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INFORMAL REPORT

ENVIRONMENTAL RESTORATION PROGRAM IN SITU VITRIFICATION INTERMEDIATE SCALE SAMPLING AND ANALYSIS PLAN

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EG&G Idaho

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

ENVIRONMENTAL RESTORATION PROGRAM

IN SITU VITRIFICATION
INTERMEDIATE SCALE

SAMPLING AND ANALYSIS PLAN
REVISION 0

JULY 1989

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FOR

U. S. DEPARTMENT OF ENERGY
IDAHO OPERATIONS OFFICE
IDAHO FALLS, IDAHO
UNDER DOE CONTRACT NO. DE-AC07-76ID01570

ISV INTERMEDIATE SCALE
SAMPLING AND ANALYSIS PLAN

Revision 0

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ISV INTERMEDIATE SCALE SAMPLING AND ANALYSIS PLAN

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LIST OF ACRONYMS

CAP	Corrective Action Program
CFA	Central Facilities Area
COC	Chain of Custody
DCQAP	Data Collection Quality Assurance Plan
DIRC	Data Integrity Review Committee
DOE-ID	Department of Energy - Idaho Operations Office
DQO	Data Quality Objectives
ERP	Environmental Restoration Program
INEL	Idaho National Engineering Laboratory
ISV	In Situ Vitrification
NBS	National Bureau of Standard
PD	Program Directive
PNL	Pacific Northwest Laboratory
QA/QC	Quality Assurance/Quality Control
QAO	Quality Assurance Officer
RCRA	Resource Conservation and Recovery Act
RFP	Rocky Flats Plant
RWMC	Radioactive Waste Management Complex
SAP	Sampling and Analysis Plan
SDA	Subsurface Disposal Area
SOP	Safe Operating Practice
SOP	Standard Operating Procedure
SOW	Statement of Work
TC	Thermocouple
TCL	Target Compound List
WRRTF	Water Reactor Research Test Facility

1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) has been prepared in accordance with the Environmental Restoration Program (ERP) Program Directive (PD) 5.2 to define specific field, laboratory, and quality assurance activities necessary to generate defensible data required to evaluate in situ vitrification (ISV) as an appropriate remedial technology for all or a portion of the Subsurface Disposal Area (SDA). The SDA is located at the Radioactive Waste Management Complex (RWMC) of Idaho National Engineering Laboratory (INEL). This SAP will consider the data needs of operational, engineering, regulatory, and health and safety activities for two "cold" intermediate scale tests scheduled for August 1989 to be conducted outside the fence of the Water Reactor Research Test Facility (WRRTF) site. Separate SAP's will be generated for an engineering scale test to be conducted at Pacific Northwest Laboratory (PNL) in June 1989 and a "hot" large scale test scheduled to be conducted at the SDA in 1991.

This SAP is based on the following guidance documents:

Preparation of Sampling and Analysis Plans, ERP PD-5.2, 5/03/89.

Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, EPA, March 1988.

Guidance on Remedial Investigations under CERCLA, EPA/540/G-85/002, June 1985.

Data Quality Objectives for Remedial Response Activities: Development Process, EPA/540/G-87/003, March 1987.

Test Methods for Evaluating Solid Waste, Physical/Chemical Properties, EPA SW-846 Third Edition, November 1986.

Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, QAMS-005/80.

2.0 PROJECT DESCRIPTION

ISV is an emerging technology for in-place conversion of contaminated soils into a durable glass and crystalline waste form. ISV is based on the joule-heating principle used by electric melter technology developed by Battelle Memorial Institute at Pacific Northwest Laboratory (PNL) for the immobilization of high-level nuclear waste. Initial ISV tests were performed at PNL in August 1980. Since then ISV has grown from a concept to an emerging technology through a series of:

- 4 bench-scale tests
- 24 engineering-scale tests
- 14 pilot-scale tests
- 4 large-scale tests.

The process has been broadly patented (U.S. Patent 4,376,598; Brouns, Buelt, and Bonner, 1983) domestically and abroad, and Battelle, the prime subcontractor at PNL, has been granted worldwide rights to all ISV technology except for ISV of radioactive wastes. The program has been sponsored by the U.S. Department of Energy (DOE) for potential application to contaminated soil sites (1). Data available through published PNL reports has been assessed and used to develop intermediate scale sampling strategies at WRRTF.

2.1 Background Information

The RWMC encompasses approximately 144 acres in the southwestern corner of the INEL (Figure 1). The RWMC was established in 1952 as a controlled area for burial of solid low-level wastes generated by INEL operations. In 1954 the 88-acre SDA (Figure 2) was designated as a solid transuranic (TRU) waste disposal site and received waste generated by nuclear weapons production activities at the Rocky Flats Plant (RFP) near Golden, Colorado. From 1954 to 1970 this waste, as well as waste received from other DOE sites and research universities, was disposed of by shallow-land burial in pits and trenches at the SDA. RFP process wastes include an estimated 88,400 gal of TRU contaminated organics including carbon tetrachloride, used machining oils, 1,1,1-trichloroethane, trichloroethene, and tetrachloroethene.

In 1987 the Buried Waste Program (BWP) (renamed the Environmental Restoration Program in 1989) was established within EG&G Idaho to manage the Corrective Action Program (CAP) at the SDA. The CAP established the scope of work necessary to characterize the SDA, develop and evaluate corrective measure alternatives, and design, construct, operate, maintain and monitor the performance of corrective action measures. Although the Resource Conservation and Recovery Act (RCRA) defines the scope of the CAP as evaluation of hazardous contaminants of concern, i.e. chlorinated volatile organics, the ERP is also responsible for radionuclide and/or other hazardous constituent investigations and corrective measures (including the ISV Treatability Study Project) at the SDA.

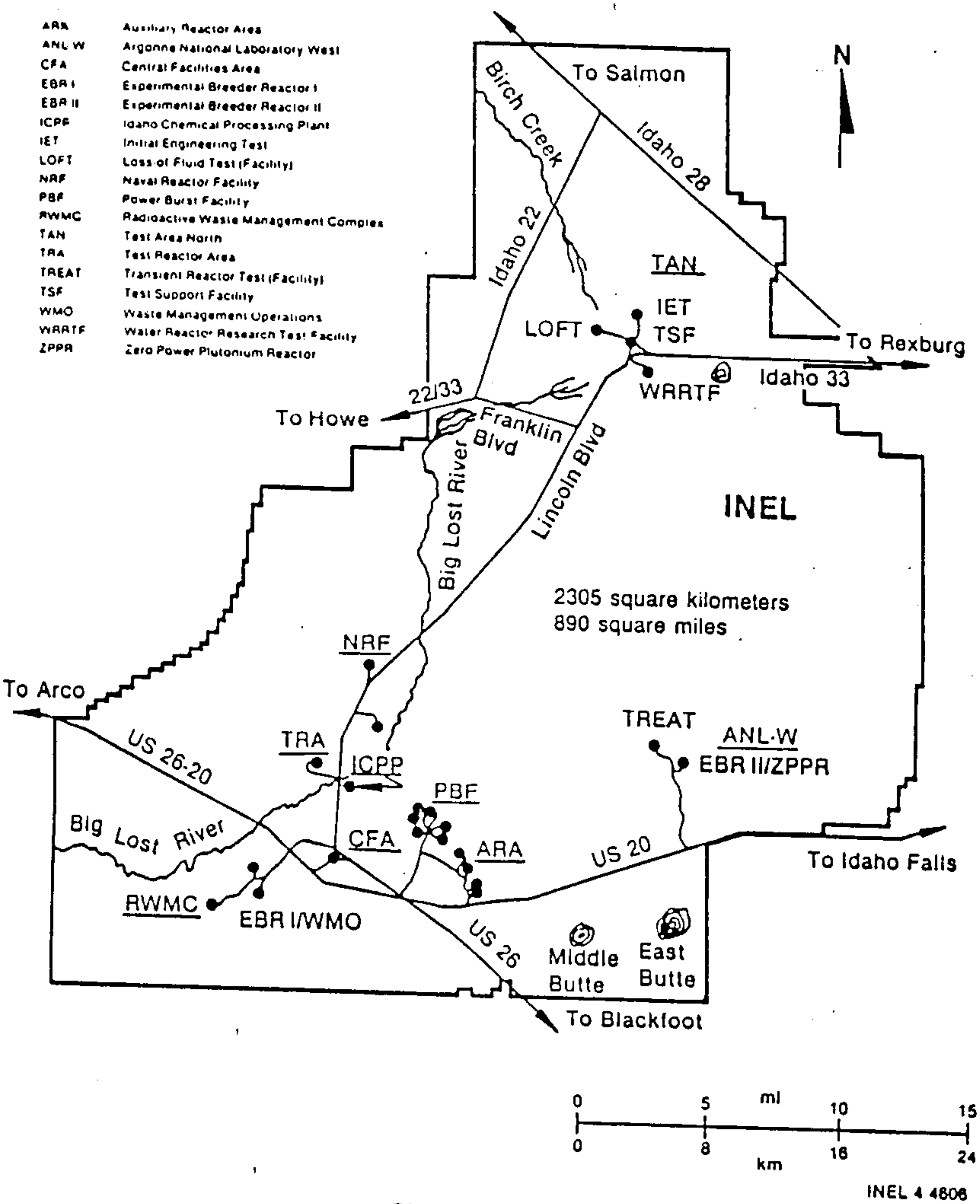


Figure 1: INEL/RWMC Map

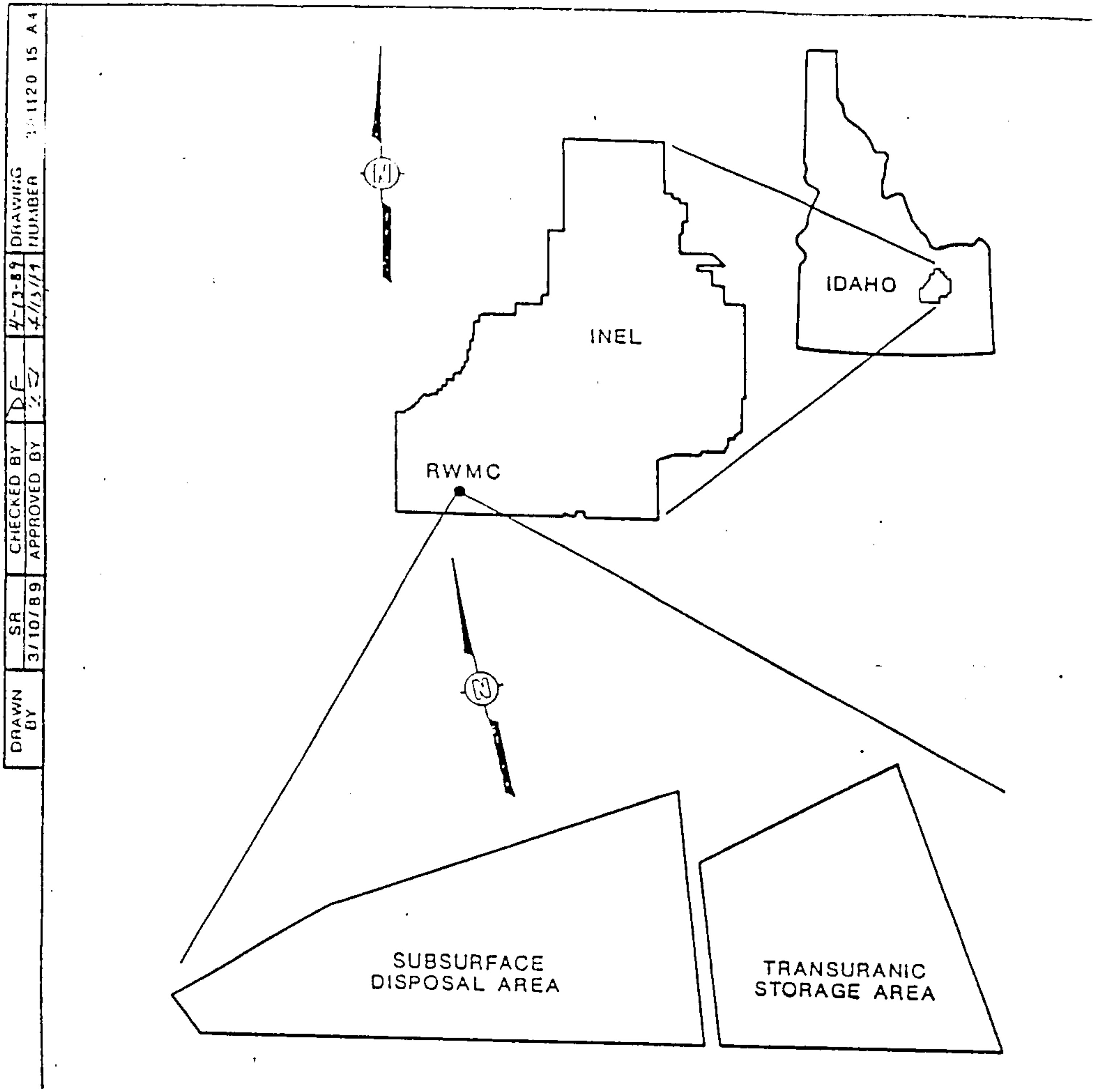


Figure 2: SDA Map

2.2 ISV Intermediate Scale Treatability Study

Three series of tests are associated with the ISV Treatability Study:

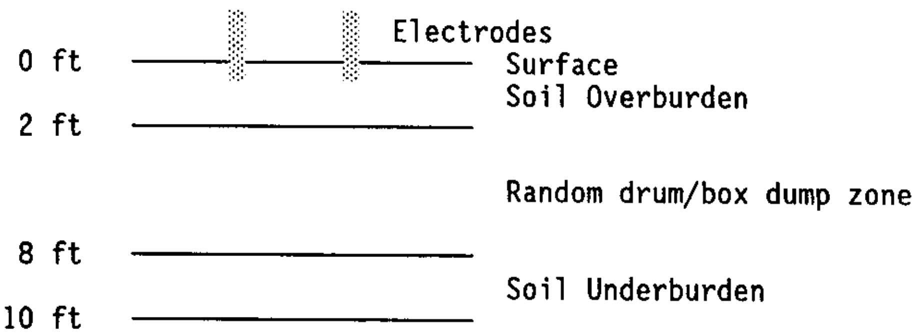
1. Four engineering scale tests conducted at PNL.
2. Two "cold" intermediate scale tests scheduled for August 1989,
3. A "hot" large scale test scheduled for 1991.

The following discussion summarizes the two intermediate scale tests.

The intermediate scale ISV tests are part of an overall Treatability Study designed to determine the applicability of the ISV technology to the INEL/SDA site. Two test pits will be constructed outside the fence at WRRTF (Figure 3); each pit will be scaled down representations of SDA pits (i.e., waste containers, combustibles content, metals content, and container configuration were all designed from SDA waste records) , and have unique engineering objectives. The first test is designed to demonstrate the operational capabilities of an electrode feeding system, and demonstrate system performance in a random dump layer with waste form composition similar to that found in the SDA. The second test will demonstrate system performance in a minimum soil content waste layer and a high metal content waste layer; should the system fail, or operate in less than optimum fashion, it would be under Test 2 conditions. It is expected that Test 2 conditions will be found at the SDA.

The dimensions of Test Pit 1 (below) will be approximately 10 ft x 10 ft x 10 ft. The pit will contain two vertical feet of soil overburden, six vertical feet of approximately 208 randomly dumped, unpainted, steel, lidded drums (approximately 2 gal) and 20 5-ft^3 cardboard boxes, and two vertical feet of soil underburden. The electrodes are arranged in a square configuration; spacing between adjacent corner electrodes is 3.5 ft.

Test Pit 1:



The dimensions of Test Pit 2 (below) will be approximately 10 ft x 10 ft x 10 ft. The pit will contain two vertical feet of soil overburden, two vertical feet of approximately 504 horizontally stacked, unpainted, steel, lidded drums (approximately 2 gal), three vertical feet of approximately 48 5-ft^3 stacked cardboard boxes, and three vertical feet of soil underburden. Electrode spacing is 3.5 ft.

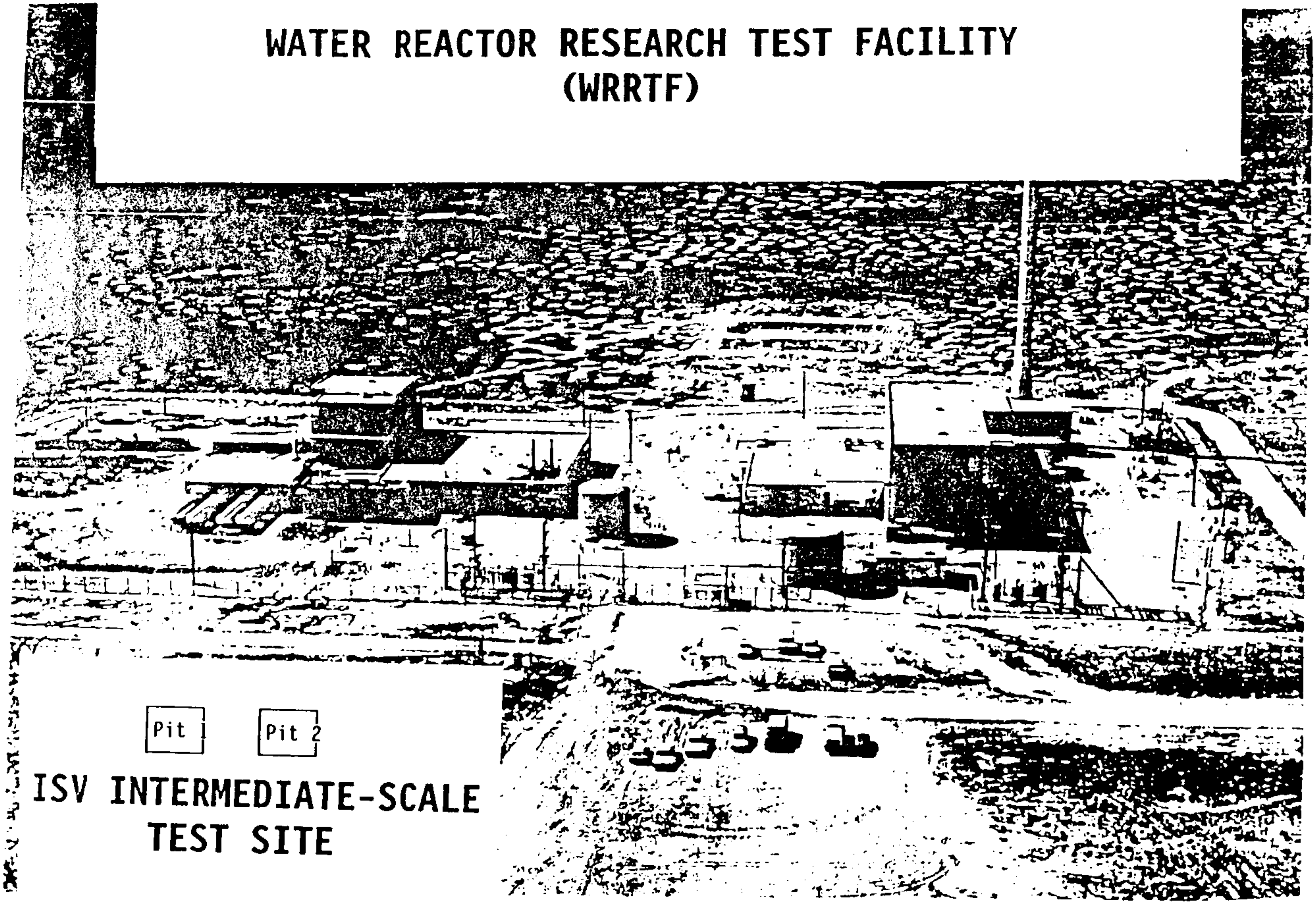
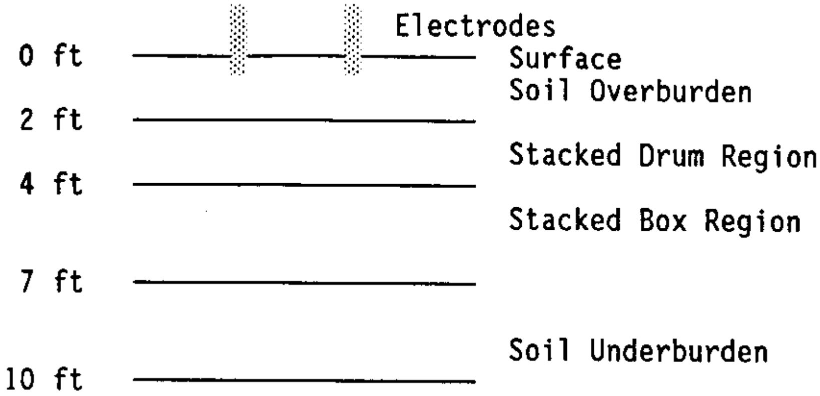


Figure 3: WRRTF

Test Pit 2:



The waste fractions for drums and boxes for both test pits (on a volume basis) are as follows:

For drums:	
Sludge	0.30
Combustibles	0.50
Metals	0.08
Concrete/asphalt	0.10
Filters/wood/glass	0.02
For boxes:	
Metal	0.80
Asphalt/wood	0.20

Separate waste materials will not be mixed within individual drums/boxes, e.g., 50% of the drums will consist of entirely combustibles, 30% of entirely sludge, etc.

2.3 Sampling Objectives

Figure 4 graphically summarizes the ISV Treatability Study sampling objectives. Highest tier Environmental Restoration Program/Buried Waste Program objectives include:

- o Provide sufficient data to allow treatment alternatives to be fully analyzed and evaluated.
- o Reduce the cost and performance uncertainties for treatment alternatives.

ISV Project specific objectives include:

- o Site characterization prior to and following the intermediate scale ISV tests.
- o Qualitative determination of the appropriateness and applicability of ISV as a corrective measure for all or part of the SDA by immobilization of contaminants available for migration in a safe and environmentally sound manner.
- o Data collection necessary to ensure compliance with health, safety, and regulatory requirements.

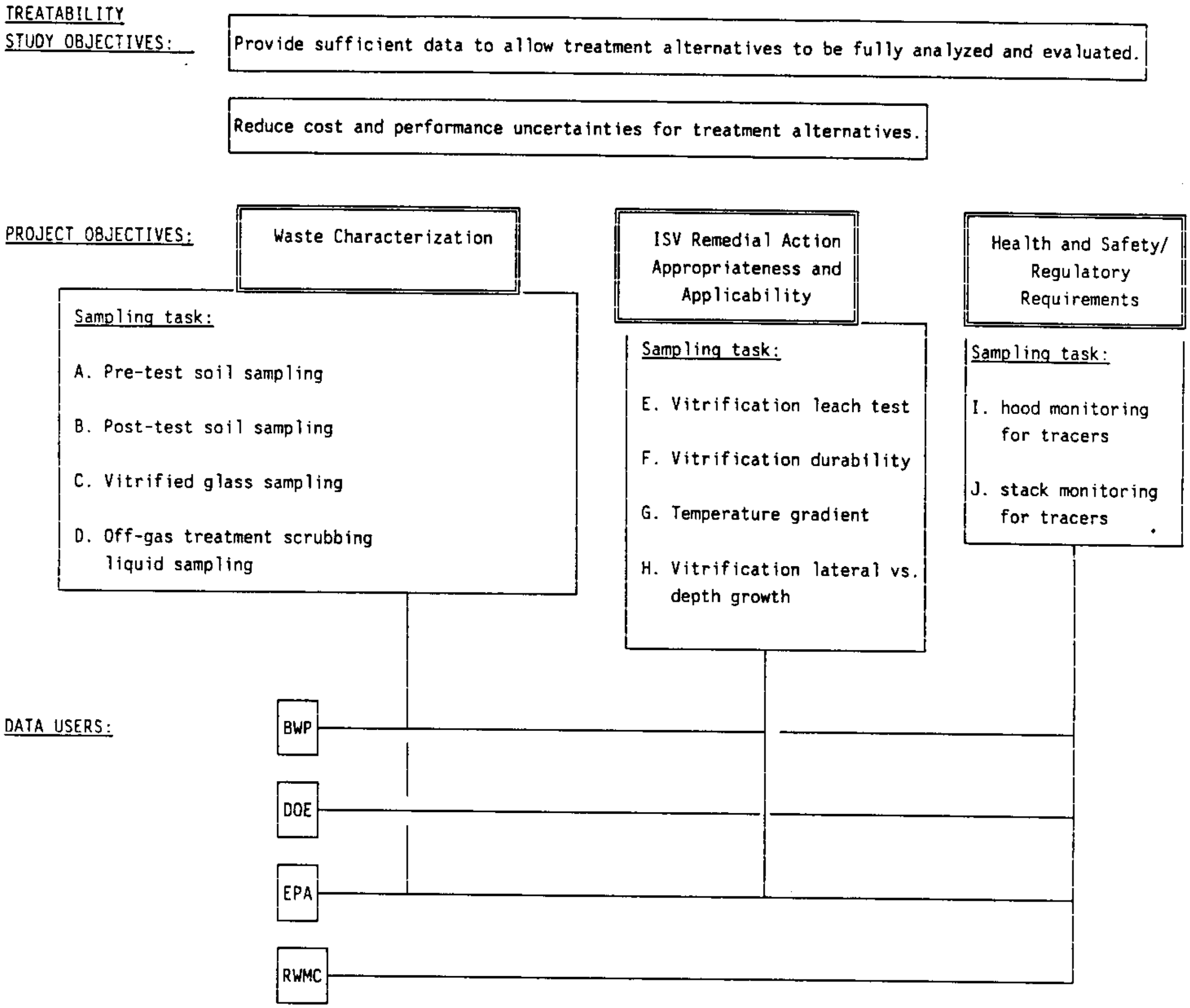
A series of ISV project concerns and uncertainties have been developed, each of which fall under one of the above stated objectives. A sampling task has been identified to address each project concern.

The following list presents sampling tasks necessary to meet stated project objectives:

1. Pre-test soil sampling
2. Post-test soil sampling
3. Vitrified glass sampling
5. Off-gas scrubbing liquid
6. Temperature gradient
7. Stack monitoring

The following data quality objectives and sampling procedures are designed specifically for the intermediate scale test. Many may be applicable to the large-scale test and will be elaborated upon in the <u>ISV Large Scale Sampling and Analysis Plan</u> to be completed at a later date.

Figure 4: ERP ISV TREATABILITY STUDY OBJECTIVES



PROJECT CONCERNS	SAMPLING TASK
o Plutonium movement as simulated by inert tracers.	A,B,D,I,J
o Underground waste fire hazard.	G
o Voids, fractures, pockets providing waste migration pathways.	H
o Glass cooling stratification.	C
o Vitrified waste durability.	F
o Waste immobilization.	E
o Off-gas treatment system overload.	I,J

2.4 Data Quality Objectives

The following data quality objectives (DQO's) have been established to ensure that the data collected are sufficient and of adequate quality for their intended uses. Data collected and analyzed in conformance with the stated DQO's can be used in assessing the uncertainty associated with decisions related to remedial response. Refer to Section 10 for ISV accuracy and precision requirements.

1. Data Users: ISV intermediate scale primary data user is the Environmental Restoration Program, In Situ Vitrification Project. The ERP is responsible for collecting data resulting from several promising, diverse remedial pilot scale tests and demonstrations, of which ISV is included. Decisions resulting from ERP data will be used by the EPA to recommend remedial action(s) at the SDA.

2. Available Information: As stated in Section 2.0 the Battelle Institute at Pacific Northwest Laboratory has developed and conducted numerous bench-, pilot-, and large-scale ISV tests. Data and reports on those tests have been reviewed and used has input in the development of EG&G Idaho tests and establishing sampling strategy.

3. Sample Objectives: Program and ISV Project objectives are discussed in Section 2.3. The primary intermediate scale test objective is to identify trends regarding:

    a. The migration of rare earth tracers, placed in the test pits, within (and if applicable beyond) the vitrification zone. Identification of tracer material movement will provide qualified trends which may be extrapolated to predict alpha particle movement in the ISV large-scale test and future production-scale remediation.
    b. The rate of vitrified product growth.
    c. The potential for underground fires.

    Objective a. above will be achieved by sampling potential tracer migration paths and calculating a mass balance: Total tracer (known quantity in grams) = tracer found in (scrub solution + filter media + product + hood residue + surrounding soil). The qualitative nature of the balance is recognized; it is expected, however, that interpreted results will provide particle migration trends.

    Objective b. and c. above will be achieved by interpretation of measurements from an array of Type C and Type K thermocouples (TC's, refer to Section 4.2). Vertically arrayed Type K TC's will monitor vertical melt growth; horizontally arrayed Type K TC's will monitor horizontal melt growth. It is anticipated that Type K TC's will fail (at approximately 1600°F) as the melt progresses (qualitatively meeting Objective b.); the centrally placed Type C TC's will monitor melt temperature. Type K TC's placed outside the expected melt zone will provide measurements which will be interpreted to determine the potential for underground waste fires directly adjacent to the anticipated vitrification zone.

4. Data Uses: ISV intermediate scale data uses fall under two broad categories:

   o Evaluation of alternatives: ISV intermediate scale data will be used to evaluate the process as a viable remedial action alternative for all or a portion of the SDA. Data may also be used to develop cost estimates for large scale and production tests.
   o Engineering design of alternatives: Data collected will be used to establish a preliminary baseline database for ISV as a remedial action alternative at the SDA. The data will supplement data collected by Battelle from past tests.

5. Data Types: Primary data types include:

   o Chemical characteristics (i.e. background and post-test concentrations of tracer material) of sample matrices included in mass balance calculations.
   o Physical characteristics, e.g., temperature of melt, durability of product.

6. Data Quality Needs: The unique nature of the sampling effort associated with ISV testing makes it difficult to correlate data quality needs with established EPA analytical levels. A broad generalization would place ISV intermediate scale test quality needs no greater than Analytical Level 5. Tracer analysis would, however, require Analytical Level 3 laboratory work though the sample task objective of the analysis is qualitative rather than quantitative. It is reiterated that there are no RCRA or CERCLA contaminants of concern being sampled and analyzed for in the ISV intermediate scale test. There are required detection limits for tracer material:

   o 1 ppm within the scrub solution
   o 5 ppm within solid sample matrices.

7. Data Quantity Needs: The number of samples collected for the intermediate scale test must balance cost with the intended use of the data. The review and application of data gleaned from past ISV studies has provided the basis for the data quantity needs for several of the sampling tasks included in this SAP. These tests include:

   o Product durability
   o Thermocouple measurements
   o Scrub solution sample collection
   o Hood and filter sampling.

8. Evaluation of Sampling/Analysis Options: The sampling strategies included in this SAP were driven by the primary project objective: is ISV an appropriate remedial technology for the SDA. Two areas of concern include radionuclide migration during vitrification and underground fires. Radionuclide migration can be tested by spiking the pit(s) with monitored radionuclides, or tracers to simulate radionuclides. From a health and safety, cost, and political standpoint it was most acceptable to include simulated tracers in the

intermediate scale test.
The use of Type K TC's to identify temperature trends is the most cost beneficial alternative.

9. Precision, Accuracy, Representativeness, Comparability and Completeness (PARCC) requirements are specified in Section 10.0.

Test measurements includes the following:

- o Analytical results regarding tracer concentrations (parts per million, ppm, mg/kg),
- o Thermocouple measurements (converted to °C),
- o Visual observations,
- o Product durability (g/m^2)

Critical test measurements includes:

- o Analytical results regarding tracer concentrations (parts per million, ppm, mg/kg)

A final data package to DIRC will include analytical data, (calibration and sample), chain-of-custody forms, field instrument calibration data, and QC data.

3.0 PROJECT ORGANIZATION AND RESPONSIBILITY

The general organization and responsibilities for the ERP personnel is described in the ERP Program Management Plan, EG&G-WM-8219, and the Data Collection Quality Assurance Plan, EG&G-WM-8220. The project specific responsibilities are listed below and the organizational structure is depicted in Figure 5:

The Treatability Studies Manager (TSM), J. L. Landon, is responsible for the ISV project and other treatability studies. The TSM responsibilities include ensuring all appropriate EPA, State, and Company regulations and requirements are met and the INEL COCA is complied with during the ISV activities. Specifically she will manage the budget, review and approve project documents like the Sampling and Analysis Plan (SAP), Detailed Operating Procedures (DOPs), laboratory Statements Of Work (SOW), and procedures used to perform the work. In addition, she is responsible for reporting to ERP management project status and arranging the necessary personnel and subcontracts to meet schedules and assure required data quality is obtained.

The ISV Intermediate Scale Task Project Manager (TPM), R. M. Schletter, has the ultimate responsibility for the safe and successful completion of all task activities necessary to complete the Intermediate Scale Tests in accordance with the ISV Treatability Study Work Plan. Additionally, the TPM has the responsibility to assure that all field operations are conducted in accordance with procedures specifically developed to conduct the demonstration in compliance with appropriate federal, state, and company requirements.

The ERP QA Officer, R. G. Thompson, is responsible for reviewing and approving the SAP, reviewing the SOW, auditing the field and laboratory activities and reporting to ERP management the results of the audits. In addition, the ERP QA Officer will ensure that the Data Quality Objectives are met and that the quality of the data is verified. The QA Officer has the independence to report directly to the ERP Manager.

The Data Collection Supervisor, J. F. Ginsburg, is responsible for ensuring: the samples are obtained following the sampling procedures, the chain-of-custody are completed, the custody seals are used and the field logbooks are properly filled out. In addition, the Data Collection Supervisor will coordinate with the laboratory manager to obtain the results and correct any discrepancies noted in the data obtained.

The Data Integrity Review Committee (DIRC) is responsible for reviewing the data, SAP and SOWs, and any supporting data needed to decide if the data meets the Data Quality Objectives and assigning uncertainty values to the data. The DIRC Chairman will report to the Treatability Studies and ERP managers the results of the data review. The DIRC members' qualifications are stated in the ERP Project Directive discussing the DIRC's charter.

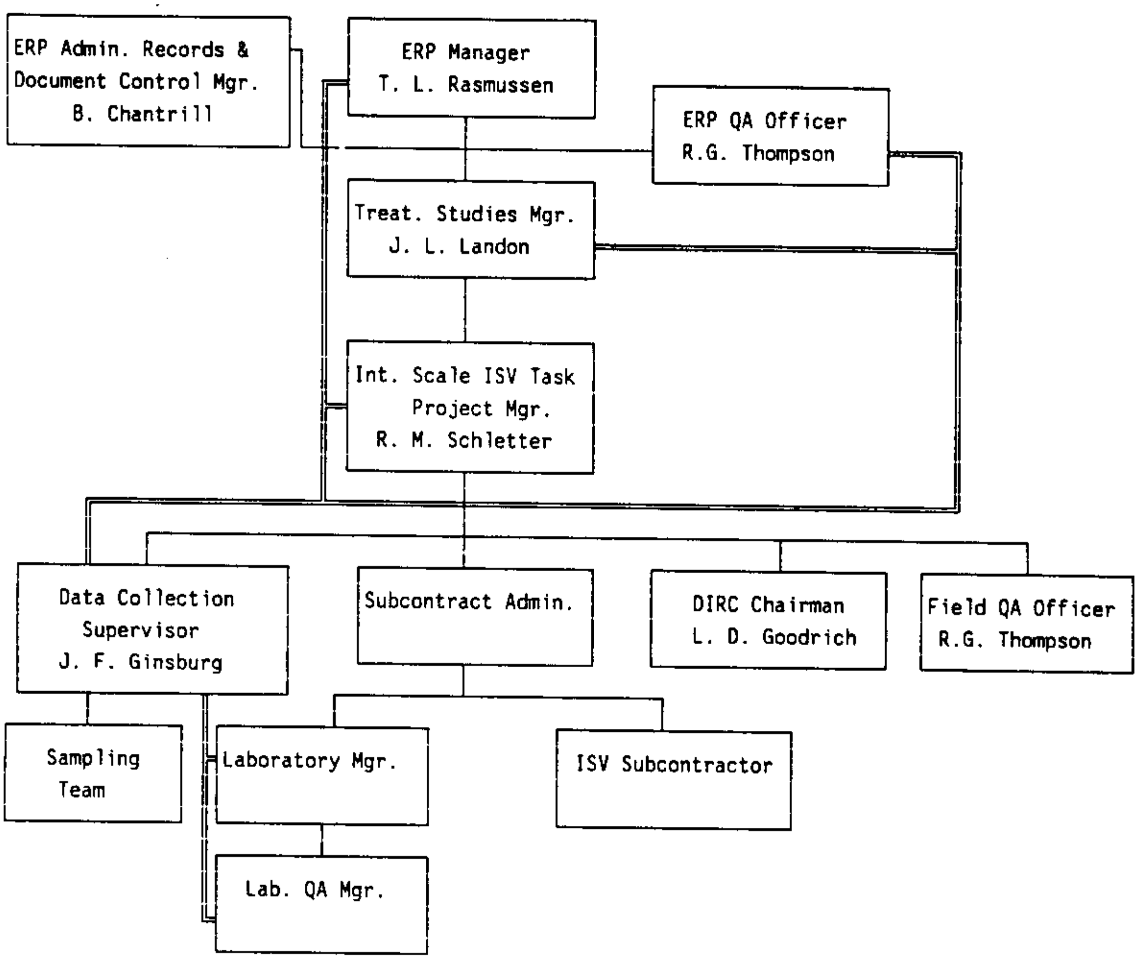


Figure 5: Intermediate Scale ISV Organization

The ISV Specialists, Battelle Laboratories is responsible for all operations and equipment used during ISV testing, and for providing trained operations personnel. This includes the calibration of all instrumentation, and ensuring the proper operation and maintenance of the equipment.

The ERP Administrative Records and Document Control Manager, Bonnie Chantrill, is responsible for the storage and retrieval of the ISV logbooks, data, and other pertinent information collected during the ISV activity once the information is transmitted to her by the Treatability Studies Manager. In addition, she is responsible for issuing the logbooks, custody seals, chain-of-custody forms, and all other controlled documents to the data collection supervisor.

The EG&G Subcontract Administration, is responsible to procure the services of an Environmental Restoration Program approved analytical laboratory. The SA is also responsible for submitting the laboratory Statement of Work (SOW) and serve as contractual liaison.

The Laboratory Manager, will have overall responsibility for laboratory technical quality, cost, control, laboratory personnel management, and adherence to schedules. Responsibilities include preparing analytical reports and ensuring that analytical procedures are performed properly, chain-of-custody (COC) information is complete, and all specified QA/QC procedures are implemented and recorded.

The Laboratory QA Manager, is responsible for the development, implementation and continued operation of procedures that ensure the acceptability of all generated and produced data.

4.0 SAMPLING AND ANALYSIS STRATEGY

The following discussion summarizes sample collection and analyses strategies for each sampling task identified in Section 2.4. Table 1 lists each sample task, sample matrix, number of samples to be collected, approximate date of collection, and analyte.

4.1 Tracer Detection

A primary ISV project objective is to ensure the inhibition of radiologically contaminated particle migration. The strategy designed to determine the extent of particle movement includes the use of the following rare earth oxides:

o Dysprosium oxide (Dy_2O_3)
o Terbium oxide (Tb_4O_7)
o Ytterbium oxide (Yb_2O_3)

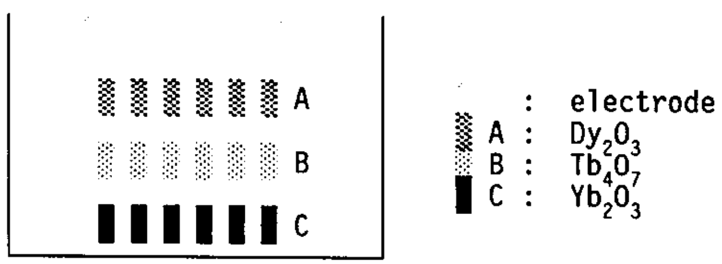
These oxides have been chosen as simulation tracers for the following reasons:

o Non-toxic,
o Low naturally occurring background levels,
o Movement similar to alpha particles,
o Relatively inexpensive.

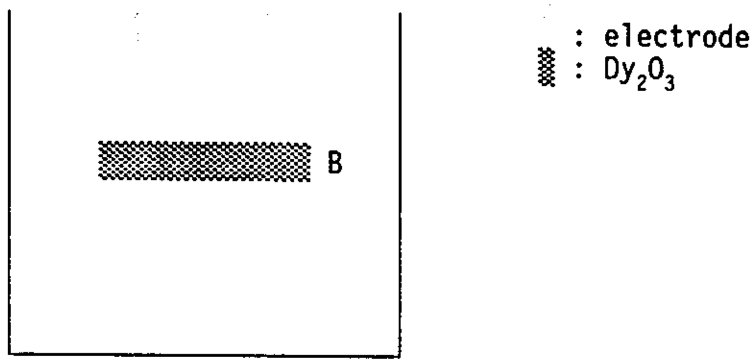
Tracer movement will be qualitatively analyzed by conducting a mass balance on each of the above oxides which will be used to spike both test pits. Particulates may migrate:

o Within the molten glass,
o To surrounding waste/soil,
o To the off-gas treatment system.

The quantity of tracer used to spike both pits was determined by conservatively assuming 0.1% of each tracer will be captured in the off-gas scrubbing solution. The detection limit of one part per million (ppm) was equated to 0.1% of tracer. To ensure analytical detection, the calculated amount of tracer was doubled to approximately 3.0 lbs. The 3.0 lbs of each tracer will be divided into 6 paper packets (1/2 lb each) and distributed in drums near the center of the pit to ensure the drums are included in the vitrification. Pit 1 will contain all three earth oxides layered to identify migration trends within and if applicable beyond the anticipated vitrification zone, as shown in the illustration below.



Pit 2 will contain 5.0 lbs of a signal tracer (Dy_2O_3, Dysprosium Oxide). The 5.0 lbs will be divided into 10 (1/2 lb) packets and located near the electrodes to ensure vitrification, as shown below.



The mass balance will be calculated by sampling and analyzing for detectable quantities of each tracer in the vitrified product, the scrubbing solution, and the stack effluent. The heterogeneity of the simulated waste/soil surrounding the product partially obviates the sampling and analysis of this material. However, upon product excavation, soil will be collected from the bottom of the pit and analyzed for tracer material above background concentrations. Approximately five post-test samples will be collected. Sample locations will be determined by the Data Collection Supervisor following product excavation. Depending on the size and shape of the excavation pit, a grid will be developed and samples will be collected randomly from within each grid section.

Table 1: ISV INTERMEDIATE SCALE SAMPLING SUMMARY

Sample Task		Matrix	No. Samples	Analysis	Collection Date
1.	Pre-test soil sampling	Soil	5	Tracers	8/89
2.	Pre-test scrub solution sampling	Liquid	2/tank	Process tests, Tracers	8/89
3.	Post-test soil sampling	Soil	5	Tracers	11/89
4.	Vitrified products sampling	Glass Glass	20-25 5	Tracers Strength, leach test	10/89
5.	Off-gas scrubbing solution	Liquid	Periodic appr x. 20 per tank	Tracers	9/89
6.	Temperature gradient	Soil/ waste	5 minute interval	NA	9/89
7.	Stack/hood monitoring	Gas o glass fiber filter o hood smears (2) o HEPA fold/pleat (3)	6	Tracers, Process vapors	9/89

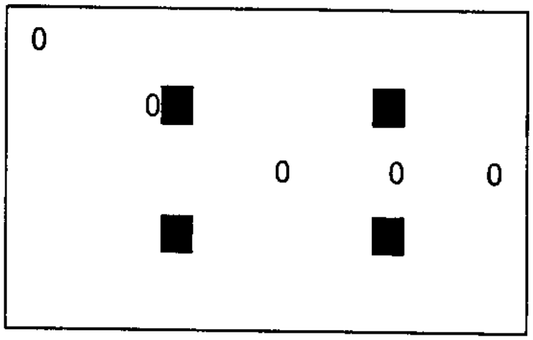
note: Data package will be available for DIRC qualification following excavation and analysis of post-test soil samples. Anticipated date is late spring 1990.

4.1.1 Product Sampling

The vitrified product will be cored and sampled in the following locations:

■ : electrode

0 : coring location



Coring locations were chosen to qualitatively determine effect of electrode on migration. The distance between corings will be dependent on the final product shape and dimensions, but are estimated to be 2'. A one inch slice will be collected from each core at one foot intervals. Core lengths will range from 3' to 7' depending upon location. A linear relationship correlating the distribution and concentration of spiked tracers versus the distance from original placement will be developed. The qualitative nature of identifying migration precludes the need for quality assurance splits and/or duplicates.

A background level of tracers will be established prior to vitrification by randomly collecting five samples from the soil to be vitrified. This soil is likely to be shipped from the RWMC borrow pit facilitating simplified sample collection.

4.1.2 Scrub Solution Sampling

Off-gas treatment scrub solution from two tanks will be sampled periodically at four hour intervals. A total of 15-20 samples per tank will be collected and analyzed for tracer material. Additionally samples will be obtained when the graphite has completely burned off, tank to tank transfers are made, and transfers are made to disposal containers.

4.1.3 Off-Gas Hood and Stack Sampling

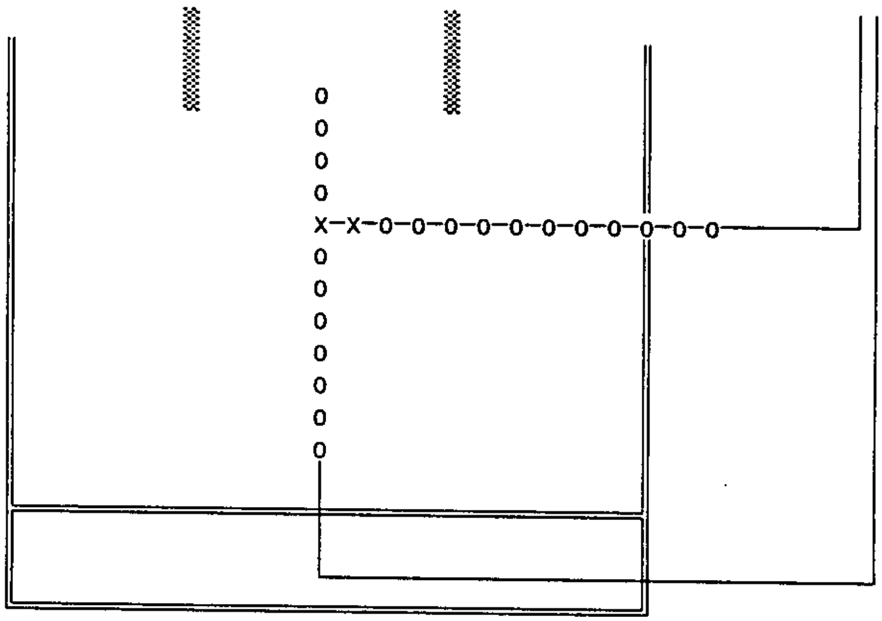
ASTM Standard Practice D 2009-65 will be used for sampling the off-gas effluents. A measured and representative sample is drawn through a filter medium selected to arrest and permit measurement of the particles that are to be studied. The filter is then removed from the system and analyzed.

The basic system includes a sampling nozzle, filter holder, filter medium, flow-measuring device, flow-inducing device, and means for regulating the flow of the sample off-gas. Two systems will be incorporated to sample the off-gas before and after off-gas treatment.

Hood and off-gas line smears (approximately 2) will be collected at the discretion of the Data Collection Supervisor upon recommendation by Battelle personnel. Additionally, following system shut-down one fold or pleat from each of the three HEPA filters will be collected for tracer analysis.

4.2 Temperature Gradient

A network of thermocouples will be placed in the soil and/or waste surrounding the vitrification zone to continuously monitor the temperature profile. Data interpretation will provide a three dimensional time dependent depiction of the melt. This information is valuable in monitoring product growth and determining the potential for underground waste fires. Thermocouple locations are illustrated below; thermocouple spacing is 6":



: electrode

o : Type K thermocouple
x : Type C thermocouple

Vertical TCs will monitor melt growth, while the horizontal thermocouples provide a qualitative temperature gradients approaching pit boundary and soil outside boundary (past studies indicate relative symmetry of the product). Measurements will be collected at the rate of each thermocouple every five minutes.

5.0 SAMPLING PROCEDURES

Sampling and data collection procedure development for the intermediate scale ISV has been based upon acceptable EPA practices.

5.1 Pre- and Post-Test Soil Sampling

Approximately five samples will be collected for both pre- and post-test soil sampling. Pre-test sampling will establish background levels of tracer. Sampling involves soil collection from a mass rather than an established grid. Sample will be collected with a stainless steel sampling spoon or spatula. Sample size will be approximately 100 g in a 250 ml wide mouth, high density polyethylene (HDPE) sampling bottle. Sampling locations will be determined by the Data Collection Supervisor, and logged in the field log book. The soil sampling equipment list includes:

- 12 - 250-ml HDPE wide mouth bottles
- 2 - stainless steel sampling spoons or spatulas
- Decontamination equipment including spray bottles of deionized water, methanol, and three stainless steel catch trays.

Soils will be prepared for analysis as described in "Standard Operating Procedure for Soil Sample Preparation for the RWMC Site Characterization Program" (EG&G, 1989).

Decontamination of sampling tools will be performed as follows:

1. Wash in tap water using a non-phosphate glassware detergent.
2. Rinse with tap water.
3. Rinse with deionized distilled water.
4. Spray or wipe with dilute nitric acid.
5. Air dry on clean blotter paper.
6. If storage or shipping will be required triple bag the tools in clean plastic bags and seal the bags individually.

5.2 Vitrified Product Sampling

Drilling procedures to core the vitrified product will be similar to basalt drilling operations at the RWMC. Detailed procedures are described in:

- Buried Waste Program Site Characterization Procedures: Deep Drilling Project for Vacuum Extraction Borehole, (EG&G, 1989b).

Coring will be accomplished with a diamond core bit. The core will be recovered by withdrawing the inner tube assembly from the outer tube assembly using wireline. A 1"-2" slice of core will be cut off with a pipecutter per each foot of collected core. Vitrified product sample collection procedures will be adapted from the above referenced procedures and developed as part of this SAP. The sample will be double- bagged and labeled for laboratory analysis of tracer concentration.

If voids prevent a section of core from providing material required for all specified analytical procedures, tracer analysis has precedence.

5.3 Off-Gas Scrub Solution Sampling

Scrub tank sampling procedures are detailed in:

- Safe Operating Procedures - In Situ Vitrification Pilot-Scale Test System, Battelle, Pacific Northwest Laboratories, Revision 4, 1/9/89.

Samples will be collected approximately every six hours in 250-ml HDPE wide mouth bottles and kept cool.

Prior to system operation, two scrub solution samples per tank will be collected for baseline data.

5.4 Off-Gas Hood and Stack Sampling

Off-gas hood and stack sampling entails:

- Sample collection from the off-gas sampling apparatus,
- Hood and off-gas line smears,
- HEPA filter sample collection.

Procedures for collection of the above samples will be included in Battelle authored Safe Operating Procedures. Battelle SOP's have been reviewed and found satisfactory by ISV project management.

5.5 Temperature Gradient Measurements

Thermocouple locations are identified in Section 4.2. Placement of thermocouples will take place during pit construction. Type C thermocouples will be used to monitor melt growth and heat transfer to surrounding waste/soil. Two Type K thermocouples will be used to monitor melt temperature. Output from these probes will be sampled in a rotating manner using a OM480 Datalogger (or similar instrument) and fed into a computer for data storage and interpretation. Each thermocouple will be read every five minutes for the duration of the study. A detailed equipment list will be provided in the SOP.

6.0 SAMPLE CONTROL AND DOCUMENT MANAGEMENT

The collection of sample and measurement data ISV intermediate scale activities will be fully documented in the appropriate field logbooks. All samples to be shipped for laboratory analysis will be labeled, tagged and accompanied by a ERP chain-of-custody (COC) form. Radiological surveys and volatile organic vapor screening of collected samples will not be necessary. Procedures for the proper documentation of data and sampling collection, for the control and tracking of samples, and for ensuring the integrity of the samples are described in the following sections.

6.1 Documentation

Documentation of field measurement and sampling activities will include the use of sample labels, sample tags, custody seals, and unique sample identifiers as specified in the ERP DCQAP. Necessary field documentation is detailed below. Field label examples are presented in Figure 6.

6.1.1 Sample Labels

All samples collected for laboratory analysis will be labeled. Gummed and/or taped labels will be affixed to the sample container and to any outer wrapping of the sample. Sample labels will include unique identifier, date and time of sample collection, requested analysis, preservative, and the name of collector.

6.1.2 Sample Tag

All samples collected for laboratory analysis will have affixed (tape, rubber band, wire fastener) to them a ERP sample tag. The sample tag will contain the same information as the sample container label.

6.1.3 Custody Seals

All samples collected for laboratory analysis will require a custody seal. Custody seals are used to detect sample tampering between the time that the sample is collected and opened at the laboratory. Custody seal information includes the date of sample collection and the collectors name.

6.1.4 Unique Identifier

Unique sample identification numbers will be assigned to discrete sample collected. The 8-digit number will have the following form:

Digit	Designation	Significance
1	I	Denotes sample collected for the ISV project
2	A-E	Specific ISV sampling task: A: Pre-test soil sampling B: Post-test soil sampling C: Vitrified glass sampling D: Off-gas scrubbing solution E: Stack monitoring and filters

I-CHEM RESEARCH

CHEM (800) 443 1689 (800) 553 3696

SITE NAME	DATE
ANALYSIS	TIME
	PRESERVATIVE

SPECIALTY CLEANED CONTAINER

```
RWMC/BNP SAMPLE                 Tag No. 003
-------------------------------------------
SAMPLE ID NO.:|_|_|_|_|_|_|_|_|_|_|_|_|
LOCATION:
DATE:          TIME:        SAMPLER:
-------------------------------------------
ANALYSIS:
CONC: ( )ENV  ( )HAZ   HAZARD:____________
RAD Screen:______________________mREM/hr
Activity:________mCi  Istope(s):_________
```

Figure 6: Field Label Examples

3-5	xxx	Unique sequential number except for splits; same number is then used.
6	A-Z	Indicator of multiple samples that correspond to unique sample designated in digits 3-5. The first sample is always "A"; all multiples are assigned letters of the alphabet in chronological order.
7,8	89	Calendar year sample is collected.
		Additional digits (e.g. 9-12)may be incorporated at the discretion of the Data Collection Supervisor

6.1.5 Field Logbooks

Logbooks will be used to document all field aspects of the ISV Intermediate Scale sampling effort. Logbooks are consecutively numbered and bound. All entries will be made in permanent black ink, dated, and signed by the person making the entry. Logbooks are distributed and controlled by the ERP Administrative Records and Document Control Manager. Figure 7 lists the logs that will be maintained for the ISV sampling effort, the individual responsible for log maintenance, and the data required in each log. An example of the log forms are contained in Appendix B.

Figure 7: Field Logbook Requirements

Logbook	Responsibility	Data Required
FIELD INSTRUMENT CALIBRATION STANDARDIZATION LOG	Instrument User Field Team Leader	One logbook per instrument, users, date and time of calibration and maintenance.
SAMPLE SHIPPING LOG	Field Team Leader	Sample ID, date collected, lab or storage area shipped to, date shipped, COC number, sample shipping classification, shipped by, QA check by.
SAMPLE LOG	Field Team Leader	Sample date, location, sample description (matrix), narrative, map.
FIELD TEAM LEADERS LOG	Field Team Leader	Record information on field activities when different crews are involved.

If an error is made in the logbooks, corrections will be made by drawing a single line through the error and entering the correct information. All corrections will be initialed and dated by the individual making the correction.

6.1.6 Chain-of-Custody

The COC record (Figure 8) establishes the documentation necessary to trace the sample possession from collection to analysis. The COC is initiated by the field sample team and accompanies the sample to the laboratory. The COC is signed by the Laboratory Manager or Custodian and returned to the Data Collection Supervisor with the data package. A copy of the COC is sent to ERP ARDC for tracking.

6.1.7 Sample Analysis Request

The Request for Analysis form will be fully completed by sample team personnel. The information provided on the form must be consistent with information on the COC record to ensure complete sample tracking. The laboratory portion of the form will be completed by the contract analytical laboratory. The Request for Analysis form will accompany the COC record and the sample shipment. A copy of the form will be retained in the field record. The form will include the following information:

- COC control number
- Project name and sample team leader's name
- Laboratory destination and contact
- Data package due date and designated recipients
- Unique sample identification number
- Sample matrix
- Preservative
- Requested analysis and special instructions
- Possible hazards identification
- Sample disposal instructions.

6.1.8 Sample Tracking

The laboratory will have a QA/QC program that, as a minimum, will accomplish the following. Upon sample receipt by the laboratory, the Laboratory Custodian will inspect the sample and sample seal condition, reconcile the information of the sample label and seal against that of the COC record, assign a laboratory number, log in the sample in the laboratory logbook, and store the sample in a sample storage room or cabinet until assigned to an analyst.

The Laboratory custodian will inspect the sample for leakage. A leaky container containing a multiphase sample should not be accepted for analysis because the sample may no longer be representative. If the sample is under pressure or releasing gases, it should be treated as a potentially explosive or as possibly containing hazardous gases. Any discrepancies between the information on the sample label and seal, and the information on the COC record and the Sample Analysis Request Sheet will be resolved before the sample is assigned for analysis. This effort may require communications with the sample collector. Results of the inspection will

EG&G Idaho, Inc.

EG&G FORM 114 (REV 10-88)

BURIED WASTE PROGRAM CHAIN OF CUSTODY FORM

Page ________ of ________

Project Name	Contract No.	Sampler (Signature)	Project Contact / Phone

Sample Number			Sampling Date	Sample Matrix	Remarks / Descriptions
Item	Field I.D.	Lab I.D.			

Special Instructions:

Item	Relinquished by: (Signature)	Received by: (Signature):	Date	Time	Item	Relinquished by: (Signature)	Received by: (Signature):	Date	Time

Figure 8: ERP Chain of Custody Record

be noted on the Sample Analysis Request Sheet and on the Laboratory Sample Logbook. Incoming samples will carry the ISV sampling unique identifier. To further identify samples, the laboratory should assign its own identification numbers; each sample should be marked with the assigned laboratory number. This number is recorded in the Laboratory Sample Logbook along with information describing the sample. The sample information is copied from the Sample Analysis Request Sheet and cross referenced against the information on the sample label. In most cases the Laboratory Manager assigns the sample to an analyst. The Manager shall review the information on the Sample Analysis Request Sheet which includes inspection notes recorded by the Laboratory Custodian. The analyst assigned to analyze the sample shall record in the Laboratory Notebook the identifying information about the sample, the receipt date, analysis date, and other pertinent information. This notebook shall also include the subsequent raw analysis data and calculations.

Once the laboratory receives the sample the Laboratory Manager or assignee is responsible for the sample care and custody. The Laboratory Manager or assignee should be prepared to testify that the sample was in his/her possession or secured in the laboratory at all times from receipt until the analysis were completed.

6.2 Sample Handling

To prevent contamination and to ensure sample representativeness, proper sample handling is required. The sections below discuss proper handling procedures.

6.2.1 Sample Containers and Preservatives

The laboratory will furnish appropriate size, pre-cleaned sample containers along with vendor certification as to how these containers were cleaned. A list of sample containers for each sample matrix of the target compound list (TCL) is included below (samples are to be kept cool and equipment blanks preserved with HNO_3 to pH <2 are required.):

Target compound	Matrix	Container Material	Container Size
Dysprosium oxide (Dy_2O_3)	soil	HDPE	250-ml
Terbium oxide (Tb_4O_7)	glass	PE bag	NA
Ytterbium oxide (Yb_2O_3)	filter	PE bag	NA
	liquid	HDPE	250-ml

6.2.2 Field Screening

Sampling tasks normally associated with Buried Waste are conducted within the fence of the SDA. The location of the ISV intermediate scale test and sampling, outside the fence of WRRTF, precludes the need for field screening, for hazardous materials.

6.2.3 Sample Transportation

The following procedures will ensure ISV intermediate scale samples will be shipped to the commercial analytical laboratory in accordance with Department of Transportation (DOT) requirements.

1. Sign the COC record, ensure the sample is properly labeled and sealed and that the sample is properly entered into the appropriate logbook.
2. Attach sample security seal to sample containers in such a way that it is necessary to break the seal in order to open the sample container.
3. Double bag the sample.
4. Place a layer of absorbent, cushioning material such as vermiculite on the bottom of the shipping cooler.
5. Place bagged samples in cooler making sure all void spaces are filled with vermiculite.
6. If required as a preservative, include blue ice in shipping cooler.
7. Place completed COC and sample request forms in a plastic bag and include in the shipping cooler.
8. Seal the space between the cooler lip and lid with strapping or fiberglass tape.
9. Make several wraps around the cooler, perpendicular to the seal, to ensure that the lid will remain closed if the latch is accidentally released or damaged.
10. Tape the cooler plug so it will not open.
11. Label the cooler with the following gummed labels:
    - o "Laboratory Samples" on lid
    - o "This End Up" on lid and sides
    - o Address label including name, address, and telephone number of recipient and sender.
12. Secure cooler with hasp and lock or custody seal affixed across top and side.
13 Transport cooler to shipping personnel at Central Facilities Area (CFA) for laboratory shipment.

7.0 EQUIPMENT

Sampling equipment associated with vitrification operations (scrubbing solution, off-gas hood and stack) will be maintained by Battelle personnel. Thermocouples will be provided and calibrated by EG&G; the thermocouple potentiometer will be provided and maintained by Battelle. All soil collection and product coring equipment will be provided by EG&G. Sample bottles will be provided by the contracted analytical laboratory.

8.0 ANALYTICAL PROCEDURES

Sample preparation and specific analytical procedures required to detect tracer material will be provided by the contracted commercial or in-house laboratory. Samples will be analyzed by ICP; required detection limits are 1 ppm (liquid), and 5 ppm (solid). At the time of the writing of Revision 0 of this SAP specific analytical procedures have not been established. A copy of the procedures and the laboratory Statement of Work will be included with the analytical results for data qualification.

9.0 DATA REPORTING, REDUCTION, AND VALIDATION

Data management for this task includes data reporting, reduction, and validation.

9.1 Data Reporting

Specified data reporting format will be detailed in the ISV Intermediate Scale Sampling Statement of Work (SOW). Sample collection history and analytical data for outliers will be examined to determine possible natural causes for the outliers. If an outlier exists because of error in statistical treatment the cause will be noted and the value of the outlier will be adjusted to accommodate the error. If a systematic explanation can be found to support the validity of an outlier, the reason will be stated and the data used without adjustment. If no statistical or systematic explanation of the outlier is apparent, it will be reported with a warning statement. Unexplained outliers will not be used for decisions.

9.2 Data Reduction

Data reduction methods will be limited to placing the data in an ERP standardized format for incorporation into the Buried Waste Information System (ERIS). Units of measure will be consistent with those of the ERIS. All formulas used to correct or convert units will be included in the data package.

9.3 Data Validation

The ERP DIRC has the ultimate responsibility to review and validate the reported data. The DIRC may call upon technical experts to assist in data validation. Data will not be made available for decisions until validated by the DIRC.

Data will be validated by examining the required documentation and QC sample data including duplicates (when applicable), equipment blanks, blind laboratory blanks, and matrix spikes (when applicable). Data will be qualified as per the requirements outlined in the BWP Data Qualification Manual (EGG-WM-8488). All aspects of the sampling program will be subject to audit.

10.0 QUALITY ASSURANCE

All sampling and analysis activities described in this SAP will be performed in accordance with the QA/QC practices described in the ERP Data Collection Quality Assurance Plan (DCQAP). The DCQAP contains guidance for the following: sampling and decontamination, sample custody, calibration procedures and frequency, analytical procedures, data reduction, validation, and reporting, internal quality control checks and frequency, performance and system audits, preventive maintenance, specific routine procedures used to assess data precision, accuracy, and completeness, corrective actions, quality assurance reports to management.

This section summarizes QA/QC practices to be followed during the execution of this SAP.

10.1 Field QA/QC

Field QC for thermocouple measurement will be limited to calibrating the system to a reference standard prior to use and checking the calibration after the measurements are taken. Calibration checks will be made if temperature readings become erratic or suspect. All measurements will be recorded with a Known tolerance. The manufacturers recommended operating procedure will be adhered to while taking the measurements.

During all sampling operations the Field QA Officer shall conduct periodic inspections as specified in the DCQAP and relevant SOP's. The inspections specified in the SOP's are sufficient to assure the quality of the data.

QC samples required during soil, core and scrub solution sampling are specified in the Data Qualification Summary Sheets in Appendix 1.

10.2 Laboratory QA/QC

10.2.1 General Laboratory Controls

In addition to instrument calibration and analysis of quality control samples, the following controls will be implemented:

- Reagents and solvent will have certified compositions,
- Reagent storage environment and duration will meet the manufacturer's guidelines,
- Commercial laboratory equipment will be calibrated/standardized following SW-846, Test Methods for Evaluating Solid waste Physical/Chemical Methods, requirements for the method(s) used,
- Volumetric measurements will be made with certified glassware,
- Data reduction computations will be independently checked, and
- Qualified personnel will be used for laboratory analyses.

10.2.2 Commercial Laboratory QA/QC

The contracted commercial or in-house laboratory shall run one duplicate sample for every 10 samples and calculate a relative standard deviation which will be recorded on the laboratory QC forms. If the results for the % RSD is greater than ±20% the samples will be re-analyzed.

One sample in 20 of each waste type will be spiked with the parameters of interest to determine the accuracy as percent recovery. The concentration of the spike should be five times the quantification limit to accurately evaluate percent recovery. The percent recovery will be recorded on the analytical quality control forms. If the results fail a 75-125% recovery criteria, a post-digestion spike should be analyzed to evaluate whether it is the digestion or the instrumentation that is not performing. outside the samples will be re-analyzed.

One reagent blank shall be carried through the entire analytical procedure. One check sample per waste type shall be run. The check sample shall contain a subset of the analytes to be determined. The concentration of these analytes shall approach the estimated quantification limit.

10.3 Laboratory Management Review

The laboratory manager or designate will review testing/analytical results prior to external distribution. The reviewer will:

- compare analyses performed to the request-for-analysis forms
- review results for reasonableness
- review quality control data results, and
- verify that required checking was properly performed.

If the laboratory manager finds that the review indicates the data meet the project quality requirements, the data will be released as final information.

10.4 Audits

A systems audit will be conducted by the ERP QA Officer prior to or at the start of the pre-test sampling and prior to ISV operations. The systems audit will evaluate the sampling procedures described in the SAP for adequacy and to ensure these procedures are being used. The contract laboratory used will have been evaluated by EG&G Idaho or other DOE contractors.

A performance or field audit will be conducted weekly on a random basis by the Field QA Officer or alternate. These audits will ensure the continuing use of the approved procedures and good logging practices. No performance audits are scheduled to be performed at the laboratory conducting the analyses.

Following completion of the audits, any deficiencies will be discussed with responsible project staff and the corrective actions identified. Significant problems will result in the ceasing of both field and laboratory activities. Such a decision will only be made after discussion with the ERP QAO, the Project Manager, and the Unit/Cost Account Manager. The ERP QAO will review results of major corrective actions after implementation to determine the effectiveness of the actions and will provide a written report of this review to the ERP Program Manager.

10.5 Reports to Management

A monthly report on the performance of the quality assurance program will be prepared by the ERP QAO and presented to the Unit/Cost Account Manager and ERP Program Manager. When appropriate, analytical laboratory QA/QC reports will be included. At the completion of a task and after data verification and validation, all QC data will be sent to the administrative Record and Document Control Manager to become part of the program files.

Monthly QA reports will include:

- Results of any systems and performance audits conducted during the period
- An assessment of accuracy, comparability, completeness, precision, and representativeness of data collected during the period,
- A list of any changes that have occurred in the SAP, and
- Identification of any significant quality assurance problems and recommended solutions.

All of this information will be collected and results documented in the field logbooks and data packages from the analytical laboratory.

11.0 SPECIFIC ROUTINE PROCEDURES TO ASSESS DATA PRECISION, ACCURACY AND COMPLETENESS

Table 2 summarizes ISV intermediate scale analytical precision and accuracy requirements per sampling task, that meet the objectives for qualitative analysis.

11.1 Field Data

Field data includes all data recorded in field and laboratory logbooks during the field sampling activities including sample description and narratives. Field precision will be assessed by field audits conducted to ensure the use of uniform sampling techniques and by the evaluation of smears. Field completeness will be assessed by calculating the ratio of sample analyzed to the total number of samples taken. The completeness goal for field data is 90%

11.2 Laboratory Data

The QAPP and SOP's of the laboratory will describe procedures to evaluate precision, accuracy, and completeness. This includes the preparation of blanks, replicates, and spikes. The accuracy, precision, and completeness of the data will be assessed for each sample lot using samples spiked to a known concentration and the percent recovery calculated.

Precision of laboratory data will be measured by the analysis of duplicates. Laboratory reagent blanks will be analyzed to monitor the introduction of artifacts into the process. The data obtained will be within the prescribed control limits for accuracy and precision.

Accuracy of laboratory data will be assessed by examining the analysis of in-house laboratory prepared matrix spikes of scrub solution and post test soil samples, with known amounts of Dysprosium oxide, Terbium oxide, and Ytterbium oxide.

Completeness of the laboratory data will be measured by the ratio of samples with results of acceptable accuracy and precision to the total number of samples analyzed. The completeness goal for laboratory data is 90%.

Measured Parameter	Method	Maximum Allowable (% RSD)	Accuracy (% Recovery)
Pre-test soil samples	ICP	60	60 - 130
Post-test soil samples	ICP	60	60 - 130
Vitrified glass samples	ICP	60	60 - 130
Off-gas scrubbing liquid	ICP	60	70 - 130
Vitrification leach test	MCC-1[1]	60	70 - 130
Temperature gradient			
Type K	TC	N/A	$\pm$ 2%[2]
Type C	TC	N/A	TBD
Hood monitoring	ICP	60	60 - 130

Table 2: Minimum ISV Precision and Accuracy Requirements

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[1]MCC-1: Material Characterization Center 28-day leach test (procedures to be provided).

[2] Valid for type K thermocouples to 1600 °F

12.0 HEALTH AND SAFETY PROGRAM

Health and safety requirements for the ISV intermediate scale test are detailed in the ISV Intermediate Scale Health and Safety Plan, Revision 0, June 1989. All personnel involved with ISV sampling operations acknowledge their understanding of the Health and Safety Plans with their signature on a Health and Safety Certification Form.

13.0 DATA MANAGEMENT

All information, logbooks, analytical packages, project files, and field records will be submitted to the Administrative Records and Document Control Manager upon completion of ISV sampling activities. These records will be maintained under lock and key and access provided to EG&G Idaho and DOE-ID personnel following data validation.

Document checkout entails filling out a form identifying document removed, date removed, and the person receiving the document. Upon return of the document, it will be placed under lock and key and the checkout form removed.

14.0 REFERENCES

Environmental Restoration Program Program Directive (PD) 5.2, Preparation of Sampling and Analysis Plans, May 22, 1989.

Buried Waste Program Data Collection Quality Assurance Plan, Revision 1, Informal Report EGG-WM-8228, December 1, 1988.

Oma, K. H., Sample and Analytical Plan - Intermediate Scale Testing of In Situ Vitrification, Run Number IS-INEL-1 and IS-INEL-2, Revision 0 (Draft), INEL, Idaho, March 1989.

Peterson, M. E., Battelle, Pacific Northwest Laboratory, Safe Operating Procedures - In Situ Vitrification Pilot-Scale Test System, Revision 4, January 9, 1989.

Timmerman, C. L., Oma, K. H., An In Situ Vitrification Pilot-Scale Radioactive Test, PNL-5240/UC-70, October 1984.

Oma, K. H., et. al., Support for the In Situ Vitrification Treatability Study at the Idaho National Engineering Laboratory: FY 1988 Summary, PNL-6787/UC-510, February 1989.

Oma, K. H., Butner, R. S., Draft PNL Plan - Intermediate Scale Testing of In Situ Vitrification - Run Numbers: IS-INEL-1 and -2, Revision 0, March 1989.

APPENDIX A

DATA QUALIFICATION SUMMARY FORMS

Appendix A includes Data Qualification summary forms for each intermediate scale sampling task. Each form includes the following information:

1. Project information: Project name, project manager, and expected sampling date.

2. Sampling media: specifies soil, groundwater, surface water/sediment, air, biological, or other.

3. Data Use:
   a. Site characterization: includes a determination of the level(s) of health and safety protection required at the site.
   b. Risk assessment: data to be used to perform the endangerment assessment or public health evaluation.
   c. Evaluate alternatives: data will be used to evaluate or screen remedial/technological alternatives/
   d. Engineering design: data will be used to perform detailed engineering design of remedy.
   e. Monitoring: data will be used to monitor during remedy implementation or establish baseline conditions for long term monitoring after site remediation.
   f. Other.

4. Sampling task objective.

5. Site information: summarizes information unique to sampling location such as size, soil characteristics, etc.

6. Data types: specifies the appropriate analytical and physical data required to determine the type, degree, extent and migration characteristics of the contaminants and the required site characteristics.

7. Sampling method:
   a. Environmental: refers to media sampling of air, water, soils and the biological environment.

b. Source: refers to the sampling of the actual contamination source(s).
c. Biased: refers to sampling which focuses on a specific site area, characteristic, or problem factor based upon site knowledge and/or modeling.
d. Grid: refers to unbiased sampling which provides a representative estimate of contamination problem over the entire site.
e. Grab: refers to discrete samples which are representative of a specific location at a specific point in time.
f. Composite: the mixture of a number of grab samples to represent the average properties of the parameters of concern over the extent of the area sampled.
g. Non-intrusive: refers to obtaining data using methods and equipment that do not require the physical extraction of sample from the media being sampled.
h. Intrusive: refers to physically extracting samples from the media being sampled.

8. Analytical levels:
    a. Level 1 field screening - equipment: identifies the field monitoring equipment to be used and the manufacturers specified detection limits (when known).
    b. Level 2 field analysis - equipment: identifies the field analysis to be used and achievable instrumentation limits.
    c. Level 3 non-CLP laboratory - methods: identifies laboratory method(s) and historically achievable accuracy and precision.
    d. Level 4 CLP laboratory - methods: identifies CLP laboratory method(s) and historically achievable accuracy and precision.
    e. Level 5 non-standard - specifies requirement for non-standard analysis, analytical procedures to be used and required precision and accuracy.

9. Sampling procedures: summarizes procedures and required equipment/hardware.

10. Quality control samples: identifies minimum field and laboratory standards to meet QA requirements specified in Section 10.0.

11. Administrative requirements: summarizes budget estimate, scheduling estimate, and staffing estimate for sampling effort.

ERP DATA QUALIFICATION SUMMARY FORM

1. Project: Intermediate Scale In Situ Vitrification
   Project Manager: J. L. Landon
   Expected sampling date: August 1989

2. Media:
   x Soil
   ___ Groundwater
   ___ Surface water/Sediment
   ___ Air
   ___ Biological
   ___ Other ___

3. Use(s):
   ___ Site Characterization (Health and Safety)
   ___ Risk Assessment
   x Evaluate Alternatives
   x Engineering Design
   ___ Monitoring
   ___ Principle Responsible Party (PRP) Determination
   ___ Other ___

4. Sampling Objective: Determine the extent (if any) of migration of tracers from vitrification zone. Requires sample collection prior to test to establish baseline data, and sample collection following test to determine migration.

5. Site Information: (Provide information unique to sampling location e.g. size, soil characteristics) Samples to be collected randomly from soil trucked from RWMC borrow pit for pre-test sampling and from soil underburden from post-test sampling.

6. Data Types:

A. Analytical Data
   ___pH
   ___Conductivity
   ___Volatile Organics
   ___PCB's
   ___Metals
   Targeted Constituents ___ Specified rare earth tracers.

B. Physical Data
   ___Permeability
   ___Porosity
   ___Grain Size
   ___Bulk Density
   ___Penetration Test
   Other ___

7. Sampling Method:

x Environmental ___Source ___Biased ___Grid ___Phased

x Grab ___Composite ___Non-intrusive ___Intrusive

8. Analytical Levels (Indicate Level(s), Equipment and Methods)

___ Level 1: Field Screening -equipment________________________

___ Level 2: Field Analysis - Equipment________________________

_x_ Level 3: Non-CLP Laboratory - Methods ICP

___ Level 4: CLP Laboratory - Methods________________________

___ Level 5: Non-standard________________________

9. Sampling Procedures: (Summarize sample collection procedures)
Samples will be collected with stainless steel sampling spoons.

10. Quality Control Samples:

A. Field
_x_Field Blank
___Trip Blank
_x_Equipment Blank
_x_Duplicate
___Split
Other________________________

B. Laboratory
___Reagent Blank
_x_Matrix Spike
_x_Replicate
Other________________________

11. Administrative Requirements:

Budget (Cost Estimate)________________________

Schedule (Time Estimate) Appx. 4 hrs for pre- and post-test sampling.

Staff 2-3 person sampling team, including team leader and quality assurance officer.

ERP DATA QUALIFICATION SUMMARY FORM

1. Project: Intermediate Scale In Situ Vitrification
   Project Manager: J. L. Landon
   Expected sampling date: August 1989

2. Media:
   - x Soil
   - ___ Groundwater
   - ___ Surface water/Sediment
   - ___ Air
   - ___ Biological
   - ___ Other________________

3. Use(s):
   - ___ Site Characterization (Health and Safety)
   - ___ Risk Assessment
   - ___ Evaluate Alternatives
   - ___ Engineering Design
   - x Monitoring
   - ___ Principle Responsible Party (PRP) Determination
   - ___ Other________________

4. Sampling Objective: Establish temperature gradient in waste/soils surrounding vitrification zone.

5. Site Information: (Provide information unique to sampling location e.g. size, soil characteristics) Soil, waste and vitrification to be monitored every six inches, every five minutes. 24 Type K thermocouples and 2 Type C thermocouples to be used per test pit.

6. Data Types:

   A. Analytical Data
   - ___pH
   - ___Conductivity
   - ___Volatile Organics
   - ___PCB's
   - ___Metals
   - Targeted Constituents______

   B. Physical Data
   - ___Permeability
   - ___Porosity
   - ___Grain Size
   - ___Bulk Density
   - ___Penetration Test
   - Other Temperature

7. Sampling Method:

   ___Environmental ___Source ___Biased x Grid ___Phased

   ___Grab ___Composite ___Non-intrusive x Intrusive

8. Analytical Levels (Indicate Level(s), Equipment and Methods)

___ Level 1: Field Screening - Equipment________________________________

___ Level 2: Field Analysis - Equipment Thermocouple

___ Level 3: Non-CLP Laboratory - Methods________________________________

___ Level 4: CLP Laboratory - Methods________________________________

___ Level 5: Non-standard________________________________

9. Sampling Procedures: (Summarize sample collection procedures) Thermocouples will be placed in the waste/soil zone during test pit construction.

10. Quality Control Samples:

A. Field
___Field Blank
___Trip Blank
___Equipment Blank
___Duplicate
___Split
Other________________________

B. Laboratory
___Reagent Blank
___Matrix Spike
___Replicate
Other________________________

11. Administrative Requirements:

Budget (Cost Estimate)________________________________

Schedule (Time Estimate) pit construction - July 1989

Staff two engineers, operations personnel (during pit construction), Battelle operations during test, QA Officer.

ERP DATA QUALIFICATION SUMMARY FORM

1. Project: Intermediate Scale In Situ Vitrification
   Project Manager: J. L. Landon
   Expected sampling date: November 1989

2. Media:
   ___ Soil
   ___ Groundwater
   ___ Surface water/Sediment
   ___ Air
   ___ Biological
   _x_ Other Glass vitrification product

3. Use(s):
   ___ Site Characterization (Health and Safety)
   ___ Risk Assessment
   _x_ Evaluate Alternatives
   _x_ Engineering Design
   ___ Monitoring
   ___ Principle Responsible Party (PRP) Determination
   ___ Other________________

4. Sampling Objective: Determine suitability of vitrification process as long-term remedial measure through product evaluation.

5. Site Information: (Provide information unique to sampling location e.g. size, soil characteristics) Vitrified mass will be approximately 6'x6'x12'.

6. Data Types:

A. Analytical Data
   ___pH
   ___Conductivity
   ___Volatile Organics
   ___PCB's
   ___Metals
   Targeted Constituents______
   Rare earth tracers

B. Physical Data
   _x_Permeability
   ___Porosity
   ___Grain Size
   ___Bulk Density
   ___Penetration Test
   Other________________
   Product strength

7. Sampling Method:

___Environmental   _x_Source   ___Biased   ___Grid   ___Phased

___Grab   ___Composite   ___Non-intrusive   _x_Intrusive

8. Analytical Levels (Indicate Level(s), Equipment and Methods)

___ Level 1: Field Screening - Equipment___________________

___ Level 2: Field Analysis - Equipment___________________

_x_ Level 3: Non-CLP Laboratory - Methods_ICP_____________

___ Level 4: CLP Laboratory - Methods_____________________

___ Level 5: Non-standard_________________________________

9. Sampling Procedures: (Summarize sample collection procedures)
Glass sample will be cored.

10. Quality Control Samples:

A. Field
___Field Blank
___Trip Blank
___Equipment Blank
_x_Duplicate
___Split
Other_______________

B. Laboratory
_x_Reagent Blank.
___Matrix Spike
_x_Replicate
Other_______________

11. Administrative Requirements:

Budget (Cost Estimate)_____________________

Schedule (Time Estimate)_November 1989, appx. 2 days per core.

Staff_Subcontracted

ERP DATA QUALIFICATION SUMMARY FORM

1. Project: Intermediate Scale In Situ Vitrification
   Project Manager: J. L. Landon
   Expected sampling date: September 1989

2. Media:
   ___ Soil
   ___ Groundwater
   ___ Surface water/Sediment
   _x_ Air
   ___ Biological
   _x_ Other filter media

3. Use(s):
   ___ Site Characterization (Health and Safety)
   ___ Risk Assessment
   ___ Evaluate Alternatives
   _x_ Engineering Design
   _x_ Monitoring
   ___ Principle Responsible Party (PRP) Determination
   ___ Other___

4. Sampling Objective: Determine tracer suspension and off-gas treatment efficiency.

5. Site Information: (Provide information unique to sampling location e.g. size, soil characteristics) Hood and stack filter media, HEPA filters, process line smears.

6. Data Types:

   A. Analytical Data
   ___pH
   ___Conductivity
   ___Volatile Organics
   ___PCB's
   ___Metals
   Targeted Constituents___
   Rare earth tracers

   B. Physical Data
   ___Permeability
   ___Porosity
   ___Grain Size
   ___Bulk Density
   ___Penetration Test
   ___Other___

7. Sampling Method:

   _x_Environmental ___Source _x_Biased ___Grid ___Phased

   _x_Grab ___Composite ___Non-intrusive ___Intrusive

8. Analytical Levels (Indicate Level(s), Equipment and Methods)

___ Level 1: Field Screening - Equipment________________________

___ Level 2: Field Analysis - Equipment________________________

_x_ Level 3: Non-CLP Laboratory - Methods ICP

___ Level 4: CLP Laboratory - Methods________________________

___ Level 5: Non-standard________________________

9. Sampling Procedures: (Summarize sample collection procedures)
A. Isokinetic stack monitoring to glass paper filter medium.
B. HEPA filter sampling following test.
C. Process line smears.

10. Quality Control Samples:

A. Field
_x_ Field Blank
___ Trip Blank
___ Equipment Blank
_x_ Duplicate
___ Split
Other________________________

B. Laboratory
___ Reagent Blank
___ Matrix Spike
_x_ Replicate
Other________________________

11. Administrative Requirements:

Budget (Cost Estimate)________________________

Schedule (Time Estimate) August/September 1989

Staff Battelle and EG&G personnel

ERP DATA QUALIFICATION SUMMARY FORM

1. Project: Intermediate Scale In Situ Vitrification
   Project Manager: J. L. Landon
   Expected sampling date: September 1989

2. Media:
   ___ Soil
   ___ Groundwater
   ___ Surface water/Sediment
   ___ Air
   ___ Biological
   _x_ Other Scrub tank solution

3. Use(s):
   ___ Site Characterization (Health and Safety)
   ___ Risk Assessment
   ___ Evaluate Alternatives
   _x_ Engineering Design
   ___ Monitoring
   ___ Principle Responsible Party (PRP) Determination
   ___ Other

4. Sampling Objective: Determine efficiency of off-gas treatment system in collecting simulated plutonium tracers.

5. Site Information: (Provide information unique to sampling location e.g. size, soil characteristics) Sample drawn from process tanks 1 and 2.

6. Data Types:

   A. Analytical Data
   ___pH
   ___Conductivity
   ___Volatile Organics
   ___PCB's
   ___Metals
   _x_Targeted Constituents
   Rare earth tracers

   B. Physical Data
   ___Permeability
   ___Porosity
   ___Grain Size
   ___Bulk Density
   ___Penetration Test
   Other

7. Sampling Method:

   ___Environmental ___Source ___Biased ___Grid ___Phased

   _x_Grab ___Composite ___Non-intrusive ___Intrusive

8. Analytical Levels (Indicate Level(s), Equipment and Methods)

___ Level 1: Field Screening - Equipment__________________________

___ Level 2: Field Analysis - Equipment__________________________

_x_ Level 3: Non-CLP Laboratory - Methods ICP

___ Level 4: CLP Laboratory - Methods__________________________

___ Level 5: Non-standard__________________________

9. Sampling Procedures: (Summarize sample collection procedures) As per Safe Operating Procedures.

10. Quality Control Samples:

A. Field
_x_Field Blank
___Trip Blank
___Equipment Blank
_x_Duplicate
___Split
Other__________________

B. Laboratory
___Reagent Blank
_x_Matrix Spike
_x_Replicate
Other__________________

11. Administrative Requirements:

Budget (Cost Estimate)__________________________

Schedule (Time Estimate) September/October 1989

Staff Battelle personnel

APPENDIX B

SAMPLE LOG FORMS

SAMPLE LOGBOOK

Date (dd/mmm/yy): __ __/__ __ __/__ __

Field Team Members:

Weather:

Narrative (description of field sampling activities with time and location, description of sampling point, and samples collected.):

RECORDED BY: ____________ (Signature) QA CHECK BY: ____________(Signature)

SAMPLE LOGBOOK

MAP OF SAMPLING LOCATION:
(include location of sampling points and reference points)

RECORDED BY: ______________________ QA CHECK BY: ______________________

ISV Shipping Log Form

SAMPLE IDENTIFICATION NUMBER	DATE COLLECTED	LAB OR STORAGE AREA SHIPPED TO	DATE SHIPPED (COOLER NO.)	CHAIN-OF-CUSTODY NUMBER	COMMENTS AND SAMPLE SHIPPING CLASSIFICATION

SHIPPED BY: ______________________ (Signature) QA CHECK BY: ______________________ (Signature)

SAMPLE LOGSHEET

DATE(DD/MMM/YY): __ __/__ __ __/__ __ LOCATION: ______________________

SAMPLE TYPE: (0) Normal (1) Equip. Blank (PRIOR) (2) Trip Blank (3) Replicate (4) Split (5) Equip. Blank (POST) (6) Spike (7) Other ______________

ID NO.:	CODE	ID NO.:	CODE	ID NO.:	CODE

SPECIFIC SAMPLING POINT(S)/LOCATIONS AND DEPTH:

POINT (LOCATION)	DEPTH FROM	TO	
	____	____	(UNITS) BELOW SURFACE

SAMPLE METHOD: CODE: (_____)
(0) Grab (1) Spatial Comp. (2) Time Comp. (3) Other __________

SAMPLE DESCRIPTION: CODE (_____)

SOIL/ROCK
(00) Surf. Soil
(01) Sub. Surf. Soil
(02) Basalt
(03) Sediment Interbed
(04) Other

SEDIMENT/SLUDGE
(05) Pond/Impoundment
(06) Drum/Tank
(07) Other

AIR/GAS
(15) Soil Gas
(16) Other

LIQUIDS
(08) Pond/Impoundment
(09) Drum/Tank
(10) Plant Discharge
(11) Spring/Seep
(12) Perched Aquifer
(13) Regional Aquifer
(14) Other

Other: ______________________________

FIELD MEASUREMENTS: (list field measurements of the samples)

		Units	Instr. Make/Model	Instr. No.:
pH:				
temperature:				

SAMPLING AND ANALYSIS PLAN FOLLOWED: NO (___) YES (___) IF NO EXPLAIN DEVIATIONS:
____
____

RECORDED BY: ______________________ QA CHECK BY: ______________