Denver, Colorado.

DOE, 1989; DOE Environmental Survey Manual, Appendix I - Sample and Document Audit, U.S. Department of Energy, Office of Environmental Audit.

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EG&G Idaho, Inc.	
SAMPLE I.D. NO.: _____	
Date: _____	Time: _____
Location: _____	Depth: _____
Media: _____	
Preservative: _____	
Field Parameters: _____	
Potential Hazards: _____	
Sample Acquired By: _____	

Environmental Sample Label

EG&G Idaho, Inc. Custody Seal 31024	Sealed By: _____ Date: _____
---	---------------------------------

Custody Seal

SAMPLE

**OBTAIN LATEST REVISION
FROM ARDC**

FIGURE 1

E-14

ENVIRONMENTAL RESTORATION PROGRAM
CHAIN OF CUSTODY FORM

00391

Page _____ of _____

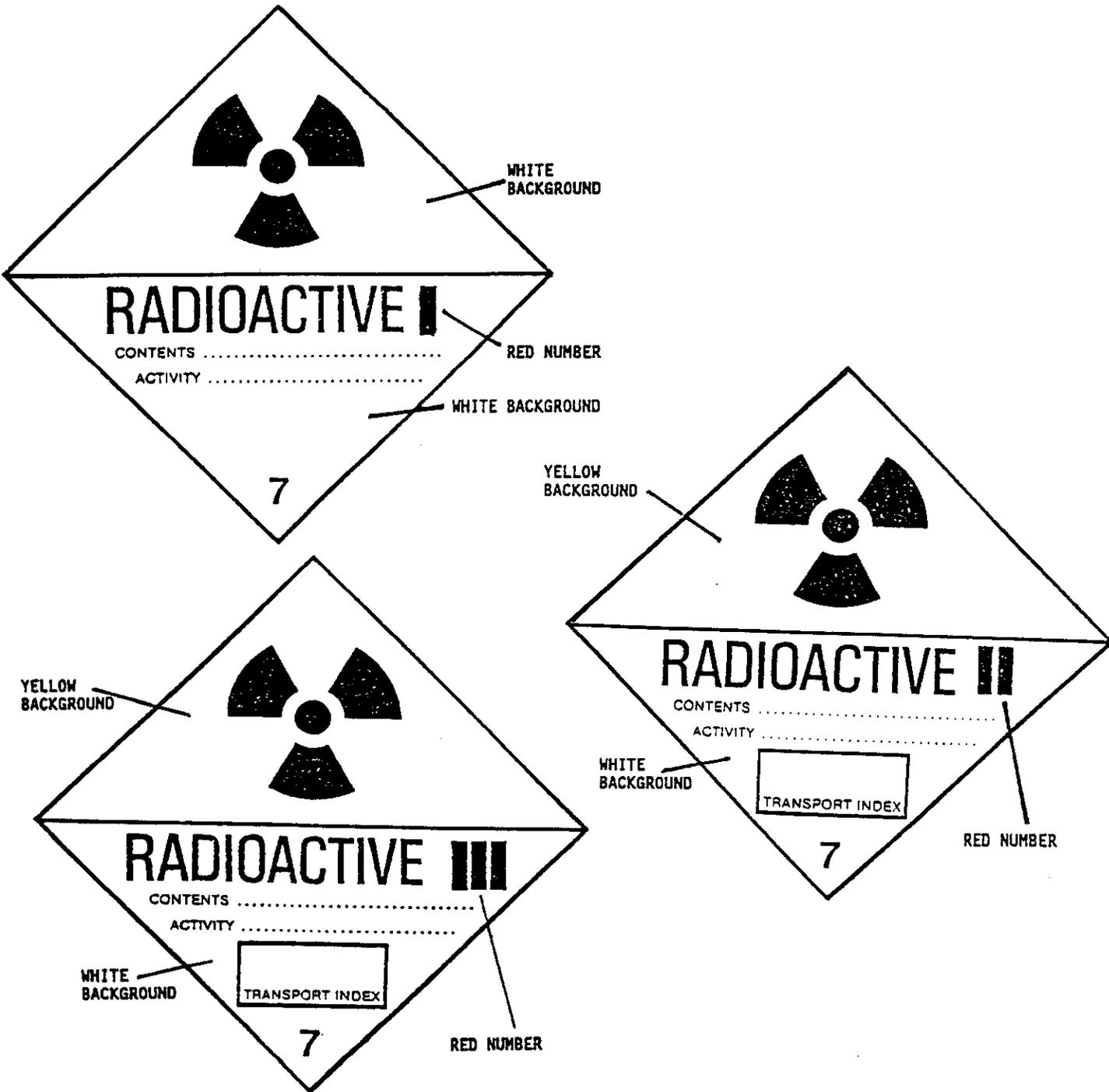
ENVIRONMENTAL
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Sampler/Field Team Leader (Printed)					Sampler/Field Team Leader (Signature)					Project Name														
Laboratory Shipped To:					Sample Location					Characterization Plan No.					Statement of Work No.									
										Remarks (Depth)														
Sample No.	Sample Date	Sample Time	Comp	Grab	Aqueous	Solid	Flac	Metals	Volatiles	Sem. Volatiles	Volatiles	Preservative												
OBTAIN LATEST REVISION FROM ARDC SAMPLE																								
Special Instructions:																								
Cooler Numbers:																								
Relinquished by: (Sig.)			Date	Time	Received by: (Sig.)			Date	Time	Relinquished by: (Sig.)			Date	Time	Received by: (Sig.)			Date	Time					

DISTRIBUTION: Original & Yellow: Accompany shipment to laboratory Pink: Forward to Administrative Records and Document Control Green: Retained by Project File

ENVIRONMENTAL RESTORATION DEPARTMENT
CHAIN OF CUSTODY FORM
FIGURE 2
E-15



RADIATION PROPERTIES LABEL

FIGURE 3

ENVIRONMENTAL STANDARD OPERATING PROCEDURES MANUAL	TITLE: CHAIN-OF-CUSTODY, SAMPLE HANDLING, AND PACKAGING NUMBER: 11.3 ISSUE DATE: 04/03/92
---	---



REQUEST FOR SHIPMENT OF MATERIALS

Ship From		Ship To	
Charge No. _____	Org. No. _____	Attn: _____	RA# <input type="checkbox"/> Collect <input type="checkbox"/> Forward
Requestor: _____	Phone: _____	Company: _____	
Approved By: _____	Date: _____	Address: _____	
Date Needed at Destination: _____		City: _____ State: _____ Zip: _____	
Air Freight Yes _____ No _____		Purchase Order No.: _____	
		No. of Boxes: _____	Weight (Approx): _____

Description of Materials (include complete part number and serial number)
If material is hazardous, it must be accompanied by a DOE-10 hazardous material form

Line Items	Quantity	Unit	
			SAMPLE

**OBTAIN LATEST REVISION
OF FORM FROM
FORMS MANAGEMENT OFFICE**

Detailed Reason For Shipment

Current Location of Material: _____

"Consistent with the Government Self-Insurance Policy, (DOE 101-40.104) funds shall not be expended to insure property against loss, damage or destruction in transit."

Additional Information Required (for premium transportation only)

Premium Transportation Consists of Air Freight Over 100 lbs., Special Vans, Exclusive Use Vehicles

Justification for Services: _____

Mode of Transportation: _____

Size of Shipment: _____

Authorized By: _____ Date: _____

Approved By: _____ Date: _____

REQUEST FOR SHIPMENT OF MATERIALS
FIGURE 4 (page 1 of 2)

INSTRUCTIONS FOR FORM EG&G-176

1. The requester is responsible for initiating the Request for Shipment of Materials form. Provide instructions to the consignee as to the identification, use and disposal of the material. Provide charge numbers for labor to cover efforts involved in the inspection of packaging, preservation and shipment of the materials. Insure proper paperwork, packaging, and labels accompany the shipment. All shipments are shipped from CFA 601.
2. If a shipment involves hazardous materials, it is the requester's responsibility to insure that the proper containers and forms are used. The DOE-DO hazardous material shipping form is required in addition to the form 176.
3. Traffic is responsible for inspection of materials for shipment from the INEL and to adhere to requirements furnished by the requester.
4. Traffic is responsible for coordinating the shipment of materials, making shipping arrangements, completing bills of lading for shipments originating at the INEL and releasing shipments originating outside the INEL.
5. After Request for Shipment is approved, Traffic shall complete shipping arrangements, prepare the bill of lading and a form EG&G-361, Shipping Document, and ship the material.

For those shipments requiring Premium Transportation,
please complete "ADDITIONAL INFORMATION REQUIRED"
at the bottom of the front page in detail.

AMMI E

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OF FORM FROM
FORMS MANAGEMENT OFFICE

REQUEST FOR SHIPMENT OF MATERIALS (INSTRUCTIONS)

FIGURE 4 (page 2 of 2)



US DOE OFF-SITE RADIOACTIVE MATERIAL SHIPMENT RECORD

Shipment From: SAMPLE Log No. _____

Reference:
DOE 5490.1A Chap III,
48 CFR 100-109

OBTAIN LATEST REVISION

To: <u>OF FORM FROM</u>		Charge No. _____	Collect <input type="checkbox"/> Present <input type="checkbox"/>
FORMS MANAGEMENT OFFICE		Comments:	
Consignee is Authorized to Receive Shipment <input type="checkbox"/>		Seal Use <input type="checkbox"/>	INEL Long Haul <input type="checkbox"/> Other <input type="checkbox"/>
Material(s) (Proper DOT Shipping Name)		Consignee Notice <input type="checkbox"/> Date _____	
DOT Identification No. _____		Chemical Form _____	
Physical Form: Solid <input type="checkbox"/> Liquid <input type="checkbox"/> Gas <input type="checkbox"/>		Weight _____ Vol. _____	
Type of shipment:		Container Used (describe) _____	
Original	Physical Form: Nuclear <input type="checkbox"/> Curies (Ci) _____ Limited Quantity <input type="checkbox"/> Rad. Article <input type="checkbox"/> A ₁ <input type="checkbox"/> A ₂ <input type="checkbox"/> Greater than <input type="checkbox"/> A ₁ <input type="checkbox"/> A ₂ <input type="checkbox"/> Highway Route <input type="checkbox"/> Controlled <input type="checkbox"/> LSA <input type="checkbox"/> Empty <input type="checkbox"/>	Packaging:	Industrial <input type="checkbox"/> DOT Spec. <input type="checkbox"/> Type A <input type="checkbox"/> B <input type="checkbox"/> B(U) <input type="checkbox"/> B(M) <input type="checkbox"/> C of C No. _____ Size _____ Weight _____ Transport Index _____ Other _____
	Seal No(s) _____ FISSILE MATERIALS: Not Applicable <input type="checkbox"/> Plutonium <input type="checkbox"/> Plutonium <input type="checkbox"/> Plutonium <input type="checkbox"/> Plutonium: U _____ gms Pu _____ gms Plutonium <input type="checkbox"/> Class I <input type="checkbox"/> Class II <input type="checkbox"/> Trans. Index _____ Class III <input type="checkbox"/> Ceramic: _____ (No more than _____ packages may be loaded on any vehicle or storage location) ACCOUNTABLE NUCLEAR MATERIALS: Not Applicable <input type="checkbox"/> Applicable <input type="checkbox"/> DOE/NRC P 741 No. _____ Remarks: _____		
Health and Safety	Timeouts Adequate <input type="checkbox"/> Remarks: _____ Radiation (surface) _____ mrem/hr <input type="checkbox"/> lead _____ mrem/hr Contamination: (Averaged over any 300 cm ² Package Surface) Beta-Gamma _____ dpm/cm ² Alpha _____ dpm/cm ² Additional Surveys: Vehicle <input type="checkbox"/> Driver <input type="checkbox"/> Other _____ Remarks: _____	LABELS None Required <input type="checkbox"/> White I <input type="checkbox"/> Yellow II <input type="checkbox"/> Yellow III <input type="checkbox"/> Plutonium <input type="checkbox"/> Empty <input type="checkbox"/> Other(s) _____	
Signatures	Loader: _____ Date _____ Seal Applicator: _____ Date _____ Safety Insp.: _____ Date _____ Consignee Safety: _____ Date _____ Rad. Surveyor: (Packaged) _____ Date _____ (Driver and Vehicle) _____ Date _____ (Please enter Accountable Nuclear Material only) Safeguards Rep.: _____ Date _____ Security Rep.: _____ Date _____ This is to certify that the above-named materials are properly classified, described, packaged, marked, and labeled, and in proper condition for transportation according to the applicable regulations of the Department of Transportation and DOE <input type="checkbox"/> Originator: _____ Date _____ Area Supervisor: _____ Date _____	VEHICLE PLACARDS: None Required <input type="checkbox"/> Radioactive <input type="checkbox"/> Highway Route Controlled <input type="checkbox"/> Other(s) _____	
Trans	Carrier Rec. _____ Date _____ Traffic Agent _____ Originator _____ Date Released _____		

(DIRECTIONS ON REVERSE SIDE)

US DOE OFF-SITE RADIOACTIVE
MATERIAL SHIPMENT RECORD

FIGURE 5 (page 1 of 2)

INSTRUCTIONS FOR COMPLETION OF ID F 5480.1A

GENERAL

1. All entries must be completed with either the appropriate information or the abbreviation of "not applicable" (N/A).
2. Where a selection is made from several choices in a group (e.g., Mode of Transport), that selection negates the need to use N/A for the remainder.
3. Each section of the form (Originator, Health and Safety, Signatures, etc.) must be completed in accordance with 1. above.
4. The individual signing authenticates the accuracy and validity of all information pertinent to the activity.

SPECIFIC

Most of the selections are self-explanatory; however, the following brief explanations may be helpful:

1. Originator
 - a. Materials shipped - use proper shipping name(s) in accordance with 49 CFR part 172 (para. 172.101).
 - b. Physical Form.—
 - A₁ - Special Form - solid or encapsulated as defined in 49 CFR Para. 173.403(a).
 - A₂ - Radioactive materials that do not qualify as Special Form and are generally dispersible. This designation is defined in 49 CFR Para. 173.403(b).
 - c. Packaging -
 - Industrial - used for less than A₁ or A₂ quantities and in accordance with 49 CFR 173.421.
 - C of C - Certificate of Compliance issued for Type B containers.
 - BM and BMU - packaging used for international shipments as defined in 49 CFR 173.407(e) and (f), respectively.
 - d. Fissile - (49 CFR 173.481)
 - (1) Fissile Materials: Uranium-233, Uranium-235, Plutonium-238, Plutonium-239, Plutonium-241, Neptunium-237, and Curium-244.
 - (2) Fissile exempt - less than 15 grams or in accordance with 49 CFR 173.453.
 - (3) Transport Index - used for Fissile Class II in accordance with 49 CFR 173.403(b) or Cert. of Comp.
 - (4) Fissile Class III - require listing controls and maximum number of these pkgs. permitted for the transport vehicle or storage location.
 - e. Accountable Nuclear Materials indicates the presence of any of the following materials: Uranium, Plutonium, Californium, Neptunium, Thorium, Tritium, Beryllium, Americium, LITHIUM (enriched), Deuterium, and Curium.
 - (1) ID Facilities: Applicable to materials greater than two nanocuries per gram matrix.
 - (2) NRP and ANLWC: Applicable to any quantity of accountable nuclear material.
 - f. Type of shipment
 - (1) Limited Quantity - as defined in 49 CFR 173.421.
 - (2) LSA - Low Specific Activity - as defined in 49 CFR 173.425.
 - (3) Radioactive Article - as defined in 49 CFR 173.422.
 - (4) A₁ and A₂ - as carries in 49 CFR 173.403(a) and (b), respectively.
 - (5) Greater than A₁ or A₂ - a quantity of radioactivity in excess of A₁ or A₂ but less than "Highway Route Controlled".
 - (6) Highway Route Controlled - as defined in 49 CFR 173.403(i).
2. Health and Safety
 - Safety Inspection - to be performed in accordance with ID 5480.1 Chapter III, Part C.
3. Signatures
 - All entries must be filled (either with the appropriate name or N/A.)
4. Transportation (Truck)
 - a. Driver or carrier representative, assumes custody and responsibility for shipment.
 - b. Traffic agent represents final release authorization from INEL.

SAMI

OBTAIN LATEST REVISION
OF FORM FROM
FORMS MANAGEMENT OFFICE

US DOE OFF-SITE RADIOACTIVE
MATERIAL SHIPMENT RECORD (INSTRUCTIONS)

FIGURE 5 (page 2 of 2)

ENVIRONMENTAL
STANDARD OPERATING
PROCEDURES MANUAL

TITLE: CHAIN-OF-CUSTODY, SAMPLE HANDLING, AND
PACKAGING

NUMBER: 11.3

ISSUE DATE: 04/03/92



Number 50

SHIPPING DOCUMENT

Date Returned _____ Return for Credit Ship for Analysis
EG&G Idaho, Inc. Order No. _____ Material for Repair or Exchange
EG&G Idaho, Inc. Charge No. _____ Other Explain Below Required Accounting Action
Vendor's RMA No. _____ Method of Shipment _____ Collect Prepaid

Vendor and Person Contacted for Return _____ Material Shipped to _____

SAMPLE

Description of Material Being Shipped _____
_____ **OBTAIN LATEST REVISION** _____
_____ **OF FORM FROM** _____
_____ **FORMS MANAGEMENT OFFICE** _____

Decided Reason for Return _____

Signature of Person Shipping Material _____
• SHIPPING ADDRESSES
EG&G Idaho Inc. For U.S. D.O.E.
785 Lindsay Blvd.
Idaho Falls, Idaho 83415
EG&G Idaho, Inc. For U.S. D.O.E.
CF-601/Order No. _____
Idaho National Engineering Laboratory
Scoville, Idaho 83415
MAIL & PARCEL POST
EG&G Idaho, Inc. For U.S. D.O.E.
P.O. Box 1623
Order No. _____
Idaho Falls, Idaho 83415

Signature of Person Receiving Material _____
ATTENTION - REPAIR ORDERS: Please advise estimated repair cost and delivery date. DO NOT proceed with repairs until you have received authorization to do so. Material should be returned by same method received. Excess transportation cost will be charged to shipper unless authorized. Telephone 208-526-2444 for further information.

BILLING INSTRUCTIONS
Mail Invoice in Duplicate
To: ACCOUNTS PAYABLE SECTION
P.O. Box 1623
Idaho Falls, Idaho 83415

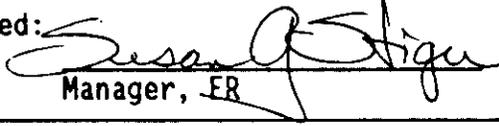
TRAFFIC COPY

SHIPPING DOCUMENT

FIGURE 6

Appendix F

Environmental Restoration Department Program Directive 4.2, “Logbooks”

EG&G Idaho, Inc. PROGRAM DIRECTIVE ENVIRONMENTAL RESTORATION	Title: LOGBOOKS	No.: PD 4.2 Page: 1 of 6 Date: 01/08/93
	Approved:  Manager, ER	Legend - Change
Reviewed by: Original signatures appear on DRR# ER-732, released date 01/07/93.		

INFORMATION ONLY

1. PURPOSE AND SCOPE

This Program Directive (PD) defines policy, procedures, and requirements for use of logbooks controlled by an Environmental Restoration (ER) Field Data Coordinator.

2. ACRONYMS/DEFINITIONS

- EPA -- Environmental Protection Agency
- ER -- Environmental Restoration
- FTL -- Field Team Leader
- PD -- Program Directive

Characterization Plan: An abbreviated Sampling and Analysis Plan; Sampling and Analysis Plan [PD 5.2 (Reference 1)]; Monitoring, Analysis, and Testing Plan; or Groundwater Monitoring Plan.

3. POLICY

- 3.1 ER logbooks shall contain all data, activities, references to procedures, and observations necessary to reconstruct the activity being recorded. Reference shall be made to other logbooks (e.g., operations, inspections) maintained by other organizations in support of other ER activities, as required by the Field Team Leader (FTL).
- 3.2 Logbooks shall be bound in a manner that prevents easy removal of pages. Pages of logbooks shall be sequentially numbered.
- 3.3 Project logbooks are the property of ER, regardless of the performing organization. Requesters shall obtain unused logbooks and an associated control number from the Field Data Coordinator and return used and unused logbooks to the Field Data Coordinator.
- 3.4 The logbooks designated for project use shall be listed in the Characterization Plan.
- 3.5 The FTL is responsible for ensuring project information is recorded in the appropriate logbook. Recordable information may include, but is not limited to, field work documentation, field instrumentation readings, calculations, calibration records, photograph references, sample tag/label numbers, meeting information, and relevant times and dates of telephone conferences, correspondence, or deliverables.

<p align="center">PROGRAM DIRECTIVE</p>	<p>Title: LOGBOOKS</p>	<p>No.: PD 4.2 Page: 2 of 6 Date: 01/08/93</p>
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4. PROCEDURES

4.1 Administration of Logbooks

- FTL .1 Reviews list of available logbooks; requests needed logbooks from the Field Data Coordinator.
- .2 If documentation requirements for the project are not satisfied by existing logbooks, provides Field Data Coordinator with master pages for new logbook.
- Field Data Coordinator .3 If master pages for a new logbook are received, initiates process of creating new logbook to meet project specifications.
- .4 Ensures that logbooks are bound and pages are numbered sequentially.
- .5 Provides FTLs with logbooks and an assigned control number for each logbook.
- FTL .6 Receives appropriate logbooks from the Field Data Coordinator before initiating a sampling activity.
- .7 Returns logbooks to the Field Data Coordinator at a time agreed upon between the FTL and the Field Data Coordinator.
- Field Data Coordinator .8 Files project logbooks and ensures the record storage requirements of PD 1.9 (Reference 2).

4.2 Use of Logbooks

- Personnel Using Logbooks .1 Ensure minimum requirements for common logbooks found in Appendix A of this PD are met. Specific instructions for the use of other logbooks listed in Appendix A shall be obtained from the Field Data Coordinator.
- .2 Apply the following for all logbooks:
 - a. Use nonsmearable, waterproof ink.
 - b. Write legibly.

<p style="text-align: center;">PROGRAM DIRECTIVE</p>	<p>Title: LOGBOOKS</p>	<p>No.: PD 4.2 Page: 3 of 6 Date: 01/08/93</p>
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4.2 Use of Logbooks (continued)

Personnel Using Logbooks
(continued)

- c. Correct errors in logbook by drawing a single line through the error (the erroneous information shall not be obliterated) and writing the correct information next to the error. The individual making the correction shall initial and date the correction.
- d. Avoid writing information in the margins of field logbooks.
- e. Ensure all signatures and dates are completed for each page as required.
- f. Protect logbooks against damage, deterioration, or loss.
- g. Prevent contamination of logbooks when working in a high risk area by recording comments in a separate bound and numbered logbook and transferring information to the appropriate project logbook. The original records shall be retained (if not contaminated) per this PD, and the transferred information shall be noted as such.
- h. Draw an "X" over any blank space remaining at the bottom of logbook pages to indicate when entries are complete.

5. REFERENCES/BIBLIOGRAPHY

1. Environmental Restoration, Program Directives, 5.2, "Preparation of Sampling and Analysis Plans."
2. Environmental Restoration, Program Directives, 1.9, "Records Management."
3. Environmental Restoration, Program Directives, 5.7, "Chain-of-Custody Record."

PROGRAM DIRECTIVE	Title: LOGBOOKS	No.: PD 4.2 Page: 4 of 6 Date: 01/08/93
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APPENDIX A

REQUIREMENTS FOR ER LOGBOOKS

Logbooks have specific provisions required by Environmental Protection Agency (EPA), ER, and/or field sampling teams.

1. Sample Logbook

- | | |
|------------------------|--|
| FTL and Field Samplers | .1 Maintain a Sample Logbook during a sampling project. |
| Field Samplers | .2 Record the following information when applicable: sampling location, depth or depth interval, field personnel, document numbers of Standard and/or Detailed Operating Procedures, types and numbers of samples collected, collection method, time and date of sample collection, type and preparation of sample bottles, preservation of samples, field measurement data, field instrument calibration checks, weather conditions, ambient temperature, barometric pressure, any observations about conditions or incidents affecting sampling activities and/or sample quality, preparation and submission of field quality control samples, work/quality assurance plan number, and any deviations from the characterization plan used for the project. |
| | .3 Sign and date entries immediately after concluding each sampling activity. |
| FTL or designee | .4 Signs and dates the logbook immediately after concluding each sampling activity. |
| FTL | .5 Reviews, initials, and dates each page daily. |
| | .6 Ensures that the names of the field team members are recorded in the Sample Logbook for each location sampled. |

PROGRAM DIRECTIVE	Title: LOGBOOKS	No.: PD 4.2 Page: 5 of 6 Date: 01/08/93
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APPENDIX A (continued)

2. Field Team Leader's Daily Logbook

FTL

- .1 Maintains a Field Team Leader's Daily Logbook or equivalent ER logbook during a sampling/data collection activity to provide a daily record of events, observations, and measurements during field investigations. The purpose of this logbook is to report information on field activities when sampling/data collection activities are being performed.
- .2 Records Industrial Hygiene monitoring data form number from Form EG&G-737 in logbook and project information including, but not limited to, field work documentation, photograph references, meeting information, times and dates of important telephone conferences, correspondence, and deliverables.
- .3 Ensures signatures of field team workers are recorded in the logbook next to the printed name of each field team worker.
- .4 Ensures names of visitors during field activities are recorded in this logbook or in a separate site logbook. All entries shall be signed and dated.

3. Calibration Logbook

Radiological Control
Technicians or Field
Sampling Team Member

- .1 Maintains a Calibration Logbook with entries, as appropriate, for each piece of equipment and instrument that requires calibration.
- .2 Records the time, method, results, and name of individual performing the calibration.

4. Sample Shipping Logbook

FTL or designee

- .1 Records date each sample is sent to a laboratory, name of laboratory, cooler number (if appropriate), chain-of-custody number (Reference 3), and the sample

PROGRAM DIRECTIVE	Title: LOGBOOKS	No.: PD 4.2 Page: 6 of 6 Date: 01/08/93
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APPENDIX A (continued)

4. Sample Shipping Logbook (continued)

- | FTL or designee (continued) shipping classification (EPA or U.S. Department of Transportation).
- .2 Ensures each page is signed and dated as required.

Appendix G

Environmental Restoration Standard Operating Procedure 11.9, “Measurement of Ground Water Levels”

ENVIRONMENTAL RESTORATION DEPARTMENT
ENVIRONMENTAL STANDARD OPERATING PROCEDURE
COVER SHEET

SOP Number: SOP-11.9

Revision: 0

Title: **STANDARD OPERATING PROCEDURE FOR MEASUREMENT OF GROUND WATER LEVELS**

INFORMATION ONLY

Prepared by: K. N. Keck Date: 02/26/92
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Reviewed by: J. P. Shea Date: 02/27/92
J. P. Shea, Chairman
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Approved by: L. C. VanDeusen Date: 2/28/92
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Approved by: R. L. Norland Date: 2/28/92
R. L. Norland, Manager
Buried Waste Program (WAG 7) Group

INFORMATION ONLY

1. PURPOSE AND SCOPE

To provide general instructions for Field Personnel to measure ground water levels in wells intercepting both regional and perched water systems. This information may be used to determine the regional groundwater flow direction and to determine water level fluctuations. Also, prior to bailing, purging, and/or sampling, calculate the static water level in the well and the volume of standing water in the well.

2. PROCEDURE

- 2.1 Each well should have a permanent, easily identified measuring point from which its water level measurement is taken. The measuring point is established to the nearest 0.01 foot by a licensed surveyor in relation to an established National Geodetic Vertical Datum (NGVD). In remote areas, a temporary benchmark is established to facilitate resurveying.
- 2.2 The measurement will be taken to 0.01 foot. The device used to detect the water level surface is sufficiently sensitive so that a measurement to ± 0.01 foot is obtained reliably. A weighted water level steel or fiberglass measuring tape, electronic water level indicator, or transducer will suffice.
- 2.3 As a field calibration check, all new or newly repaired electronic water level indicators are checked against a weighted measuring tape in at least one well, prior to use.
- 2.4 Whenever nondedicated equipment is used, procedures as outlined in ERP-SOP-11.5, "*Field Decontamination of Sampling Equipment*" are instituted where wells are suspected or known to be contaminated.
- 2.5 At contaminated sites fumes and gases may be present, requiring both radiologic and hazardous constituent monitoring equipment. Refer to the site-specific Health and Safety Plan and/or safe work permit, for the proper personal protective equipment (PPE) required.
- 2.6 Material and equipment to perform groundwater level measurements include:
 - a. Black or dark colored pen or permanent non-smearable marker of a color that will copy.
 - b. Appropriate "Measurement of Groundwater Levels" (MGL) Forms (see Figure 1).
 - c. Keys and/or combinations for all well head protective casings and/or continuous recorder housing locks.

- d. Weighted water level measuring tape with length greater than the anticipated water depth, or electronic water level indicator, or continuous recorder.
- e. Carpenters' chalk (if using weighted measuring tape).
- f. Portable computer and cable assembly for downloading water level measurements to magnetic disks and/or drum charts (as appropriate for continuous recorder)

2.7 If a weighted measuring tape is used, the water-level measurement should proceed in the following order:

- a. Rinse the first ten feet of the measuring tape with detergent solution, then with distilled water and dried with a clean cloth. If previous measurements have been made at this well refer to them to estimate where to hold the measuring tape.
- b. Chalk the lower segment (3-5 ft) of the tape by carefully drawing the tape across a piece of carpenter's chalk. Chalk need not be used on stainless-steel tapes.
- c. Lower the weighted tape slowly down the center of the casing or riser pipe until the tape penetrates the water surface.
- d. After water is encountered in the well, hold the tape at the closest even foot marker at the measuring point (typically top of well casing on north side). Make a note in field logbook and MGL form of measuring point location. If a measuring point is not identified on the well casing or apron, mark the measuring point where the tape is held at the top of the casing, so that successive measurements are taken from the same point. Record the "hold" measurement in feet on the MGL Form (see Figure 1).

Note: If a measuring point is not marked on the well contact the area landlord or appropriate personnel to have a measuring point permanently marked on the well and recorded in the INEL Comprehensive Well Survey Database.

- e. Pull or reel the measuring tape out of the well.
- f. Record the measurement to the nearest 0.01 ft where the tape became wet on the MGL form.
- g. Depth to water (DTW) is found by subtracting the "wet" measurement from the "hold" measurement. Record depth to water to the nearest 0.01 ft on the MGL form.

- h. Water-level elevation relative to mean sea level is found by subtracting the depth to water from the measuring point elevation.
 - i. Repeat the measurement and compare the DTW measurements with past measurements at this well, if available. If the value is inconsistent with past values or if this is the first measurement at this well, repeat the measurement and record the results in the MGL form.
 - j. Repeat step 2.7a.
- 2.8 If an electronic water-level indicator is used, the water-level measurement proceeds as follows:
- a. Check battery condition and continuity as recommended in the owners' manual. The continuity cell can be tested by placing it in water and observing the audio or visual signal.
 - b. Measurement markers on the wire may slip or move out of place. Periodically, check that the measurement markers on the wire have not shifted with a tape measure.
 - c. Clean the first ten feet of the electric tape with detergent solution; rinse with distilled water; and dry it with a clean cloth.
 - d. Slowly lower the probe into the center of the casing until a contact with the water surface is indicated. Raise and lower the probe several times to ascertain surface water level. Use caution so that the electric tape is not cut by a sharp casing edge. Record the measurement to the nearest 0.01 ft on the MGL form; the reading represents DTW.
- Note:** If the tape is not incremented in 0.01 ft, measure (using folding ruler or tape measure with 0.01 ft increments) the distance from the "hold" mark to the nearest tape band or marker and add or subtract to the band or marker reading. Repeat the reading before pulling out the electronic water-level indicator. Record all measurements on the MGL form.
- e. Reel the probe out of the well.
 - f. Compare the DTW measurement with past measurements at this well, if available. If the value is inconsistent with past values or if this is the first measurement at this well, repeat the measurement and record the results in the MGL form.

- g. Water-level elevation relative to mean sea level is found by subtracting the depth to water from the measuring point elevation.
- h. Repeat step 2.8c.

2.9 If a continuous recorder is used, the water-level measurement proceeds as follows:

- a. Check batteries prior to use in the field to ensure an adequate power supply for the recorder. Reset (or set, if an initial installation) the downhole float or the transducer, as appropriate in compliance with the manufacturers' operating manual.
- b. For initial installation, install the recorder at the wellhead and fit the supplied weatherproof housing as specified in the owners' manual. Install a new chart (for drum recorders) or initiate the data recording function as necessary. Initial and date the chart or disk and specify well number. Recheck all operating functions.
- c. For routine maintenance, change the chart or download data onto magnetic disks, as appropriate for the type of recorder. Initial and date the chart or disk and specify well number.
- d. Water-level elevation relative to mean sea level is found by subtracting the depth to water from the measuring point elevation.

3. DEFINITIONS

Depth to Water (DTW)- is the depth from the MP to the water level intercept point.

Land Surface Datum (l.s.d.)- is a surveyed benchmark indicating the true elevation at the land surface, generally identified by a brass marker set in the concrete surrounding the well.

Measurement Point (MP)- is a fixed, clearly marked point of reference at the top of the well riser casing or on the apron, and where applicable, the protective casing; from which the depth to groundwater is measured.

4. REFERENCES

U.S. EPA, 1986. RCRA Groundwater Monitoring Technical Enforcement Guide (TEGD).

ERP Environmental Standard Operating Procedures Manual, 1992. ERP-SOP-11.5, Field Decontamination of Sampling Equipment.

Appendix H

Environmental Restoration Standard Operating Procedure 11.8, “Ground Water Sampling”

ENVIRONMENTAL RESTORATION DEPARTMENT

DOCUMENT APPROVAL COVER SHEET

Document Number: SOP - 11.8

Revision: 0

Title: **ERD Standard Operating Procedure - Ground Water Sampling**

INFORMATION ONLY

Prepared by: Karen N. Keck

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Date: 3-27-92

ENVIRONMENTAL STANDARD OPERATING PROCEDURES MANUAL	TITLE: GROUND WATER SAMPLING	ISSUE DATE: 03/09/92
	NUMBER: 11.8	
APPROVED: _____		Manager

INFORMATION ONLY

1.0 PURPOSE AND SCOPE

This procedure provides general instructions and requirements for the sampling of ground water. Ground water sampling entails collecting ground water for geochemical and contaminant chemistry analyses for ground water adjacent to the well screen. Often the investigator will be evaluating contaminants at the parts per million (ppm) or parts per billion (ppb) concentration levels. Consequently, the possibilities of errors in data collection are enlarged. Therefore, extreme care and quality control must be used when obtaining samples.

Implement this procedure in conjunction with the statement of work (SOW) for the analytical laboratory. The laboratory should be contacted through the ERD SMO prior to sampling to obtain the proper sample-handling specifications.

2.0 PROCEDURE

2.1 Quality Assurance

Activities conducted according to this procedure will be in compliance with an investigation-specific Quality Assurance Project Plan (QAPjP) or other project-level plan as applicable.

2.2 Health and Safety

Activities conducted according to this procedure will be in compliance with an investigation-specific Health and Safety Plan and/or Safe Work Permit, as required.

2.3 Training

All personnel training relative to the use of this procedure shall be conducted in compliance with Section 2.0 of QPP-149 (EG&G, 1991a) or other applicable EG&G QPPs at the direction of the Project Manager.

2.4 Field Equipment

A list of necessary and recommended equipment is included in Table 1. Sampling equipment will be decontaminated prior to use in the field and after use according to ERP-SOP-11.5 *Field Decontamination of Sampling Equipment*. Clean sampling equipment should not be placed directly on the ground or other contaminated surfaces prior to insertion into the well. Non-dedicated pumps and tubing must be thoroughly decontaminated between well sampling sites.

2.5 Measurement of Static Water Level

Prior to bailing, purging and sampling of the well, the static water level in the well must be measured. Water levels are measured from the surveyed reference marker and recorded to the nearest 0.01 ft. Procedures for taking static water level measurements are outlined in ERP-SOP-11.9 *Measurement of Ground Water Levels*. Repeat the ground water level measurements again after sample collection.

2.6 Purging the Well

The water standing in a well prior to sampling may not be representative of in-situ ground-water quality. The standing water in the well and filter pack should be removed so that formation water replaces the stagnant water. When purging standing water in the casing, typically three to five times the calculated volume of water in the well is removed in an effort to obtain a representative sample from the aquifer. The actual number of volumes to be removed are specified in the Sampling and Analysis Plan (SAP). To calculate the volume of standing water in a well, the following generalized equation may be used:

$$V = (h_1 - h_2)r^2(0.163)$$

where: V = static well volume in gallons
h₁ = depth of the well in feet, from the top of the casing
h₂ = depth to water, in feet, from the top of the casing
r = inside radius of well casing in inches

Well purging continues until the volume specified in the SAP is removed and certain indicator parameters (i.e., pH, specific conductance, dissolved oxygen and temperature) are stabilized. Take measurements periodically during purging and again after sample collection to check the stability of the water sampled over time. Stabilization of the indicator parameters is satisfied when successive readings indicate the following criteria are met:

- a. pH: ± 0.1 standard units
- b. Specific conductance: ± 10 micromhos/cm
- c. Temperature: $\pm 0.5^\circ$ C
- d. Dissolved oxygen: ± 1 mg/L

Document the readings of the indicator parameters on the well purging field measurements data sheet (Figure 1). After purging the well, record the amount of water removed on the data sheet.

2.7 Low-Yield Formations

When purging a low-yield well (a well that is incapable of yielding three casing volumes), evacuate the well to dryness once. As soon as the well recovers sufficiently (ample water for collection), the first sample should be tested for pH, specific conductance, dissolved oxygen and temperature. Samples should then be collected and containerized in the order of the parameters' volatilization sensitivity. In the event the well has very limited production it may be possible to collect smaller volumes depending on the analysis required and after consultation with the analytical laboratory and ERD SMO. Retest the well after the samples have been collected for pH, specific conductance, dissolved oxygen, and temperature as a measure of purging efficiency and as a check on the stability of the water samples over time.

2.8 Disposal of Purge Water

Refer to the site specific SAP and Investigation Derived Waste Plan for the proper handling of purge water.

2.9 Selecting Equipment for Collecting the Water Sample

Select sampling equipment so that disturbance of the actual concentrations of the chemical constituents of interest is minimized. To remove water from the well, bailers, low-volume suction pumps, and submersible pumps may be used. Use of dedicated bailers or pumps for each well is desirable, where feasible, to avoid cross contamination.

2.9.1 Dedicated Pumps

Many of the production wells at the INEL have dedicated high capacity turbine pumps. The advantage of having dedicated pumps at a well include: avoiding cross-contamination between wells, water samples are readily available, and provides an efficient manner for sample collection. However, the high flowrates may impact the volatiles present in the water due to the agitation of the water.

2.9.2 Bailer

A bottom-filling bailer constructed of Teflon™, or stainless steel can be used to remove the stagnant water in monitoring wells and obtain samples. The bailer is preferred when volatile stripping is of concern or the well casing diameter is too narrow to accept a submersible pump. However, this method can be very time-consuming and is recommended for shallow wells only. The bailer should not come in contact with any materials outside of the well casing. Wear clean disposable gloves during sampling and

changed between each well sampling. Keep the bailer cord (teflon coated) clean and change the cord after each well sampling. Sample from 5 to 10 feet below water level or as the SAP specifies. Lower the bailer slowly until it contacts the water surface and allow the bailer to sink and fill with a minimum of surface disturbance. Slowly raise the bailer to the surface. Tip the bailer to allow slow discharge from the top of the bailer to the sample bottle, allowing the water sample to flow gently down the side of the sample bottle with minimum entry disturbance.

2.9.3 Electric Submersible Pumps

Submersible pumps are used for both the purging and collection of samples from depths which often exceed the limitations of conventional sampling equipment and can be used to sample several monitoring wells in a brief period of time. Before lowering into the well, the discharge tubing is rolled out and cleaned using a cloth and non-phosphate detergent followed by a rinse with distilled water. Then the pump is slowly lowered into the well with the safety line. All tubing and cord is gently wiped clean with cloth as the pump is lowered. Ideally the pump is set just below the dynamic water level and above the screened section of the well. The pump should not be set on the bottom.

2.9.4 Positive Displacement Pumps

Positive displacement pumps work by blowing compressed air or an inert gas into a sample chamber. The gas displaces the water in the chamber and forces it up an excavation tube. The gas is blown intermittently, using a pressure-controlled regulator, to allow for recovery. Water returns to the sample chamber from the well through the bottom of the sampler, and is then prevented from leaving the bottom by a ball check-valve. Although the sampler is in contact with compressed air or inert gas, there is no violent introduction of gas into the sample, so the sample water is unaltered. All downhole parts must be assembled and cleaned with a non-phosphate detergent and rinsed before use in each well.

2.9.5 Air-lift Pumps

Air-lift pumps are useful for evacuation of the well or as skimmers, separating liquid from solid, but not for sampling. The violent introduction of air into the water changes its chemical characteristics. These pumps may be used when samples are to be analyzed for constituents that are not volatile, are not effected by aeration, and are not effected by changes in pH.

2.9.6 Lysimeters

Lysimeters are used for sampling water in the unsaturated zone. They induce the collection of soil moisture through negative

pressure. A vacuum is put on the chamber, which is buried in the unsaturated zone, and moisture is drawn into the sample chamber through a porous-filter intake. Depending on soil texture and moisture content, as much as several hours or days under vacuum may be required.

2.10 Filling the Containers

Inspect the containers first to ensure they are the right type and number and are certifiably pre-cleaned. Wear clean gloves to prevent skin oils, dust particles or other contaminants from contaminating the sample. Gloves may also serve to protect the sampler from direct skin contact with the sample material, when potential contaminants are present. Affix the waterproof gummed labels containing information concerning the sample ID number, name of project area/well, type of analysis, date, and time to the containers at the time of collection. Place clear plastic tape over the label to protect it from damage. Transfer samples in the field from the sampling equipment directly into the container that is specifically prepared for that analysis. It is not an acceptable practice for samples to be composited in a common container in the field and then split in the laboratory, or poured first into a wide mouth container and then transferred into smaller containers. Pour the samples carefully into the containers, avoiding agitation or turbulence, which might result in loss of volatile organics and/or excessive oxygenation of the samples. Fill the bottles to the neck, except for volatiles, which require no headspace to minimize the possibility of volatilization of organics. Be careful to avoid breakage and to eliminate the entry of, or contact with, any substance other than the water sample being collected. Do not remove caps until the actual sampling time and then just long enough to fill the container.

Samples should be collected and containerized in the order of the volatilization sensitivity of the parameters of interest. A preferred collection for some common ground-water parameters is as follows:

- a. Volatile organics (VOA)
- b. Purgeable organic carbon (POC)
- c. Purgeable organic halogens (POX)
- d. Total organic halogens (TOX)
- e. Total organic carbon (TOC)
- f. Extractable organics

- g. Total metals
- h. Dissolved metals
- i. Phenols
- j. Cyanide
- k. Sulfate and chloride
- l. Turbidity
- m. Nitrate and ammonia
- n. Radionuclides

2.11 Filtration

Prior to preservation, water samples for dissolved metals analysis are filtered through a 0.45 micron pore-size filter to remove suspended particulate matter. Some radionuclides require filtration except certain radionuclides (i.e., tritium, carbon 14, and radioiodines). Usually the majority of radioactivity is in the solid phase and dissolved isotopes have an affinity for adsorption on solid particles in the sample, sampling material, and sample container walls, necessitating filtration. The SAP should specify if filtration is necessary for samples. Filtration should be done as soon as possible after a water sample is obtained, preferably simultaneously with the production of the water. Where possible, the standard procedure should be to use an in-line flow-through filter. Refer to the SAP for direction as to whether the metals and/or radionuclides need to be filtered.

2.12 Sample Preservation and Handling

Sample preservation is required for many of the chemical constituents and physiochemical parameters that are not chemically stable but are measured or evaluated in a ground water sampling program. Methods of sample preservation are generally intended to retard biological action, retard hydrolysis, and reduce sorption effects. Preservation methods usually include pH control, chemical addition, refrigeration, and protection from light. Specific preservation methods for each constituent are found in the SOW for the analytical services. A summary list of appropriate sample container types and sample preservation is found in Table 2. Appropriate chemical preservation is performed in the field for the various analytical parameters at the time of sampling. Indicate the type and amount of preservation used in the field logbook.

Samples should be preserved at approximately 4°C in the dark

during transport to the laboratory for analysis, excepting samples for metals and radionuclide analysis.

A documented chain-of-custody program shall be used to identify and trace all samples, from the point of collection to final analysis. The procedures for following this chain-of-custody and proper sample handling and packaging is outlined in ERP-SOP-11.3 *Chain-of-Custody*, and ERP-SOP-11.3.1 *Sample Handling, Packaging and Shipping*.

2.13 Field Quality Control Samples

The SAP should provide for the routine collection and analysis of the following field QC samples: trip blanks, field blanks, equipment blanks, and duplicate samples. A trip blank is used for purgeable organic compounds only. Trip blanks are typically prepared by the analytical lab sent to the project site and stored with precleaned sample containers, taken to sampling location and treated like a sample from that point on and travel with the collected VOA samples. Trip blanks are not opened and are returned and analyzed with the project samples. A field blank is prepared in the field with organic-free water. Fill a vial with organic-free water and follow all other sampling and handling practices. The sample accompanies the project samples to the laboratory and are analyzed for specific chemical parameters unique to the site at which they are prepared. The equipment blank is collected from the field equipment rinsate as a check for decontamination thoroughness. Pour organic-free water through or over the cleaned equipment and collect water in sample bottle and return to laboratory for analysis. Duplicates are collected as "second samples" from a selected well. They are collected as either split samples (collected from the same bailer volume or pumping discharge) or as second-run samples (separate bailer volumes or different pumping discharges) from the same well.

2.14 Transportation of Samples

Make prior arrangements for timely delivery of the samples to the analytical laboratory. All on-site and off-site shipments must follow DOT 49 CFR shipping requirements. EG&G Form 176 "Request for Shipment of Materials" will be filled out for off-site shipments and will accompany the shipment to its final destination. If the total activity level of the sample is above EG&G and DOT 49 CFR standards (0.002 pCi/L), procedures for shipping radioactive materials will be implemented. DOE-ID Form 5480 will be filled out prior to removing the sample from the site. Requirements regarding transportation of samples of potentially hazardous material, on the INEL, are detailed in EG&G Company Procedure 14.1 *Onsite Transportation of Hazardous Material*.

Samples collected from a controlled radioactive area must be surveyed by an HP technician and if clean a release tag will be issued prior to removing from the site.

2.15 Departure from the Site

When leaving the site ensure the well cap is replaced and locked, the area is policed for trash, and the pump and power is off. Return keys or any other plant property and inform contacts of any unusual circumstances.

3.0 DEFINITIONS

Duplicates/replicates-are collected as "second samples" from a selected well and/or project site. They are collected as either split samples (collected from the same bailer volume or pumping discharge) or as second-run samples (separate bailer volumes or different pumping discharges) from the same well.

Equipment blanks-are collected from the field equipment rinsate as a check for decontamination thoroughness.

Field Blanks-are prepared in the field with organic-free water. These samples accompany the project samples to the laboratory and are analyzed for specific chemical parameters unique to the site at which they were prepared.

Trip blanks-are used for purgeable organic compounds only. They are sent to the project site and travel with the collected samples. Trip blanks are not opened and are returned and analyzed with the project samples.

4.0 REFERENCES

DOE, 1989. *DOE Environmental Survey Manual, Appendix E, "Field Sampling Protocols and Guidance."* DOE Office of Environmental Audit.

EG&G, 1991a, *Quality Plan for the Environmental Restoration Program, QPP-149*, EG&G Idaho, Inc., Idaho Falls, Idaho.

EG&G, 1991, *Environmental Standard Operating Procedures, ERP-SOP-11.2 Field Logbooks*, EG&G Idaho, Inc., Idaho Falls, Idaho.

EG&G, 1991, *Environmental Standard Operating Procedures, ERP-SOP-11.3 Chain-of-Custody*, EG&G Idaho, Inc., Idaho Falls, Idaho.

EG&G, 1991, *Environmental Standard Operating Procedures, ERP-SOP-11.3.1 Sample Handling, Packaging, and Shipping*, EG&G Idaho, Inc., Idaho Falls, Idaho.

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	NUMBER: 11.8
	ISSUE DATE: 03/09/92

EG&G, 1991, *Environmental Standard Operating Procedures, ERP-SOP-11.5 Field Decontamination of Sampling Equipment*, EG&G Idaho, Inc., Idaho Falls, Idaho.

EG&G, 1991, *Environmental Standard Operating Procedures, ERP-SOP-11.9 Measurement of Ground Water Levels*, EG&G Idaho, Inc., Idaho Falls, Idaho.

EG&G, 1991, *EG&G Company Procedure 14.1 Onsite Transportation of Hazardous Material*, EG&G Idaho, Inc., Idaho Falls, Idaho.

United States Environmental Protection Agency, 1986, *RCRA Ground-Water Monitoring Technical Enforcement Guidance Document*, Office of Waste Programs Enforcement, Office of Solid Waste and Emergency Response, Washington DC.

Table 1. Field Equipment List.

Appropriate field logbooks	Vermiculite
Data Forms	Chain-of-Custody Forms
	Custody Seals
Pencils, pens, permanent markers	This-side-up Arrows
Key to unlock wellhead	Address labels for coolers
Watch	Coolers
Electronic water-level measuring device or	Blue Ice
Weighted steel tape marked in hundredths of ft	Ziploc baggies
Chalk	Plastic trash bags
Safety equipment specified in Health and Safety Plan	Tools
Flashlight	Appropriate containers for purge water, as applicable
Mirror	
Pump, bailer, bailer line	Scissors, knife
Purge hosing	Shipping papers, forms
Bucket	
Specific conductance, dissolved oxygen, pH, and temperature sensing devices, calibrated buffer solutions	
Sampling Manifold	
Sample bottles, preservatives	
Pipette or eye dropper for dispensing preservatives	
Reagent grade water	
Tape- clear tape for bottles, parafilm, strapping tape and duct tape	

Table 2. Typical ground water sample requirements.^c

Analytical Parameter	Container		Preservative	Holding Time ^a	Sample Volume
	Size	Type			
Volatile organics	40 ml	amber glass vial	4° C 4 drops HCL	14 days	80 ml/ 2x40 ml (6x40 ml for full QC) ^b
Semivolatile organics PCBs/pesticides organophosphorus pesticides/ organochlorine herbicides	1 L per analysis	amber glass jugs	4° C	extract 7 days, analyze 40 days	1 L per analysis (pest., herb., etc.) 3 x 1L (for full QC) ^b
Nitrate	1000 ml	HDPE	4° C pH<2 H ₂ SO ₄	14 days	1000 ml
Anions	125 ml	HDPE (NM)	4° C	28 days 48 hrs NO ₃ , PO ₄	125 ml
All metals/cations	1000 ml	HDPE (NM)	pH<2 HNO ₃	6 months Hg 28 days	1 L
Cr ⁶⁺	500 ml	HDPE (NM)	4° C	24 hrs	500 ml
Cyanide	1000 ml	HDPE (NM)	pH>12 NaOH .6g ascorbic acid	14 days	2 x 1L (for full QC) ^b
Sulfide	500 ml	glass(NM)	pH>9 NaOH/Zinc acetate	7 days	3 x 500 ml (for full QC) ^b
Alkalinity	500 ml	HDPE (NM)	4° C	14 days	500 ml
Suspended particles	500 ml	HDPE (WM)	4° C	7 days	500 ml
Gross alpha, beta screen	125 ml	HDPE (NM)	pH<2 HNO ₃	screen immediately	100 ml
Gamma analysis or screen	540 ml	plastic	pH<2 HNO ₃	1 year	500 ml
Rad. analysis/Total U	2-1/2 gal	plastic	pH<2 HNO ₃	1 year	4 L
Sr-90	1000 ml	HDPE (NM)	pH<2 HNO ₃	--	1000 ml
Tritium	125 ml	HDPE (NM)	none	1 year	100 ml

a. Holding times are from the date of collection as referred to in Federal Register Vol. 49, No. 209, October 26, 1984.

b. One sample for full QC is required for each project or every 20 samples, whichever is greatest.

c. Additional guidance on sample bottle and preservative requirements can be obtained from the ERD SMO.

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ENVIRONMENTAL
 STANDARD OPERATING
 PROCEDURES MANUAL
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 NUMBER: 11.8
 ISSUE DATE: 03/09/92

Appendix I

Environmental Restoration Department Program Directive 4.1, “Document Control”

EG&G Idaho, Inc. PROGRAM DIRECTIVE ENVIRONMENTAL RESTORATION	Title: DOCUMENT CONTROL Approved: <u>S. Stigler</u> Manager, ER	No.: PD 4.1 Page: 1 of 23 Date: 11/06/92 Legend = Change
Reviewed by: Original signatures appear on DRR# ERD-684, release date 11/05/92.		

INFORMATION ONLY

1. PURPOSE AND SCOPE

This Program Directive (PD) establishes policy and procedures for issuing, distributing, controlling, and revising Environmental Restoration (ER) assigned documentation.

2. ACRONYMS/DEFINITIONS

- ARDC -- Administrative Record and Document Control
- DCN -- Document Change Notice
- D&D -- Decontamination and Decommissioning
- DOE -- U.S. Department of Energy
- DRR -- Document Revision Request
- ER -- Environmental Restoration
- ES&Q -- Environmental, Safety, and Quality Department
- INEL -- Idaho National Engineering Laboratory
- OP -- Operating Procedure
- PD -- Program Directive
- PM -- Project Manager
- RCRA -- Resource Conservation and Recovery Act
- SPM -- Specification Preparation Manual
- TBA -- Task Baseline Agreement

Approval: Formal authoritative permission to issue a document.

Camera-ready: A complete, reviewed, approved, and technically edited document ready for printing.

Construction Manager: The prime U.S. Department of Energy (DOE) contractor responsible for construction activities at the Idaho National Engineering Laboratory (INEL).

Control Process: Compliance process established to control documents (see Section 4.4 of this PD).

Controlled Documents: Numbered documents released or issued through a system that imposes appropriate controls on the origin, change, distribution, receipt, maintenance, return, and recall of the documents. (Reference 1) (Appendix A).

PROGRAM DIRECTIVE	Title: DOCUMENT CONTROL	No.: PD 4.1 Page: 2 of 23 Date: 11/06/92
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2. ACRONYMS/DEFINITIONS (continued)

Copyholder: Recipient of controlled documents.

Document Control Coordinator: Individual within Administrative Record and Document Control (ARDC) who controls and distributes copies of documents.

Document Control Number: Unique number assigned by ARDC to each controlled document .

Document Number: An EG&G Idaho, Inc. report number (e.g., EGG-ERD-XXXX).

Document Revision Request (DRR): Form EG&G-1844 (Appendix B) used to issue documents and control changes to several types of documents, unless another specific form is required.

Field Change: A change originating at the task site to an approved controlled document when: (a) specified task cannot be performed as written, (b) work directions are unsafe as written, or (c) significant productivity savings can be realized without adverse effects.

Information-Only Copy: A copy of a controlled document that is not maintained current and therefore may not contain up-to-date or approved information. Information-Only copies are labeled as such and not assigned control numbers.

Issue Sheet: Transmittal page attached to controlled document package requiring copyholder's signature, date, and return to ARDC.

Minor Change: Changes to documents, such as spelling, grammar, punctuation, and other inconsequential editorial corrections, that do not change meaning (Reference 1).

Operations Number: An alternate DRR number (e.g., MHR-01) when a DRR number cannot be obtained due to off-shift field work or remote location.

Proprietary Information: Information that a company considers relevant to its status or operations and does not want to disclose or cannot disclose to the public without proper authorization.

Requester: Individual desiring a change in an existing document or one who initiates a new document.

3. POLICY

Any person performing work for ER may initiate issuance of documentation or suggest changes. The person submitting a new document or changing an existing document will submit the request on a DRR Form EG&G-1844 with approval by the appropriate ER Unit Manager.

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3. POLICY (continued)

All ER-controlled documents requiring issue or update will be processed through ARDC.

- 3.1 ER Unit Managers shall approve a distribution list for all controlled documents generated by the respective unit.
- 3.2 Copyholders of controlled documents that are out of compliance with the control process will be removed from the documents' controlled distribution list.
- 3.3 Copyholders of controlled documents shall immediately notify ARDC of intent to transfer ownership of the document.
- 3.4 Copyholders of controlled documents are responsible for performing the actions as instructed on the controlled document issue sheets, including reading, filing updates, signing, dating, and returning to ARDC.
- 3.5 Copyholders of controlled documents are responsible for the return of controlled documents to ARDC when no longer needed and upon termination of employment.
- 3.6 ARDC shall conduct quarterly surveillance of maintenance by copyholder of controlled document.
- 3.7 Minor changes (as defined in Section 2) do not require that the revised document receive the same review and approval as the original document (Reference 1). The Document Control Coordinator and cognizant manager will determine and approve minor changes.
- 3.8 If the copyholder's controlled document is lost or misplaced, the copyholder notifies ARDC as soon as possible.

4. PROCEDURES

4.1 New Controlled Document

- Requester .1 Prepares draft of new document per ER PD 4.4 (Reference 2).
- Requester .2 Requests document number from ARDC.
- ARDC Document Control Coordinator .3 Assigns document number.

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4.1 New Controlled Document (continued)

- Requester
- .4 Obtains review/approval signatures per PD 4.8 (Reference 3).
 - .5 Completes DRR blocks 2, 3, 5, 6, 8, and 10.
 - .6 Attaches approved document to DRR.
 - .7 Forwards DRR and attachments to requester's manager for initialing in block 2 of DRR. Submits DRR and attachments to Unit Manager, requesting distribution list for controlled document.
- Unit Manager
- .8 Initials block 2 of DRR and returns to requester. Provides requester with distribution list for controlled document.
- Requester
- .9 Submits to ARDC:
 - DRR plus any attachments
 - Camera-ready approved document
 - Other information required by PD 4.4
 - Unit Manager distribution list
 - Original diskette.
- ARDC Document Control Coordinator
- .10 Assigns DRR number per DRR log and places on DRR in block 4.
 - .11 Verifies package is complete per ER PD 4.4.
 - .12 Prepares printing request (Form EG&G-95) (Appendix B).
 - .13 Initiates control process (see Section 4.4 of this PD).

4.2 Revision to Controlled Document

- Requester
- .1 Prepares draft of revised document using copy of original disk from ARDC.
 - .2 Obtains technical editing and appropriate review (see ER PDs 4.4 and 4.8).

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4.2 Revision to Controlled Document (continued)

- | | |
|-----------------------------------|--|
| Requester (continued) | .3 Completes DRR blocks 2, 3, 5, 6, 8, and 10. |
| | .4 Obtains review/approval signatures per ER PD 4.8. |
| | .5 Attaches approved revised document to DRR. |
| | .6 Forwards DRR and revised document to requester's manager for initialing in block 2 of DRR. Submits DRR and attachments to appropriate Unit Manager for update to distribution list for a controlled document. |
| Unit Manager | .7 Initials block 2 of DRR. Provides updates to distribution list for controlled document to requester. |
| Requester | .8 Submits to ARDC: <ul style="list-style-type: none"> • DRR plus any attachments • Camera-ready, approved, revised document • Other information required by PD 4.4 • Unit Manager updates to distribution list • Updated diskette. |
| ARDC Document Control Coordinator | .9 Assigns DRR number per DRR log and places on DRR in block 4. |
| | .10 Updates distribution list for controlled document per Unit Manager revised distribution list. |
| | .11 Issues document or revisions per distribution list. |
| | .12 Initiates control process (see Section 4.4 of this PD). |
| | .13 Updates controlled document in accordance with provided issue sheet instructions. |

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4.3 Field Change Process

- Requester
- .1 Obtains necessary review/approval signatures (minimum: Quality, Safety, and Project Manager signature) (telecon when necessary). Assigns an operations number when a DRR number cannot be obtained because of off-shift or remote location.
 - .2 Marks the appropriate places or steps in the controlled field copy document with "see DRR or operations number." All changes will be listed on the DRR and subsequent continuation forms rather than redlined or additional attachments. Attaches copy of DRR to controlled field copy document.
 - .3 Requests DRR number from ARDC as soon as possible and provides copy of original DRR to ARDC within five working days.
- ARDC Document Control Coordinator
- .4 Assigns DRR number per DRR log and sends copy of DRR with issue sheet to controlled copy holders.
- Requester
- .5 Upon completion of field work, determines potential reuse of document. For documents (i.e., SOPs, Monitoring Plans) to be used in the future, implements Section 4.2 of this PD.

NOTE: Documents not requiring reuse by ER do not need to be permanently changed. ARDC will provide final guidance on questions regarding documents.

4.4 Control Process

- ARDC Document Control Coordinator
- .1 Attaches issue sheet to document to be controlled.
 - .2 Applies "red dots" to front cover and spine of document indicating document is controlled.
 - .3 Issues document per Unit Manager supplied distribution list.

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4.4 Control Process (continued)

- Copyholder .4 Completes and returns issue sheet within 15 working days to ARDC upon receipt of document.
- ARDC Document Control Coordinator .5 Verifies that the issue sheet for each controlled document is returned.
- Either .6a Files issue sheets.
- or .6b Initiates inquiry with copyholder and copyholder's manager regarding return of issue sheet.
- Copyholder .7 If inquiry is made by ARDC, provides ARDC with issue sheet within 15 working days of date of inquiry.
- ARDC Document Control Coordinator .8 If issue sheet is still not returned to ARDC within 15 working days of Unit Manager notification, informs Unit Manager and copyholder that copyholder's document is no longer a controlled document.
- .9 Removes copyholder's name from document's controlled distribution list.
- Unit Manager .10 Ensures copyholder's document is returned to ARDC.

4.5 EG&G Idaho Drawings as Defined in Company Procedure 2.7

- Project Manager (PM) .1 Communicates to support organizations, via Task Baseline Agreement or similar work authorizing document, that all drawings developed within EG&G Idaho will be controlled by the Environmental Safety and Quality Department (ES&Q) per EG&G Idaho Company Procedure 2.7 (Reference 4).
- Support Organizations .2 Obtain drawing number from ES&Q.
- .3 Develop drawings that comply with the EG&G Idaho Drawing Requirements Manual (Reference 5).

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4.5 EG&G Drawings as Defined in EG&G Idaho Company Procedure 2.7
(continued)

- | | |
|--|---|
| Support Organizations
(continued) | .4 Submit drawings to PM for review and approval. |
| PM | .5 Designates appropriate reviews (e.g., safety and quality checker). |
| | .6 Ensures review(s) is conducted. |
| Support Organization | .7 Revises drawings per comments. |
| PM | .8 Ensures drawing approval in accordance with ER PD 4.8. |
| | .9 Submits drawings to the ES&Q Configuration and Document Management Unit with a distribution list and a completed Form EG&G-1217, Document Information Form (Appendix B). |
| Configuration and Document Management Unit Manager | .10 Ensures drawings are released as specified in Engineering Operating Procedure (OP)-142, "Release of Drawings and Change Control Documents" (Reference 6). |

4.6 Vendor Drawings

- | | |
|-----------------|--|
| Project Manager | .1 Identifies drawing submittal requirements on the Vendor Data Schedule Form IDF 4700.1D (Appendix B). |
| | .2 Submits the Vendor Data Schedule Form with the Inter-contractor Work Authorization, Form ID F-2100.A (Appendix B), and other work related documentation (e.g., technical specification, scope of work, Quality Program Plan) to the Facility Engineering organization for the INEL. |
| | .3 Obtains drawings or other vendor data from construction manager. |
| PM | .4 Reviews and obtains required reviews per ER PD 4.8. |

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4.6 Vendor Drawings (continued)

- PM (continued)
- .5 Submits review comments to Facility Engineering for resolution.
 - .6 If corrections are adequate, approves drawing per ER PD 4.8.
 - .7 Obtains as-built drawings from Facility Engineering.
 - .8 Reviews as-builts for adequacy and determines which drawings will be maintained as "EG&G Idaho controlled" drawings.
 - .9 Submits vendor drawings to ES&Q Configuration and Document Management Unit for inclusion in EG&G Idaho controlled document process.
- ECM
- .10 Releases vendor drawings into ES&Q Configuration and Document Management Unit Document Control system.

4.7 Change Control for Drawings

- Organization Identifying Change
- .1 Obtains Document Change Notice (DCN) (Form EG&G-1180).
 - .2 Obtains DCN number from Configuration and Document Management Unit and makes drawing revisions per the EG&G Idaho Drawing Requirements Manual, Section 7. (Reference 7)
 - .3 Submits DCN and drawing to PM for review.
- PM
- .4 Reviews and approves changes as described in Section 4.5 of this PD.

4.8 Specifications

- PM
- .1 Reviews EG&G Idaho Specifications Preparation Manual (Reference 8) to determine applicable specification format.
 - .2 Obtains specification number from ER ARDC.

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4.8 Specifications (continued)

- PM (continued)
- .3 Develops or has the specification developed.
 - .4 Submits specification for review and approval per ER PD 4.8.
 - .5 Submits approved specification to ARDC.
- ARDC
- .6 Releases and controls specification in accordance with this PD or the requirements in the Specification Preparation Manual (SPM).

4.9 Specification Changes

- PM
- .1 Revises specification as specified in Section 4.2 of this PD or the requirements of the SPM.

5. REFERENCES/BIBLIOGRAPHY

1. American Society of Mechanical Engineers, Quality Assurance Program Requirements for Nuclear Facilities, NQA-1, Supplement 6S-1, "Supplementing Requirements for Document Control."
 2. Environmental Restoration, Program Directives, 4.4, "Producing ER Reports."
 3. Environmental Restoration, Program Directives, 4.8, "Internal and Independent Review of Documents."
 4. EG&G Idaho, Inc., Company Procedures Manual, Section 2.7, "Use of Drawings."
 5. EG&G Idaho, Inc., Drawing Requirements Manual, October 1987.
 6. Engineering Document Control, OP-142, "Release of Drawings and Change Control Documents."
 7. EG&G Idaho, Inc., Drawing Requirements Manual, Section 7, "Drawing Revisions."
 8. EG&G Idaho, Inc. Specifications Preparation Manual.
- DOE Order 1324.2A, "Records Disposition."
- DOE-ID Order 1324.2A, "Records Disposition."

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5. REFERENCES/BIBLIOGRAPHY (continued)

EG&G Idaho, Inc., Quality Manual, QP-6, "Document Control."

EG&G Idaho, Inc., Quality Manual, QP-17, "Quality Records."

EG&G Idaho, Inc., Resource Manual, Section 10, "Documentation Systems."

EG&G Idaho, Inc., Specifications Preparation Manual.

Environmental Restoration, Configuration Management Plan,
EGG-WM-9413, Revision 0, September 1991.

Environmental Restoration, Implementing Program Management Plan for the EG&G
Idaho Environmental Restoration Program, EGG-WM-8676.

EG&G Idaho, Inc., Safety Manual, Section 2, "Safety Review, Analysis and
Work Control."

Environmental Restoration, Program Directives, 5.11, "Preparation and Use of
DOPs and SOPs."

EG&G Idaho, Inc., Engineering Standard Practice, 4.4.1, "Document Control."

Idaho National Engineering Laboratory Environmental Restoration Program
Records Management Plan for EG&G Idaho, EGG-WM-9742.

<p style="text-align: center;">PROGRAM DIRECTIVE</p>	<p>Title: DOCUMENT CONTROL</p>	<p>No.: PD 4.1 Page: 12 of 23 Date: 11/06/92</p>
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APPENDIX A

DOCUMENTS PROPOSED TO BE CONTROLLED BY ARDC

ER - EG&G

- Abbreviated Sampling and Analysis Plans
- Baseline Risk Assessment - Waste Area Group 7
- Characterization and Decision Analysis Plan
- Categorical Exclusions
- Closure Plans
- Community Relations Plan
- Configuration Management Plan
- Cost Account Plans
- Decontamination and Decommissioning (D&D) Final Report
- D&D Plans
- Data Collection Quality Assurance Plans
- Data Management Plan
- Design Packages
- Detailed Operating Procedures
- Feasibility Study Report
- Environmental Protection Agency Document
- Remedial Investigation Report
- Engineering Design Files
- Engineering Specifications
- Environmental Assessments
- Environmental Checklists/Categorical Exclusions
- Environmental Impact Statements
- Field Sampling Plans
- Groundwater Monitoring Plans
- Health and Safety Plan, plus addenda
- Implementation Program Management Plan

DOE-ID

- Federal Facility Agreement/Consent Order
- Level "0" and "I" Schedules
- Environmental Restoration and Waste Management Five-Year Plan
- Current-Year Budget Document
- Program Management Plan
- Appendix I Advanced Acquisition or Assistance Plan
- Appendix II Test and Evaluation Plan
- Appendix III Environment, Safety, and Health Protection Implementation Plan
- Financial Plan
- Prioritization Plan
- Program Execution Guidance
- Activity Data Sheets
- Site-Specific Plans
- Annual Budget Submittal
- Field Office Current-Year Work Plan
- Roadmapping

<p style="text-align: center;">PROGRAM DIRECTIVE</p>	<p>Title: DOCUMENT CONTROL</p>	<p>No.: PD 4.1 Page: 13 of 23 Date: 11/06/92</p>
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APPENDIX A (continued)

PROPOSED DOCUMENTS TO BE CONTROLLED BY ARDC (continued)

ER - EG&G (continued)

- Monitoring, Analysis, and Testing Plans
- Operating and Maintenance Manuals
- PDs
- Quality Assurance Project Plan
- Quality Program Plan
- Resource Conservation and Recovery Act (RCRA) Facility Investigation Report
- RCRA Facility Investigation Work Plan
- RCRA Feasibility Study
- Records Management Plan
- Remedial Investigation Report
- Remedial Investigation/Feasibility Study Work Plan
- Remedial Investigation/Feasibility Study
- Safety and Analysis Plans
- Sampling and Analysis Plans
- Safety Assessment
- Site Health and Safety Plan (Scoping)
- Standard Operating Procedures
- Summary Assessments
- Systems Engineering Management Plan
- Technical Memorandum as defined by Unit Manager
- Technical Safety Requirements
- Work Plans
- Draft Regulatory Documents as defined by managers

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APPENDIX B

Document Revision Request (Form EG&G-1844)

Printing Request for Services (Form EG&G-95)

Document Information Form (Form EG&G-1217)

Vendor Data Schedule (Form IDF-4700.1D)

Inter-contractor Work Authorization (ID F-2100.A)

Drawing Change Form (Form EG&G-1180)

PROGRAM DIRECTIVE

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APPENDIX B (continued)

PRINTING REQUEST FOR SERVICES (Form EG&G-95)



PRINTING REQUEST FOR SERVICES

43156

Requester (Please Print)		Authorization Signature		Phone		Reprographics Unit	
Division/Program		Location		Requester's Computer Job		Job Number	
Date		Charge Number		Org. No.		No. Copies Each	
Size of Original		Size Wanted		Printing Requirements		Paper	
Margin		Margin		One Side		Two Sides	
Height		Length		Weight		Color	
				needs to read		needs to Post	
Manufacturer's Comments (Description of work and special instructions, attach samples if needed.) Requester: Retain pink copy for job tracking <p style="text-align: center;">OBTAIN LATEST REVISION OF FORM FROM FORMS MANAGEMENT OFFICE</p>							Absence Stacks - Corner 2 Side 1 Side One 2 hole Top 1 hole Side Pad Post Saddle Stitch Spiral Bind Perfect Bind

To Be Completed By Printing				Qty	Qty
Camera/Plates	Req.	Manned	Coopers		
0 1 0 0 1 Negative 10 x 12	1	1 1 9 0 1 8	Printer Copier		
0 2 3 3 1 Negative 12 x 16	1	1 1 9 0 1 7	DPA Copier		
0 3 0 0 2 Negative 16 x 22	1	1 1 9 0 1 3	TAN Copier		
0 2 3 3 1 Color Image Plate	1		Miscellaneous		
0 0 0 0 1 Mask Plate (2501273)	1	1 1 4 3 0	Printing		
0 1 0 0 1 Mask Plate (Henslerburg)	1		Printing		
Auto Systems, 1250's					
0 3 0 0 1 Reg. Paper 2 Side	1	2 1 5 0 1 4	Lithography		
0 1 0 0 1 Reg. Paper 2 Side	1	2 1 5 0 0 5	Lithography (Color)		
0 1 3 1 1 Reg. Paper 1 Side	1	2 1 9 1 1 0	Numbering		
0 1 3 1 1 Reg. Paper 1 Side	1	2 1 9 1 1 0	Numbering		
0 1 2 2 2 Topcoat 4 1/4 - 11			Ozoid		
0 1 0 0 1 CoverCard Stack		3 1 1 0 1 1	11 x 17		
0 1 0 0 1 MCR		3 1 1 0 1 2	17 x 22		
0 1 0 0 1 Bench/Label Tray		3 1 1 0 0 3	22 x 34		
0 1 2 7 7 Mats		3 1 1 0 0 7	24 x 36		
0 1 1 2 1 Taps		3 1 1 0 1 4	30 x 42		
0 1 1 1 1 Topcoat Covers		3 1 1 0 1 5	34 x 44		
0 1 2 2 2 Extra Press Run		3 1 1 0 0 6	Printing - Stencil		
1275's					
0 1 0 0 1 Reg. Paper 8 1/2 Side		3 1 1 0 0 8	Square Post (8 1/2)		
0 1 0 0 1 Reg. Paper 8 1/2 Side		3 1 2 0 0 1	Verde 2700 (Lith. 4 1/2)		
0 1 2 2 2 Extra Press Run					
Henslerburg					
0 1 1 2 2 Reg. Paper 8 1/2 Side					
0 1 3 1 1 Reg. Paper One Side		3 1 4 1 0 3	Miscellaneous Labor (Per Minute)		
0 1 1 1 1 CoverCard Stack		3 1 4 1 0 0	Overline (1/2 hour increments)		
0 1 3 1 1 Preprinted Covers		3 1 4 1 1 1	Job Change (Per Minute)		
0 1 1 1 1 Reg. Paper Two Sides		3 1 4 1 1 2	Job Set (Per Minute)		
0 1 1 1 1 Reg. Paper One Side					1 Case
0 1 2 1 1 Extra Press Run		3 1 5 0 0 0	Mac. Material		
		3 1 5 0 0 1	Commercial Printing		
			Quality Check		

White - Billing Yellow - Print Shop Pink - Requester

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APPENDIX B (continued)

ENGINEERING DOCUMENT CONTROL DOCUMENT INFORMATION FORM (Form EG&G-1217)



Project/Task/Org. No. _____ -103.02-
Job No. _____

ENGINEERING DOCUMENT CONTROL
DOCUMENT INFORMATION FORM

Date _____

Rev. No. _____

Project/Task/Org. Title _____ Quality Level _____

Project/Task/Org. Mgr. _____

LAST NAME FIRST M.I.

Phone _____ Mailstop _____

Authorization _____

Manager Signature _____ Date _____

Doc. Type	Document Description	Form No.	Records Status				Vital Records		Disposition Authority	Retention Period
			Rev.	NRD	USC	DA	ECR	R&I		

AUTHORIZATIONS

NAME/TITLE	Org No.	Review	Approve	Authorize Change
OBTAIN LATEST REVISION OF FORM FROM: FORMS MANAGEMENT OFFICE				

Person or Organization authorized to approve minor changes _____

DISTRIBUTION INSTRUCTIONS:

- | | |
|--|--|
| <input type="checkbox"/> No Distribution (Requestor copy only) | <input type="checkbox"/> Controlled Distribution |
| <input type="checkbox"/> Uncontrolled Distribution (Information copies only) | <input type="checkbox"/> Receipt Acknowledgment Required |

REVISION INSTRUCTIONS:

Revised Per: _____
Procedure No. _____

Form EG&G-1217 Retention Requirements Destroy when issuance is destroyed	Form Distribution: EDC Document Control Centers, Authorized Checkers (CWGs only), Proj/Task/Org. Mgr. Specs. & Stds. Coordinator (Doc. only)
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APPENDIX B (continued)

VENDOR DATA SCHEDULE (Form IDF-4700.1D) (continued)

IDF-4700.1D
Rev. 11-87

INSTRUCTIONS FOR IDF-4700.1D

COLUMN 1-8: A number in one or more of these columns requires submittal of corresponding data and indicates the number of copies to be submitted.

COLUMN 8: A letter entered in the miscellaneous column requires submittal of corresponding data in accordance with the list below.

- | | |
|----------------------------------|----|
| A. Sample (Color, Texture, Etc.) | O. |
| B. Test Report | |
| C. Design Calculation | P. |
| D. Procedure/Instruction | |
| E. Parts List | C. |
| F. Piping Drawings | |
| G. Assembly Drawings | |
| H. Resumer/Qualifications | |
| I. Delivery Ticket | |
| J. Unopened POs | |
| K. Mix Design | |
| L. Material Safety Data Sheets | |
| M. Welder Qualification Records | |
| N. Welding Procedures | |

COLUMN 9: An "X" in this column indicates required data must be submitted and approved prior to use of the item.

COLUMN 10: An "X" in this column indicates that submittal of data is required for information only. If the exact item specified is not used, Vendor Data must be submitted for Or-Equal Approval prior to use of the item.

COLUMNS 11, 12, 13: An "X" in one of these columns indicates the agency authorized to approve corresponding required or Or-Equal Vendor Data.

COLUMN 14: Codes listed below indicate the time by which the corresponding data must be approved if column is not marked, refer to the General Conditions.

- WP With Proposal
- PTP Prior to Purchase
- BFR Before Fabrication Release
- PS Prior to Shipment
- WS With Shipment
- PTC Prior to Construction Start
- BU Before Use
- PT Prior to Test
- AT After Test
- BFA Before Final Acceptance

COLUMN 15: An "X" in this column indicates that the item must be examined and approved by the inspection agency prior to use. Notify the contractor 24 hours prior to delivery.

SAMPLE

**OBTAIN LATEST REVISION
OF FORM FROM
FORMS MANAGEMENT OFFICE**

PROGRAM
DIRECTIVE

Title: DOCUMENT CONTROL

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APPENDIX B (continued)

INTER-CONTRACTOR WORK AUTHORIZATION (ID F-2100.A)


U.S. DEPARTMENT OF ENERGY
IDAHO OPERATIONS OFFICE
INTER-CONTRACTOR WORK AUTHORIZATION

ID F-2100.A
Rev. 08-88
App. ID 2100.A

Work Authorization _____ Date _____
To: _____ From: _____

Project Title: _____
Funding: B&RC/PA/EA _____
Scope of Work: _____

SAMPLE

**OBTAIN LATEST REVISION
OF FORM FROM
FORMS MANAGEMENT OFFICE**

Design Review Bid and Proposal Subcontract Contingency Extension

Start: _____
Duration: _____
Completion: _____

Estimate of Cost (not to be exceeded) Construction Directs
Management Reserve Available for Changes
* M-K Markup

Total _____

* Markup at _____ % of construction direct's plus M.R. (rounded)

As herein provided and previously agreed upon;
 Start work as indicated above and submit a cost proposal as soon as possible to the authorizing official

Project Director: _____

Method of Performance:
 Force Work (Where required prior ID approval has been obtained - see ICWA Procedures)
 Fixed-Price Subcontract:

Authorized by (Signature) _____ Title

Approved by (Signature) _____ Title and Responsible IC Division

Accepted by (Signature) _____ Title

PROGRAM
DIRECTIVE

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APPENDIX B (continued)
DRAWING CHANGE FORM (Form EG&G-1180)

EG&G LABORATORY, 3500 S.W. 15th St., Palm Bay, FL 32909

Prepared By Title		IDAHIO NATIONAL ENGINEERING LABORATORY DRAWING CHANGE FORM		INDEX CODE NUMBER					
Reason for Change				Area	Draw. Type	1:1	Draw.	Class	
TYPE OF CHANGE AND DOCUMENT		APPROVAL	DATE	APPROVAL	DATE	Drawing Number			
Rev. #	Alt. #	IN #	Per. to be signed (Alt. #)	Checked		Number of Sheets			
()	()	()	()	Checked by		Drawing Title			
			Was Alter.						
			Checked by						
			Checked by						
			Checked by						
PROGRAM OR PROJECT AUTHORIZATION									
Title									
Date									

SAMPLE
OBTAIN LATEST REVISION
OF FORM FROM
FORMS MANAGEMENT OFFICE

DRAWING CHANGE FORM (CONT. SHEET)

INDEX CODE NUMBER				
Area	Type	Flt	Eng	Spec

ENR <input type="checkbox"/>	AMR <input type="checkbox"/>	DCR <input type="checkbox"/>	Title Proposed	AM/ENR RI - Unit	Checked	Drawing Number	Revisions
Zone	Area						

SAMPLE

OBTAIN LATEST REVISION
OF FORM FROM
FORMS MANAGEMENT OFFICE

I-25

PROGRAM
DIRECTIVE

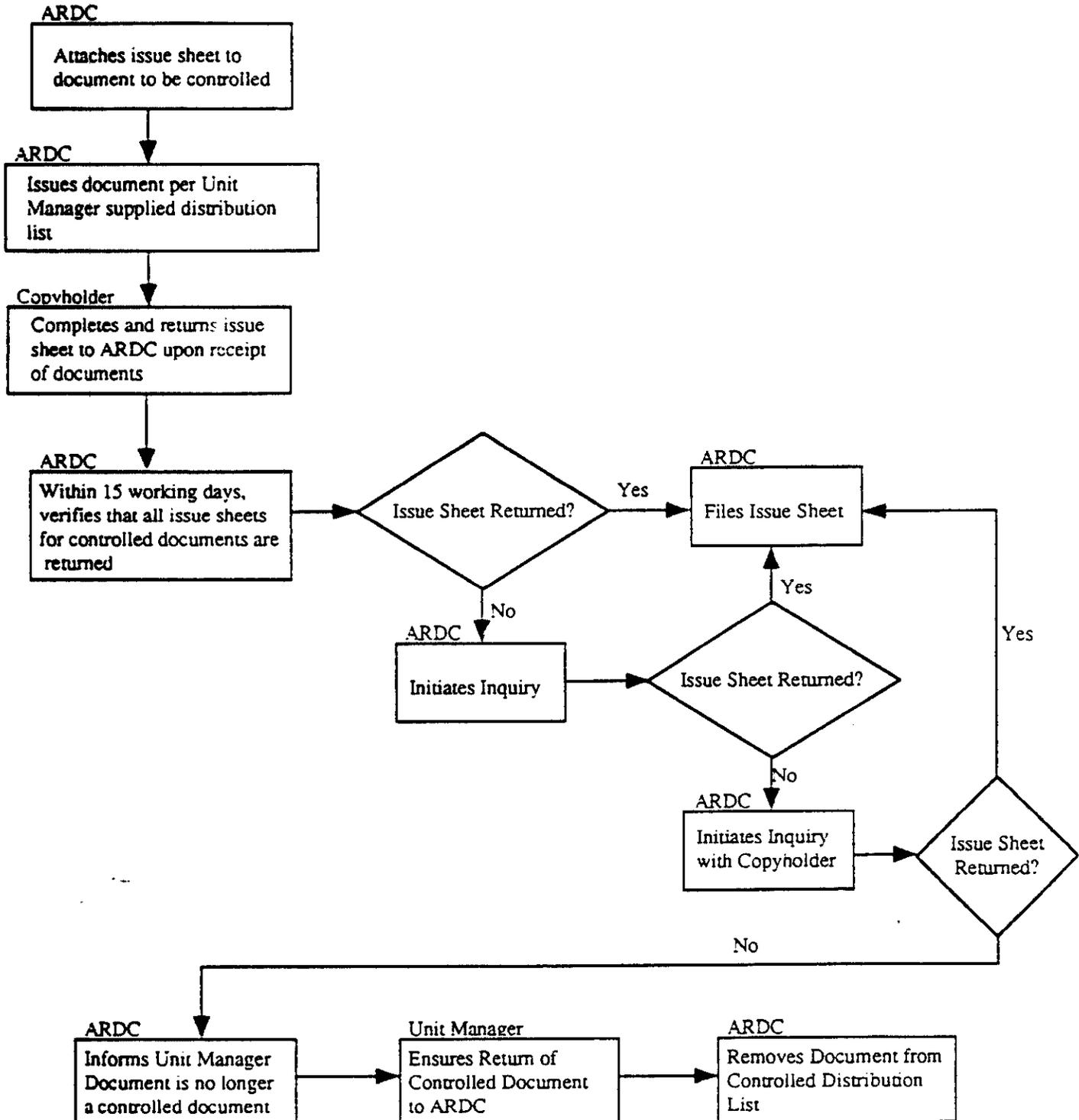
Title: DOCUMENT CONTROL

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APPENDIX B (continued)

DRAWING CHANGE FORM (Form EG&G-1180) (continued)

APPENDIX C
CONTROL PROCESS



Appendix J

Environmental Restoration Standard Operating Procedure 11.5, “Field Decontamination of Sampling Equipment”

ENVIRONMENTAL RESTORATION
ENVIRONMENTAL STANDARD OPERATING PROCEDURE
COVER SHEET

SOP Number: SOP-11.5

Revision: 1

Title: **STANDARD OPERATING PROCEDURE FOR FIELD DECONTAMINATION OF
SAMPLING EQUIPMENT**

INFORMATION ONLY

Prepared by: J. P. Shea for K. N. Keck Date: 11/23/92
K. N. Keck, Sr. Scientist
Geosciences Group

Reviewed by: J. P. Shea Date: 11/23/92
J. P. Shea, Chair
ER Independent Review Committee

Approved by: L. C. VanDeusen Date: 12/1/92
L. C. VanDeusen, Manager
Site Remediation Group

Approved by: R. L. Norland Date: 12/2/92
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Buried Waste Program (WAG 7) Group

INFORMATION ONLY

1.0 PURPOSE AND SCOPE

To provide general instructions for field decontamination of sampling equipment used to support environmental investigations. Thorough decontamination is required to prevent cross contamination between samples and sampling sites.

2.0 PROCEDURE

2.1 All sampling equipment (i.e. Teflon bailers, split-spoon samplers, funnels, spoons, pans) is decontaminated before sampling activities begin, before moving sampling activities to another location/well, and after sampling activities are completed. If several samples are being collected from a single location, such as with split-spoon sampling at depth, the sampling equipment is thoroughly decontaminated between samples. However, full decontamination of sampling equipment between locations is not required when collecting subsamples that will constitute a single composite sample. For composite samples, the equipment used between subsample collection need only be brushed or wiped off to remove any large chunks of soil adhering to the equipment.

2.2 Establish a central decontamination location away from the immediate sampling site.

2.3 Material and Equipment Needs:

- a. Non-phosphate detergent (i.e., Microclean)
- b. Wire brush/bottle brush
- c. Water:
 - a. Organic-free water
 - b. Deionized tap water
 - c. Uncontaminated/potable tap water
- d. Isopropanol
- e. Carboy and/or 55-gal drums (poly) for storage of tap water used in steam cleaning/decontamination, as appropriate
- f. Waste water collection system (may include):
 - a. Plastic sheeting
 - b. Containers for waste water collection (separate containers for water, solids, and solvents)

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- g. Steam cleaner and generator (optional)
- h. Personal protective equipment (PPE) as stated in the Health and Safety Plan
- i. Stainless steel pans with lids
- j. Maislan wipes
- k. Blotter paper
- l. Spray bottles
- m. Sponges

2.4 Field Decontamination Procedure for Sampling Equipment:

- a. Physically remove any bulk material adhering to the item that requires decontamination by using a wire brush or scraper.

Note: Wire brushes should not be used on non-metal equipment.

- b. Remove gross contamination with tap water and rinse, using pressurized or gravity flow tap water. Scrub brushes or wire brushes may help in removing material.
- c. Wash and scrub the equipment with a non-phosphate detergent and tap water.
- d. Rinse thoroughly with tap water. Steam clean the equipment if a steam cleaner is available and the equipment is not heat and steam sensitive.

Note: Steam cleaning is not acceptable if radiological contamination is present, due to the potential for creating airborne contamination problems.

- e. Check for adhered soils; use a brush to dislodge any particles.
- f. Double rinse with organic-free water.
- g. Spray-rinse all surfaces with isopropanol from an approved wash bottle.
- h. Collect the isopropanol in a container for appropriate disposal (see Section 2.5). One effective collection technique is to place a large glass or stainless steel funnel below the tools during rinsing. Allow waste to flow into appropriately sized bottles for later disposal. Use a

stainless steel mixing bowl as a collection vessel. The bowl is the last item cleaned in the sequence of operations.

- i. If a rinsate sample is required for QA, make an additional final rinse of the equipment, using ASTM Type II or HPCL grade water, and collect it in the appropriate sample bottles.
- j. If the equipment is known to be or suspected of being radioactively contaminated, have the Radiological Control Technician collect a smear (100 cm² smear) sample for immediate radionuclide analysis.
- k. The item is considered clean and suitable for unrestricted use if there are <100 cpm above background beta-gamma and no detectable alpha for direct surveys; and less than the limits presented in Chapter 2 of the EG&G Idaho Radiological Control Manual.
- l. If the radiological limits are not met, discuss with the Radiological Control Technician the possibility of using a special decontamination solution for radionuclides and/or disposing and replacing the item.
- m. Allow sampling equipment to completely dry prior to re-use.
- n. Wrap and store sampling equipment. Aluminum foil is recommended for equipment used in the sample collection for organic analysis. Use plastic wrap or bags if equipment is used for sample collection intended for inorganic analysis. Attach a label to the wrapping or bag indicating the date of decontamination and the initials of the person who performed the decontamination.

2.5 The final disposition of rinse water and material dislodged from equipment will be specified in the Sampling and Analysis Plan and the Investigative Derived Waste Plan. The ERP Project Manager, Field Team Leader, Radiological Control Technician and/or Safety Officer, and Environmental Coordinator for the facility, and the facility engineer determine appropriate disposal to decontaminated wash water. All solvents used during decontamination are collected for appropriate disposal.

3.0 DEFINITIONS

No terms cited in this procedure require special explanation.

4.0 REFERENCES

- U.S. DOE, 1989. The Environmental Survey Manual, 2nd edition, Appendix G-Decontamination Guidance, Section G2.4, sampling Equipment, p. G-6.
- NIOSH/OSHA/USCG/EPA, 1985. Decontamination of the Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, Chapter 10. U.S. Printing Office, October, 1985.
- U.S. EPA, 1985. Decontamination Techniques for Mobile Response Equipment Used at Waste Sites (State-of-the-Art Survey), EPA/600/52-85/105.

Appendix K

Position Paper for the Disposition of Groundwater Collected through ERP Characterization Activities at TRA

Position Paper for the Disposition of Groundwater
Collected Through ERP Characterization Activities at TRA

I. Issue Statement

The policy for disposal of well development and sample purge water generated during characterization activities at TRA undertaken pursuant to CERCLA authorities is not well defined. This is intended to address the issue and to recommend that well development and sample purge water be disposed directly to the Warm Waste Pond (WWP) at TRA without sampling. This recommendation is based on a review of applicable requirements, available guidance, process knowledge, and existing characterization data of the groundwater underlying TRA.

II. Background

Tritium and chromium have been identified as the major constituents of concern discharged to the environment at TRA. From the early 1950's until 1972 hexavalent chromium was added to the secondary reactor cooling systems at TRA as a corrosion inhibitor in concentrations of 11-14 mg/L. Cooling tower blowdown water containing 4-5 mg/L chromium was then added to the secondary reactor cooling water. Further dilution resulted when the blowdown water and secondary cooling water were combined with other waste streams and discharged directly to the Snake River Plain Aquifer via the TRA Injection Well or discharged to the WWP. Concentrations of chromium in the waste water discharged between 1952 and 1972 were monitored by TRA Operations and are in the range of 0.7 to 2.0 mg/L (Hull, 1989). Although chromium has not been discharged to the environment since 1972, the WWP continues to receive tritiated waste water.

Water discharged to the WWP percolates through the subsurface to perched water zones that also receive process waters percolating from the TRA Sewage Treatment, Chemical Waste, and Cold Waste Ponds. Historically, concentrations of chromium found in the perched zones are less than those found in the waste water discharged to the pond. Two factors contributing to this include mixing with other process waters in the perched zone and the chromium coming out of solution in the alluvial soil. In addition, as process water entered the Aquifer from the perched zones or the injection well, the chromium concentration was greatly diminished due to mixing with large volumes of uncontaminated groundwater from the Snake River Plain Aquifer. The USGS has monitored the groundwater at TRA since the early 1960's. Figures 1 and 2, compiled by the USGS, show chromium concentrations contours for various time periods in the perched zones. These figures do not show chromium concentrations above 0.5 mg/L. Figure 3 (Hull, 1989) shows the chromium and tritium concentrations as a function of time for two aquifer monitoring wells downgradient from TRA. Well USGS-76 typifies most aquifer wells around TRA with its chromium concentration in the 0 to 0.09 mg/L range. Well USGS-65 has always shown anomalously high chromium concentrations in the 0.2 to 0.8 mg/L range.

III. Disposal Requirements

A. RCRA Requirements

Under RCRA, a material is identified as a hazardous waste if it exhibits characteristics of hazardous waste (40 CFR 261 Subpart C) or is found on the lists of hazardous waste (40 CFR 261 Subpart D). Water below TRA is not a listed waste and does not exhibit the characteristics of hazardous waste (ignitability, corrosivity, reactivity, or toxicity). The toxicity characteristic however has some general relevance to this discussion because this characteristic lists contaminants which exist in the waters below TRA. The toxicity characteristic (40 CFR 261.24) revised by 55 FR 11862 [March 29, 1990] gives the method for testing solid waste for its toxic characteristic by using the TCLP test and analyzing the extractable leachate. When the waste contains < 0.5 percent filterable solids (such as groundwater), the waste itself, after filtering, is considered the extract and can be analyzed for its chemical content. The TCLP limits for the contaminants covered by this standard are given in Figure 4. The regulatory level for chromium is 5 mg/L (5000 µg/L). As a comparison, the highest concentrations of chromium in any of the aquifer wells at TRA were found in well USGS-65. These levels, as stated previously, were still much below the TCLP limit.

Based on the available monitoring data and process knowledge, it can be concluded that purge and well development water produced at TRA will not be a RCRA hazardous waste.

B. CERCLA Requirements

Due to the presence of chromium, tritium, and other contaminants, the purge water will contain CERCLA hazardous substances (40 CFR 302.4) and should be managed as a radioactive waste because of the tritium.

A technical memorandum was prepared by MSE, Inc., outlining the requirements governing the transportation, storage, and disposal of material generated during characterization activities at TRA (Attachment 3). The memorandum notes that for CERCLA hazardous substances generated under CERCLA authorities, it may be:

"... permissible to return these materials to other facilities or areas of contamination which are located on site. Under CERCLA, on-site is defined as the areal extent of contamination necessary for implementation of the response action. Facility is defined as any building, structure, installation, equipment, pipe or pipeline ... well, pit, pond, lagoon, impoundment, ditch, landfill, storage container ... or any site or area where a hazardous substance has been deposited, stored, disposed of, or placed."

C. LDR Requirements

In addition, the memorandum notes that RCRA hazardous wastes (i.e., characteristically hazardous or listed wastes) may be returned to the point of origin. However Land Disposal Restrictions (LDRs) (40 CFR 268) prohibit the placing of hazardous waste in a noncontiguous facility for disposal. LDRs are

applicable to RCRA hazardous wastes; they can also be considered ARARs under CERCLA. This ARAR states that a RCRA hazardous waste is also a CERCLA hazardous substance (40 CFR 302.4). The contaminated well development and purge water, which based on process knowledge and past characterization data has been determined not to be a RCRA hazardous waste, would not be covered by LDR requirements.

IV. Conclusion and Recommendations

Well development and sample purgewater produced from TRA monitoring wells can be classified as a CERCLA hazardous substance rather than a RCRA hazardous waste. Since the WWP can be defined as another on-site facility or contamination area under CERCLA, CERCLA hazardous substances may be returned to the WWP. Disposing of water to the WWP would also comply with EG&G Idaho, Inc. requirements concerning the disposal of radioactive wastes. Therefore, it is recommended that well development and sample purge water produced at TRA during all RCRA and CERCLA characterization activities be disposed directly to the WWP as the water is produced.

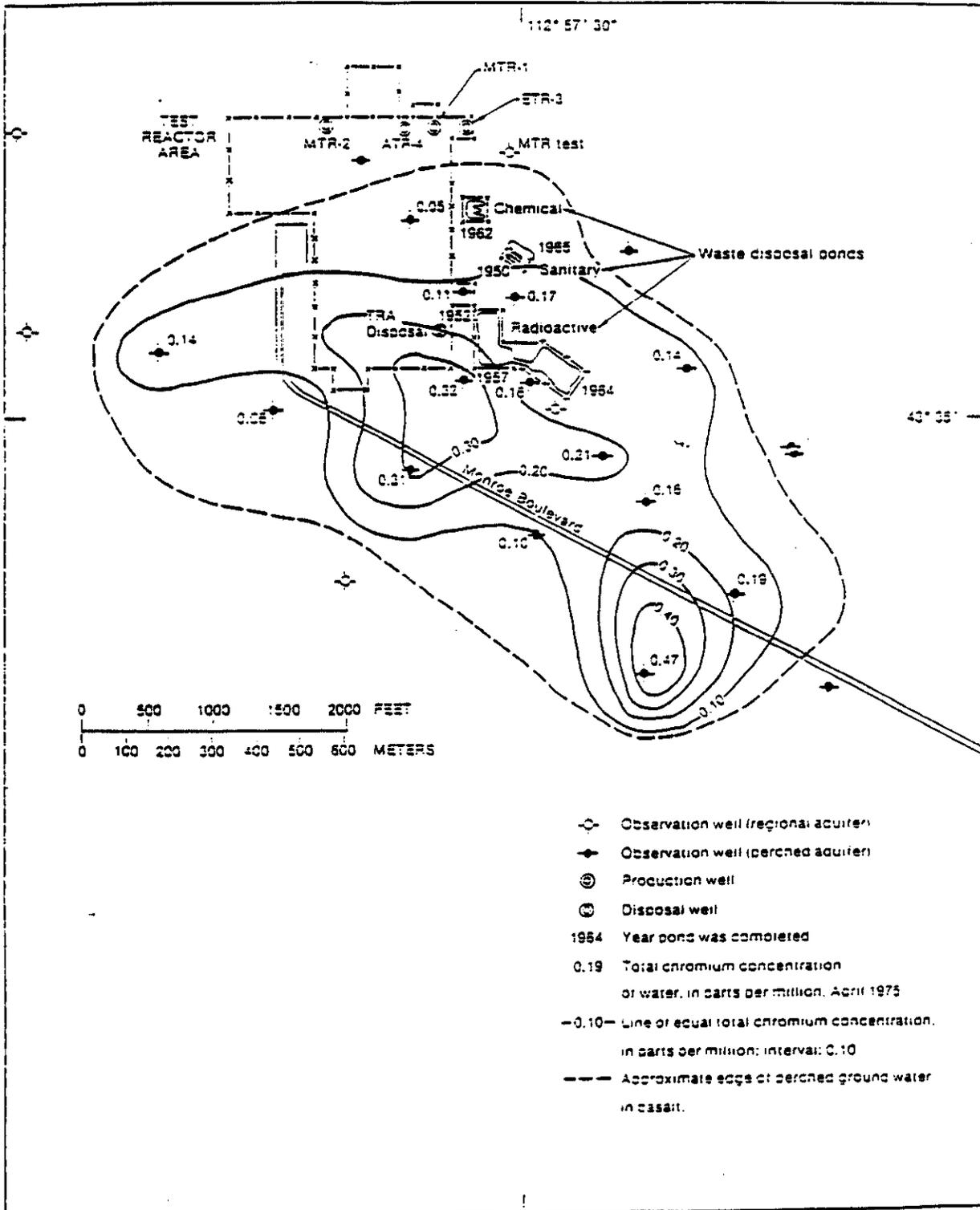


Figure 1 --Total concentration of chromium in the perched ground water in the basalt at the TRA, April 1975.

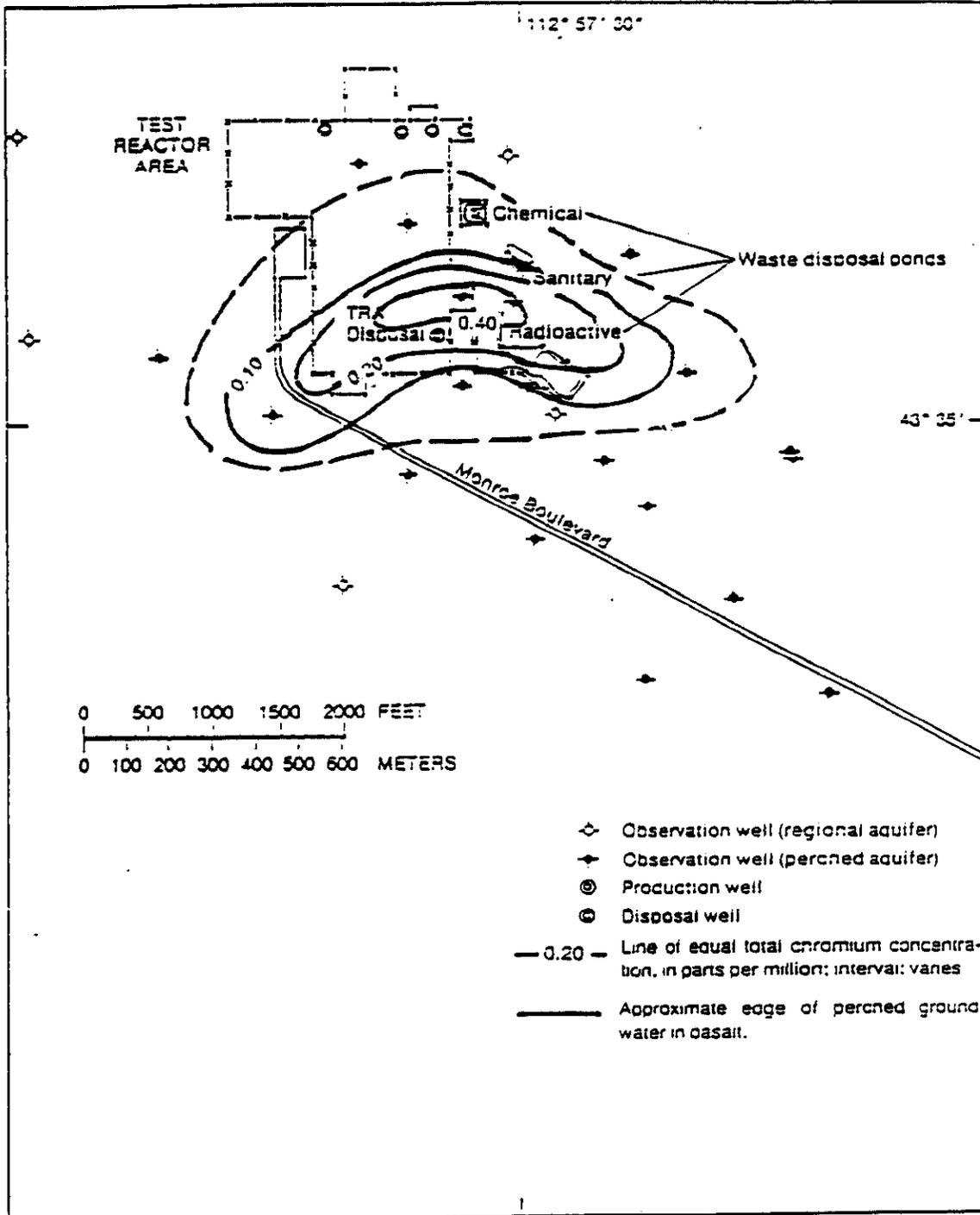
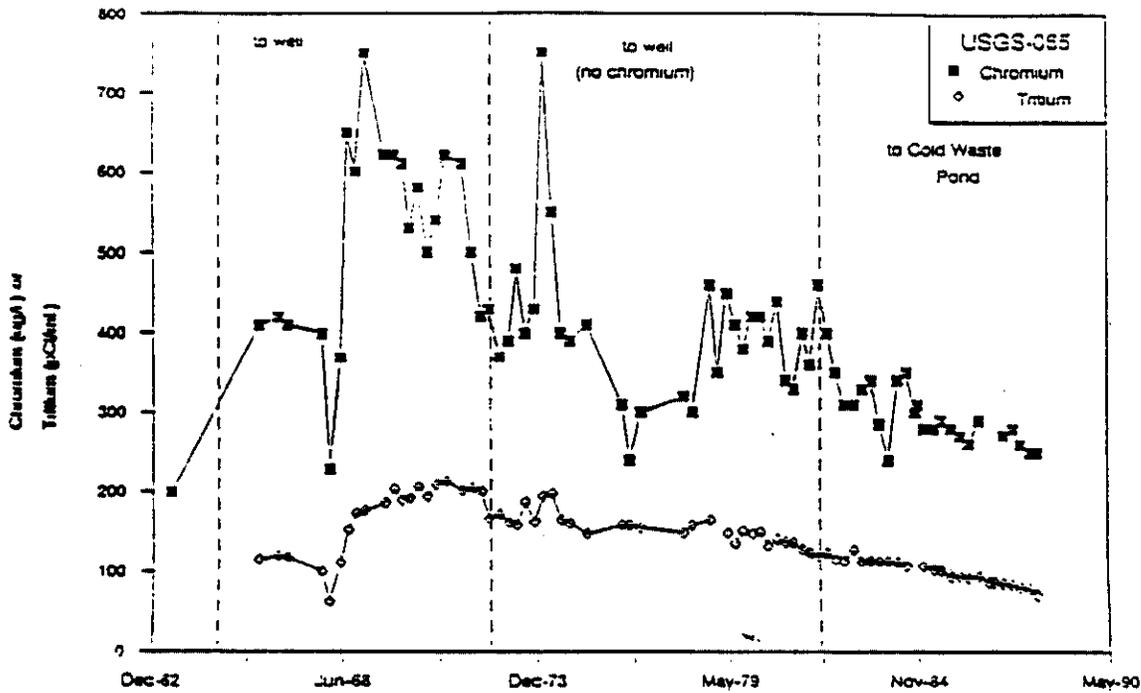
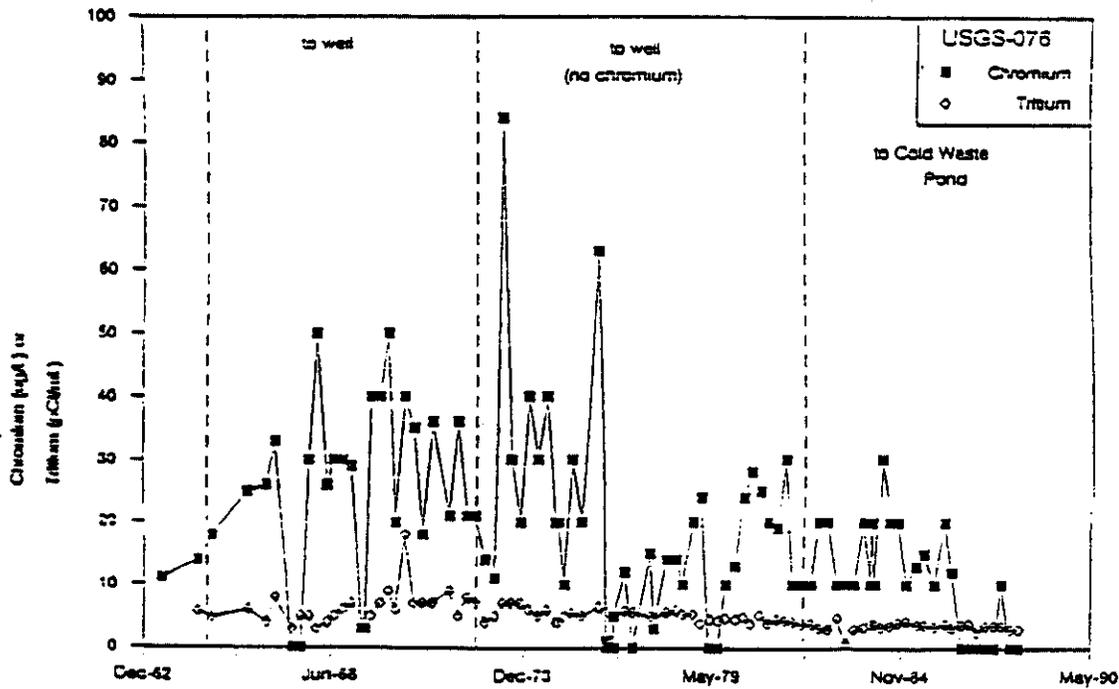


Figure 2 — Total concentration of chromium in the perched ground water in the basalt at the TRA, October 1981.



a. USGS-65



b. USGS-76

Figure 3 Chromium and tritium concentrations as a function of time in monitoring wells downgradient from TRA.

Attachment 1

Resolution of Agency Comments on the Post Record of Decision Monitoring Plan

RECORD OF COMMENTS REVIEW

TITLE/DESCRIPTION: Draft Post Record of Decision Monitoring Plan
 Test Reactor Area Perched Water System, Operable Unit 2-12

REVIEWER: Environmental Protection Agency

10805-668-5706

Item#	Sec#	Page#	Comments	Resolution
General Comments				
1			The major issues which require resolution for the proposed monitoring plan for the Perched Water System are: 1) Rational for well selection for monitoring contaminants, 2) Monitoring frequency, 3) Constituents which will be monitored, and 4) The Lack of Specificity provided in the Monitoring Plan and subsequent Technical Memorandums. These items are addressed in further detail below.	Each item will be discussed in relation to the comments provided.
2			Rational for Well Selection The rational for selecting only three deep perched wells is not supported in the monitoring plan. The number of sampling wells selected for the post Record-of-Decision (ROD) monitoring appears to be inadequate for the deep Perched Water System (PWS). According to the post-ROD monitoring objectives (Sections 2.1.1 and 3.2 of the monitoring plan), data collected from three deep PWS wells will be used to evaluate the effect of discontinued discharge to the warm waste pond on contaminant-of-concern concentrations in the deep PWS as well as SRPA. Data from the three selected monitoring wells will be insufficient to achieve the objective for the following reasons:	

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2 (cont)			<ul style="list-style-type: none"> • Discontinuing discharge to the warm waste pond may significantly affect distribution of contaminant-of-concern concentrations in the deep PWS and, consequently, the contaminant plume distribution in the Snake River Plain Aquifer (SRPA). Three deep PWS wells may not give enough information to allow evaluation of the effect of the warm waste pond on the deep PWS and SRPA. • Since monitoring well PW-8 is as close to the cold waste pond, water samples collected for well PW-8 may not reflect the effects of the warm waste pond due to the volume of water discharged through the cold waste pond. 	<p>The objectives of the post-ROD Plan and the wells to be monitored were agreed upon in the April 1, 1993 comment resolution meeting. Responses to the specific comments reflect these agreements.</p> <p>PW-8 is no longer included in the monitoring network.</p>

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3			<p>This seven SRPA wells identified in the plan for the monitoring network appear to support the objectives. Three more wells, however, (USGS-58, USGS-79, and TRA-7) are recommended for inclusion in the network for the following reasons:</p> <ul style="list-style-type: none"> • USGS-58 is near and directly downgradient from the warm waste pond. If vertical migration of contaminants of concern for the pond and the PWS to the SRPA is predominant at the Test Reactors Area (TRA) site, groundwater samples from this well will have the earliest responses that may reflect the effect of discontinuing discharge of the warm waste pond on the SRPA. This well was also constructed in the upper portion of the SRPA. • USGS-79 is near the western boundary of the deep PWS and cross-gradient in the SRPA to the potential contamination sources (ponds and disposal well). Monitoring this well will provide information to evaluate the plume extent and the transverse migration of contaminants within the SRPA. • TRA-7 was constructed in the upper portion of the SRPA, at an interval similar to that of well USGS-65. This well will provide additional information such as: 1) the transverse extent of the plume of contaminants of concern in the SRPA, and 2) additional data if a satisfactory correlation between the data collected in USGS-65 and TRA-6 cannot be obtained. Two selected wells, USGS-65 and TRA-6, actually were screened in two different vertical intervals in the SRPA. Therefore, the relationship between water quality data obtained from these two wells may not be easily established. 	<p>As agreed upon in the April 1, 1993 comment resolution meeting, USGS-58, TRA-07, and USGS-65 will be the SRPA wells monitored for the post-ROD program. Because definition of the plume extent or transverse migration in the SRPA were not objectives of the PWS RI or the post-ROD program, inclusion of well USGS-79 is not warranted.</p>

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4			<p>Monitoring Frequency</p> <p>The monitoring frequency (twice yearly) was based on an autocorrelation analysis of historical data obtained from some of the selected monitoring wells. The concept of determining sampling frequency to avoid redundancy and the applicability of autocorrelation analysis to the data are questionable and should be further evaluated. Generally, the discussion of monitoring frequency (Section 3.2.2) is invalid (see specific comments) and the frequency of the monitoring program should be reevaluated to meet the stated objectives.</p>	<p>As explained in the specific comments, the application of autocorrelation to establish monitoring frequency is an acceptable technical approach; however, the monitoring frequency agreed upon in the April 1, 1993 comment resolution meeting will be incorporated into the post-ROD Monitoring Plan.</p>

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5			<p>Monitoring Contaminants</p> <p>The discussion of the determination of contaminants/constituents which will be analyzed for in this monitoring plan should be expanded to include the following:</p> <ul style="list-style-type: none"> • A discussion should be included defining, "contaminants of concern", results of the Remedial Investigation and tables summarizing past analytical results. Rational for eliminating other contaminants in the perched water from the monitoring activity should be included. • Diesel fuel was encountered during installation of well PW-13. Volatile organic compounds (VOC) and semi-VOCs should be considered for monitoring in this well to verify the fuel contamination at this location and to confirm whether the fuel contamination is of concern. • Nitrate had been detected in one of the SRPA monitoring wells at a concentration over maximum contaminant levels (MCL) during the RI for the PWS. Nitrate concentration monitoring should be included in the monitoring plan. 	<p>A summary of the contaminants of concern identification process and rationale was detailed in the PWS RI Report and summarized in the ROD and thus incorporated by reference in the Monitoring Plan. As agreed upon in the April 1, 1993 comment resolution meeting, monitoring of hydrocarbons in well PW-13 and nitrate in the SRPA will not be conducted in support of the post-ROD program.</p>

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6			<p>Lack of Specificity</p> <p>The sampling equipment, especially the sampling pumps and field parameter monitoring instrument, should be described in detail. The sampling pump (HYDROSTAR) used during the remedial investigation of the PWS was identified as a contributor of chromium contamination to the sample. The new portable Bennette pump should be checked and cleared of similar cross-contamination problems.</p>	<p>As agreed upon in the April 1, 1993 comment resolution meeting, the level of detail provided in the post-ROD Monitoring Plan and the Standard Operating Procedures appended to the Plan is adequate. Additional information will be provided upon request.</p>
7			<p>Additional detail needs to be included for the data evaluation and statistical procedures used in this document and proposed for future data evaluation. The comparability and use of existing data should be addressed before establishing tolerance limits and trends as detection limits and quality assurance procedures can have a significant impact on the establishment of these "acceptability" limits. Equations used to generate tolerance limits, regression equation, and results of the autocorrelation should be provided. Statistical procedures proposed for analyzing future data should also be included.</p>	<p>As provided in the responses to the Specific Comments, more detail with regards to data assessment (i.e., trend analysis, regression analysis, and tolerance interval calculation) have been added to the text of the Monitoring Plan. Because of the elimination of the use of autocorrelation to support the determination of monitoring frequency, such discussions in the text have been eliminated.</p>

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8			More specific outline for data reporting should be included. The technical memoranda should include a complete data presentation and results evaluation. The extent of the deep PWS and spatial distribution of plumes of contaminants of concern in the deep PWS and SRPA should be illustrated. New and existing data should be compared, and the report should discuss results and present conclusions. The historical data base should be compiled after each sampling event, including water level and analytical data.	Data reporting will be incorporated in the Monitoring Plan as agreed in the April 1, 1993 comment resolution meeting. Details are provided in responses to the specific comments.
Specific Comments				
1	2.1.2	2-4, last paragraph	This section should include additional historical information concerning USGS data, existing site data and remedial investigation data. This information should include specifically: data, well, contaminants analyzed for, frequency of sampling, analytical results and method detection limits. In addition, determination of contaminants of concern should be explained.	As agreed upon in the April 1, 1993 comment resolution meeting, the data and information requested is provided in detail in the PWS RI Report which is incorporated into the post-ROD Monitoring Plan by reference. Reproducing this information in the post-ROD Monitoring Plan is not required.

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2	2.1.3.1	2-7	The rationale for selection of monthly monitoring for one year should be included.	As agreed upon in the April 1, 1993 comment resolution meeting, monitoring the effect of discontinued discharge to the warm waste pond on PWS water elevation is not an objective of post-ROD monitoring. As a result, monthly water level measurements of the PWS will not be conducted.
3	2.1.3.2	2-7 last paragraph	Nitrate should be included as a contaminant of concern that will be sampled for during the post-ROD monitoring. These data will help to confirm that the source of nitrate was the sanitary waste pond. This section and Section 3.1 should also specify whether the same list of contaminants of concern is applicable for both the deep PWS and the SRPA.	As agreed upon in the April 1, 1993 comment resolution meeting, the constituents to be monitored are the contaminants of concern identified in the PWS RI and presented in the ROD. Nitrate will not be added to the list of constituents to be monitored.

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4	2.3.1.4	2-15 paragraph 1 and 2	It is not clear what the purpose of this section is, statements such as, "completeness for the monitoring program will be assessed by comparing the number of samples collected to the number of samples planned", and "90% of the samples requested in this document must be collected", should be clarified.	The post-ROD monitoring plan was formatted as a Sampling and Analysis Plan per EPA guidance for conducting RI/FSS and EG&G Idaho's Procedures for developing monitoring and test plans (Program Directive 5.2). The format includes both a Quality Assurance Project Plan and a Field Sampling Plan. Developing a quantitative goal for completeness is consistent with this format. EPA guidance was used for developing data quality objectives (Data Quality Objectives for Remedial Response Activities, EPA 1987). The discussion has been expanded for clarification.
5	2.3.1.5	2-16	Evaluation of the existing data with respect to the bullets listed should be completed before establishing trends and tolerance limits. These items should, however, be evaluated also as data is collected for comparability.	Comparability of the existing data (i.e., the data which was used to conduct the PWS RI) was established during the RI. The methods proposed in the post-ROD Monitoring Plan were selected to achieve comparability.

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6	3.8.1	2-18, first paragraph	This section should be more specific than "standard equations and statistically acceptable procedures." Equations for computing summary statistics, standard errors, confidence limits, and model validation should be provided. Hypotheses need to be identified and tests of these hypothesis should be included. Details on how new data will be evaluated statistically, how nondetects and laboratory qualifiers will be addressed should also be included.	The data reduction procedures presented in this section are general in nature. Reference to Section 2.12, Data Assessment, has been added to direct the reader to the detailed data analysis description.
7	2.12.3	2-23	<p>Details concerning the use of data from locations with one sample should be included. Statistical methods, number of samples before statistical analysis is completed and specific data use should be outlined.</p> <p>Details concerning use of new data to revise trend and tolerance limits should be included.</p>	As suggested, text has been added to clarify treatment and use of data with fewer than five data points. Additionally, text and equations which describe the techniques for incorporation of new data in trend and tolerance limit calculations has been added.
8	2.12.1	2-31, second paragraph	The statement, "a change in the concentration trend, other than those anticipated by the computer model will require verification," will require quantifying model predictions.	By assessing actual (observed) change in concentration trends qualitatively against the expected (modeled) trends, an assessment of the accuracy of the model predictions can be made. Quantifying model predictions is not required to conduct the assessment and is not necessary to meet the objectives of the Plan.

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9	2.12.1	2-31, second paragraph 2-31, second	It is not clear what is meant by, "if the reanalysis indicates the high excursion is an accurate result, the new trend will be verified."	The complete sentence, as provided in the Plan, states "if the reanalysis indicates the high excursion is an accurate result, the new trend will be verified pending the results from the next scheduled round of sampling and analysis." As agreed upon in the April 1, 1993 comment resolution meeting, the need for verification of excursions (i.e., resampling) will be evaluated on a case-by-case basis. Text has been added to the plan for clarification.
10	2.13	2-32	It should be clarified that corrective action subject to EG&G approval refers to in-field corrective actions.	The corrective action section will be amended to state that the EG&G Idaho PMs have the approval to implement field changes. The statement "Corrective action may be initiated by any individual on the project, subject to approval by the EG&G Idaho PM" has been modified to read "Field corrective action may be initiated by any individual on the project."

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11	2.14	2-33	Technical memorandum reporting requirements should include deviations from monitoring plan and data evaluation and procedures. It is not clear how long after sample collection data are reported and evaluated.	A statement that deviations from the Monitoring Plan will be included in the Technical Memorandum has been added to the text. The specific data reporting requirements as agreed in the April 1, 1993 comment resolution meeting have also been delineated in the text.
12	2.14	2-33	It is not clear what evaluation of deep PWS concentrations will consist of.	Evaluation of the deep PWS is specifically discussed in Section 2.12.2.
13	3.2.1	3-2, second paragraph	The second sentence of this paragraph states that four deep PWS wells were selected for inclusion in the monitoring network. However, only three wells (PW-8, PW-9 and PW-11) were described in the following text and in Table 6.	The text has been corrected to state that six deep PWS wells were selected for inclusion in the monitoring network. The six wells (PW-11, PW-12, USGS-53, USGS-54, USGS-55, and USGS-56) were agreed upon in the April 1, 1993 comment resolution meeting.

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14	3.2.1	3-2, fourth paragraph	<p>TRA-6 and USGS-65 were both selected for groundwater monitoring in the SRPA to establish the correlation between these two wells. However, monitoring of USGS-65 should be continued because: (1) the two wells were not screened in the same interval (TRA-6, 528-558 Feet; USGS-65, 456-493 feet) even though these two wells were both installed in the upper portion of the SRPA; (2) continuous monitoring of USGS-65 was used as a calibration well in the contaminant transport modeling for the deep PWS remedial investigation; future data obtained from this well will best verify the modeled contaminant-of-concern trends; and (4) correlation of the two data sets based on four sampling rounds may be false because of differences in well construction, sampling equipment, and sampling procedures. Establishing true correlation between these two wells will require verification that may go beyond a simple comparison of four data points. Monitoring data supporting the conclusion that information from these two wells is correlated should be provided.</p>	<p>As agreed upon in the April 1, 1993 comment resolution meeting, three SRPA wells will be monitored in support of the plan: TRA-07, USGS-58, and USGS-65. Samples from upgradient SRPA wells TRA-03 and TRA-04 are obtained in support of other INEL programs. These data will be incorporated in the data reports as defined in section 2.14 of the plan.</p>

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15	3.2.2	3-8 and 3-9	<p>The monitoring frequency determined from the autocorrelation analysis cannot be justified. This section of the monitoring plan should be reevaluated and modified.</p> <p>The application of autocorrelation analysis to the TRA historical data to determine "sampling redundancy" is inappropriate. Autocorrelation analysis is generally used to determine sample spacing of time intervals for random sampling to avoid redundancy. This analysis is applicable if the random process or sampling results do not have long-term trends, cycles or show sudden variability. In other words, the mean, variance, and serial correlation for any time lag will be constant as the series of events or sampling results accumulate over time. In practice, a minimum sampling size (n) of 50 is required to accurately estimate the autocorrelation function with the maximum of lags equal to n/4 (Gilbert 1987).</p> <p>Concentrations of contaminants of concern in the deep PWS and SRPA at the TRA site do not result from a random process. Trends were identified from historical data for some contaminants such as tritium and chromium, while trends for other contaminants were predicted by groundwater modeling. In addition, noise (or errors) in some sampling results may be substantial because the monitoring results reflect accuracies and precision of groundwater purging and sampling procedures, sample collection, storage, and shipment procedures, and lab</p>	<p>The autocorrelation analysis is technically sound for selecting ground water sampling frequency for the post-ROD program. However, as agreed upon in the April 1, 1993 comment resolution meeting, the frequency of deep PWS monitoring will be quarterly for a minimum of one year. After one year the frequency of sampling will be re-evaluated and modified, if necessary. Sampling frequency of the SRPA wells will be biannual.</p>

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16	3-4	3-9 through 3-16	The sampling equipment and field parameter measuring instrument to be used in the post-ROD monitoring program should be specified to allow proper evaluation. The descriptions of equipment should include the manufacturer and specifications, as well as field setup and calibration procedures.	As agreed upon in the April 1, 1993 comment resolution meeting, the level of detail provided in the post-ROD Plan and the Standard Operating Procedures appended to the Plan are adequate. Additional information will be provided upon request.

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REVIEWER: Idaho Department of Health and Welfare

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General Comments				
1	2.1.1	2-1	<p>The Draft Monitoring Plan does present objectives for the post-ROD monitoring activities (see page 2-1, Section 2.1.1). However, these objectives need to be reevaluated to facilitate development of more specific criteria. Also, the three agencies need to agree on a specific plan that meets the goals and objectives of post-ROD monitoring activities. Therefore, IDHW requests that the three agencies meet early during DOE's next comment resolution period to develop at a minimum the criteria for the Monitoring Plan:</p> <ul style="list-style-type: none"> • The selection of monitoring wells to evaluate changes in both groundwater levels and contaminant needs. • The selection of appropriate contaminants of concern and other key parameters. 	<p>As agreed upon in the April 1, 1993 comment resolution meeting, the objectives have been limited to a) verifying contaminant concentration trends in the SRPA predicted by the computer model; and b) evaluating the effect that discontinued discharge to the warm waste pond has on contaminant concentration in the SRPA and the deep PWS.</p> <p>Other elements of the comment will be addressed in the specific comments section.</p>

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2			<ul style="list-style-type: none">• Sampling and analysis frequency.• Reporting format and specific deliverables.• Specific criteria for key decision points during the monitoring process.• Specific criteria that would indicate completion of the monitoring activities. IDHW proposes that the following items be considered in developing the criteria and objectives of the post-ROD monitoring activities.	

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			<p>A) As a result of the subject monitoring plan, previous reviews of the Remedial Investigation Report for the TRA Perched Water System, and published data on the TRA Perched Water System, IDHW has raised concerns related to the complexity of the deep perched water system and the variety of existing wells with varied screen intervals used to monitor this complex system.</p> <p>IDHW has interpreted that the deep perched water system consists of a shallow, intermediate, and deep zone (see Figure 1, attached). Existing wells are screened to evaluate various portions of this perched water system.</p> <p>Therefore, in order to monitor the vertical trends of contaminant levels, possible combinations of paired wells (i.e., close proximity wells screened in various zones of the perched water system) can be identified.</p>	<p>A) The objectives for the post-ROD monitoring program were agreed upon in the April 1, 1993 comment resolution meeting. The Monitoring Plan has been modified accordingly.</p>

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			<p>B) A review of historic concentrations of contaminants such as tritium, strontium-90, and chromium reveal areas of relatively higher contamination in the perched water system both vertically and aerially.</p> <p>We suggest that for the monitoring of contaminant trends, consideration should be given to choosing wells with the higher contaminant levels and wells closest to the sources of contamination and hydrogeologic loading areas.</p>	<p>B) As agreed upon in the April 1, 1993 comment resolution meeting, the wells to be monitored in the deep PWS are: USGS-53, USGS-54, USGS-55, USGS-56, PW-11, and PW-12. The SRPA wells to be monitored are: TRA-07, USGS-65, and USGS-58 supplemented by TRA-03 and TRA-04 data as needed.</p>
			<p>C) Criteria for selecting wells to monitor the elevation changes to the perched water system should consider the importance and impact of screened or open intervals of existing wells. If wells are chosen that are completed through the main perching layer, then the reconstruction of these wells (i.e., cemented back to the top of the perching layer) should be considered.</p>	<p>As agreed in the April 1, 1993 comment resolution meeting, monitoring of water level elevations as a Monitoring Plan objective has been eliminated.</p>
			<p>D) The frequency of monthly water level measurements seems appropriate. However, IDHW recommends that the data be evaluated after the first year to determine whether or not the frequency is appropriate and to recommend any modifications to the frequency.</p>	<p>As agreed in the April 1, 1993 comment resolution meeting, monitoring of water level elevations as a Monitoring Plan objective has been eliminated.</p>

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			E) A format needs to be developed to determine specific deliverables. For example, how will water elevations be presented for the perched water system. Also, key decision points and how all of the agencies fit into the review process needs identification.	The format for data reporting and key decision points were agreed upon in the April 1, 1993 comment resolution meeting. The post-ROD Monitoring Plan has been modified to delineate these requirements.
			F) IDHW recommends considering the initiation of quarterly sampling and analysis for all wells that are considered for the monitoring activity as several new wells (i.e., wells installed for the recent characterization effort) have very limited historical sampling data. This data needs to be evaluated after the first year data collection to determine whether or not the frequency is appropriate.	As expressed in the comment and agreed upon in the April 1, 1993 comment resolution meeting, the monitoring frequency will be quarterly for the first year for perched wells only (i.e., USGS -53, -54, -55, -56, PW-11,12). Evaluation of the monitoring frequency for all wells will be conducted after one year.
Specific Comments				
1		2-1, ¶ 2	IDHW recommends that this paragraph be rewritten to reflect that data collected under this plan has many more implications that supporting just a 3-year review. We believe that this be revised to include the specific goals of the plan that will be better defined during the tri-agency meetings to resolve comments during the week of March 29, 1993 (see IDHW cover letter for transmitting comments).	As agreed upon in the April 1, 1993 comment resolution meeting, the objectives of the post-ROD monitoring program are limited in scope to the objectives stated in the ROD and reiterated in the post-ROD Monitoring Plan.

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2	2.1.3.1	2-7	<p>The proposed water level measurement program includes wells that are dry (e.g., 64, 75, 80) because they are completed through the main perching interbed. IDHW suggests that if these are considered critical wells to the proposed network that these wells should be reconstructed (cemented back to the top of the perching layer) so that they are providing the intended data.</p> <p>We also agree that water levels in wells chosen for monitoring the deep perched water system be monitored monthly, however, we recommend that the water level data be evaluated at the end of the first year of data collection in order to determine the future sampling frequency.</p>	<p>As agreed in the April 1, 1993 comment resolution meeting, monitoring of water level elevations as a Monitoring Plan objective has been eliminated.</p>
3	2.1.3.2	2-7	<p>IDHW has concerns that the criteria for selection of wells for groundwater sampling and analysis in support of the Record of Decision goals has not been agreed to by the tri-agencies (see General Comment #s 1 & 2). IDHW recommends that the criteria be evaluated and defined in an upcoming tri-agency meeting during DOE's next comment resolution period.</p>	<p>As agreed upon in the April 1, 1993 comment resolution meeting, the wells to be monitored in the deep PWS are: USGS-53, USGS-54, USGS-55, USGS-56, PW-11, and PW-12. The SRPA wells to be monitored are: TRA-07, USGS-65, and USGS-58 supplemented by TRA-03 and TRA-04 data as needed.</p>

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4		2-19 and 2-20	In Tables 3, 4, and 5, it is not clear what the detection limits for radioactive species represent. Are these detection limits defined as an activity level based on counting statistics (e.g., 4.66s, with the random error based on a predetermined count time), or are they interpreted from uncertainty values provided with analytical results (e.g., detection assumed where measured value is 3s)?	The detection limits and supporting methodologies are included in Appendix C of the post-ROD Monitoring Plan.
5	2.8.3	2-21, ¶ 4	The plan needs to specify how often the data will be entered into ERIS.	The text has been modified as suggested.
6	2.12.1	2-23	<p>The trending results for PW-8, TRA-03, TRA-04, and TRA disposal (as presented in Figures 8, 10, 11, 12) are not useful because for these plots most of the values are at the detection limit of 5 or 10 µg/L. Thus, the zeros plotted are actually less than the detection limits.</p> <p>Also, the trending shown for TRA-03 and TRA-04 tritium is also misleading. For the figures (17, 18), the count is plotted without the associated analytical error. Error for tritium values reported by the USGS has been generally ± 300 pCi/L (or .3 pCi/mL). Therefore, this data does not appear to be correctly used. Please reevaluated these figures accordingly.</p>	<p>As agreed upon in the April 1, 1993 comment resolution meeting, one-half the detection limit will be used in the tolerance interval calculations.</p> <p>The uncertainty value reported with radiological results is routinely used to determine if the result is statistically positive. The uncertainty value is not intended to represent a concentration range to be used during calculations or data interpretations.</p>

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7		2-31, ¶ 2	<p>The half-lives for Co-60 and Sr-90 have been incorrectly stated in this paragraph. Sr-90 half-life is about 29 years, not 12 years. Co-60 half-life is about 5.2 years, not 29 years. Have the incorrect values been used in determinations of expected change scenarios? If so, what impact does using the correct values have on expected change scenarios?</p>	<p>The half-lives were incorrectly transcribed in the text of the Monitoring Plan. The text has been modified.</p>
8	2.12.3	2-32	<p>As stated previously in IDHW Specific Comment #2, in order to evaluate the changes to the areal extent of the perched water system, wells completed through the main perching zone should be reconstructed (cemented back to the top of the perching layer).</p> <p>Also, in the deep perched water zone (see previous IDHW General Comment #2), where two sedimentary layers are separated by basalt. Wells penetrating through the upper sedimentary layer should not be treated as if they are in the same water body as wells completed above the upper sedimentary layer. Wells which penetrate through the upper sedimentary layer at the margins of the perched water body(ies) may fluctuate between conditions of (a) hydraulic continuity with the water above the upper sedimentary layer, and (b) a separate water table between the two sedimentary layers.</p>	<p>Further delineation of the areal extent of the perched zone is not required to meet the objectives agreed upon in the April 1, 1993 comment resolution meeting.</p>

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9	2.14	2-33	IDHW recommends that the Monitoring Plan contain an annotated Table of Contents for covering the reports to be submitted to IDHW and EPA for review. IDHW recommends that the Table of Contents be developed and finalized during our next meeting early in DOE's comment resolution period.	The Monitoring Plan has been modified to reflect the data reporting requirements as agreed upon in the April 1, 1993 comment resolution meeting.
10	3.2.1	3-2	<p>As discussed previously (see IDHW General Comment #s 1 & 2), the criteria that the three agencies agree meets the ROD goals for monitoring needs to be determined.</p> <p>In paragraph four it is suggested that both wells TRA-06 and USGS-65 are screened in the upper portions of the SRPA. However, it needs to be pointed out that these two wells are not completed in the same zone of the aquifer (i.e., USGS-65 is screened from 465-493 ft and TRA-06 is screened from 528-558 ft.), nor do these wells exhibit the same levels for contaminants of concern (i.e., for RI sampling 1991, USGS-65 samples returned 179 and 186 µg/L Cr, while TRA-06 was non detect, and USGS-65 showed 61,000 pCi/L tritium, while TRA-06 was non detect). Please reevaluate whether or not it would be appropriate to suggest dropping USGS-65 based on results of TRA-06.</p>	<p>The goals and objectives for monitoring were stated in the ROD and agreed upon in the April 1, comment resolution meeting.</p> <p>As agreed upon in the April 1, 1993 comment resolution meeting, the SRPA wells included in the program are TRA-07, USGS-65, and USGS-58. The data set will be supplemented, as necessary, with results from wells TRA-03 and TRA-04.</p>

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11		3-3 to 3-7, Table 6	<p>Please explain the interpretation of the heading "Cased/Open" with the footnote "a." reading "Cased or open in hydrologic unit being monitored." What does it mean that a well is cased or open in the hydrologic unit of concern? If it is cased in the unit of concern, how could that well be used to monitor this unit?</p> <p>General statements concerning each well:</p> <ul style="list-style-type: none"> • TRA-06 This well is not included in the USGS monitoring network. • TRA-08 This well is not included in the USGS monitoring network. • USGS-65 TRA-06 and USGS-65 do not sample the same region of the aquifer (see IDHW Specific Comment 10), therefore, it is highly unlikely trends in TRA-06 could replace the 30 years of samples collected from USGS-65. 	<p>The footnote has been modified to clarify "Cased/Open" on the table. The cased interval identified refers to the screened interval; the open interval indicates there is no well screen.</p> <p>As agreed in the April 1 comment resolution meeting, TRA-06 and TRA-08 have been eliminated from monitoring network</p> <p>Agreed</p>