LOCKHEED MARTIN

Y/ER-309

ENVIRONMENTAL RESTORATION PROGRAM

Sampling and Analysis Plan for the Bear Creek Valley Boneyard/Burnyard Accelerated Action Project, Oak Ridge Y-12 Plant, Oak Ridge, Tennessee

ENERGY SYSTEMS ER

MANAGED BY
LOCKHEED MARTIN ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

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Science Applications International Corporation

contributed to the preparation of this document and should not be considered an eligible contractor for its review.

DISCLAIMER

Y/ER-309

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OAK RIDGE Y-12 PLANT
Oak Ridge, Tennessee 37831
managed by
LOCKHEED MARTIN ENERGY SYSTEMS, INC.
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ABBREVIATIONS

BCV	Bear Creek Valley
BYBY	Boneyard/Burnyard
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOE	U.S. Department of Energy
DQO	data quality objective
Energy Systems	Lockheed Martin Energy Systems, Inc.
EPA	U.S. Environmental Protection Agency
HCDA	Hazardous Chemical Disposal Area
OLF	Oil Landfarm
PPE	personal protective equipment
QA	quality assurance
QC	quality control
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
SAIC	Science Applications International Corporation
SAP	sampling and analysis plan
TCLP	toxicity characteristic leaching procedure
VOC	volatile organic compound

EXECUTIVE SUMMARY

In the Bear Creek Valley Watershed Remedial Investigation, the Boneyard/Burnyard was identified as the source of the largest releases of uranium into groundwater and surface water in Bear Creek Valley. The proposed action for remediation of this site is selective excavation and removal of source material and capping of the remainder of the site. The schedule for this action has been accelerated so that this is the first remedial action planned to be implemented in the Bear Creek Valley Record of Decision. Additional data needs to support design of the remedial action were identified at a data quality objectives meeting held for this project. The additional needs are to more accurately delineate the volume of material that is a source for uranium contamination of groundwater and surface water and to establish the chemical characteristics of the source material so that waste disposal options can be evaluated.

Sampling at the Boneyard/Burnyard will be conducted through the use of a phased approach. Initial or "primary" samples will be used to make in-the-field decisions about where to locate follow-up or "secondary" samples. Sampling will include surface water sampling and groundwater and soil sampling using push probe methods and rapid analysis for uranium. On the basis of the results of surface water, soil, and groundwater analysis, up to six test pits will be dug. The test pits will be used to provide detailed descriptions of source materials and bulk samples.

This document sets forth the requirements and procedures to protect the personnel involved in the Bear Creek Valley Boneyard/Burnyard Accelerated Action Project. This document also contains the health and safety plan, quality assurance project plan, waste management plan, data management plan, implementation plan, and best management practices plan for this project as appendices.

1. INTRODUCTION

This document is the sampling and analysis plan (SAP) for the Bear Creek Valley (BCV) Boneyard/Burnyard (BYBY) Accelerated Action Project. The SAP contains a description of the field investigation to be performed at the BYBY with a discussion of the rationale for sampling and the data quality objectives (DQOs). The SAP refers to accompanying quality assurance project (Appendix B), health and safety (Appendix C), waste management (Appendix D), data management implementation (Appendix E), and best management practices (Appendix F) plans that will guide safe and complete implementation of this project.

1.1 BONEYARD/BURNYARD SITE HISTORY

The BYBY/Hazardous Chemical Disposal Area (HCDA) is located north of Bear Creek Road, ~1 mile west of the main Oak Ridge Y-12 Plant (Fig. 1.1). The Boneyard and Burnyard were active disposal sites between the mid-1940s and the early 1970s. Various uranium-contaminated wastes, waste uranium turnings, and other combustible wastes were placed in trenches at BYBY and ignited. Some parts of the site were also used for abandoned equipment lay down. The HCDA is located on top of the former Burnyard and was active between 1975 and 1981. Potentially hazardous, combustible, reactive, or corrosive wastes were disposed of at this site. The HCDA has been capped with a Resource Conservation and Recovery Act (RCRA) type cap but is not a RCRA-regulated facility.

The Remedial Investigation (RI) Report for the BCV Characterization Area (DOE 1997) estimates that a total of 90,000 m^3 of waste and contaminated soil are located in the BYBY area. The distribution of groundwater and soil contamination at the BYBY coincides with a geophysical anomaly located at the northwestern corner of the HCDA cap and indicates the probable location of uranium-contaminated material that acts as a source to surface water and groundwater contamination (Figs. 1.2 and 1.3). In addition, historical aerial photographs show the location of former trenches and debris disposed areas (see pocket at the back of the document). At BYBY, the following contaminants are frequently detected: in groundwater, uranium isotopes, mercury, beryllium, manganese, nickel, vanadium, tetrachloroethene, trichloroethene, and 1,2-dichloroethene; in surface water, uranium isotopes, mercury, and lithium; and in soils, uranium isotopes, mercury, cadmium, copper, polyaromatic hydrocarbons, PCBs, phthalates, and technetium-99.

Uranium in soils and waste materials leaches to groundwater, which subsequently discharges to surface water in NT-3 (Fig. 1.4). Uranium in groundwater that has leached from buried waste and fill material at BYBY probably migrates directly to the Maynardville Limestone and Bear Creek via shallow groundwater flow. According to the BCV Watershed RI Report, the BYBY site currently contributes 50% to 60% of the potential risk and chemical hazard at the watershed Integration Point through release of uranium. Excavation and capping of the contaminated soils and waste materials at BYBY that are leaching uranium to groundwater and surface water will reduce the production of leachate and contaminant migration into NT-3, Bear Creek, and the Maynardville Limestone and will, therefore, reduce risks and hazards at the Integration Point.

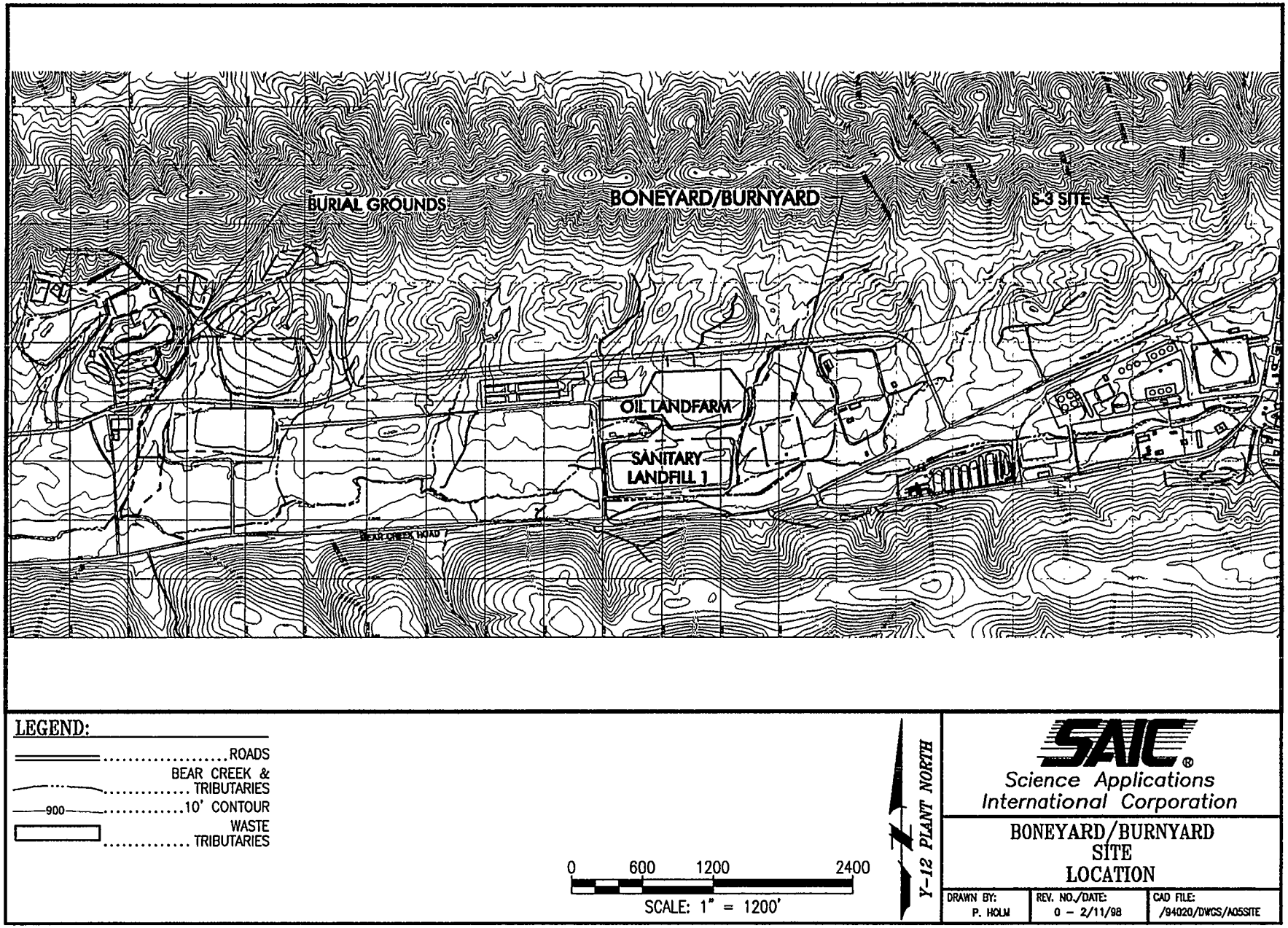

Fig. 1.1. Location of BYBY and Hazardous Chemicals Disposal Area.

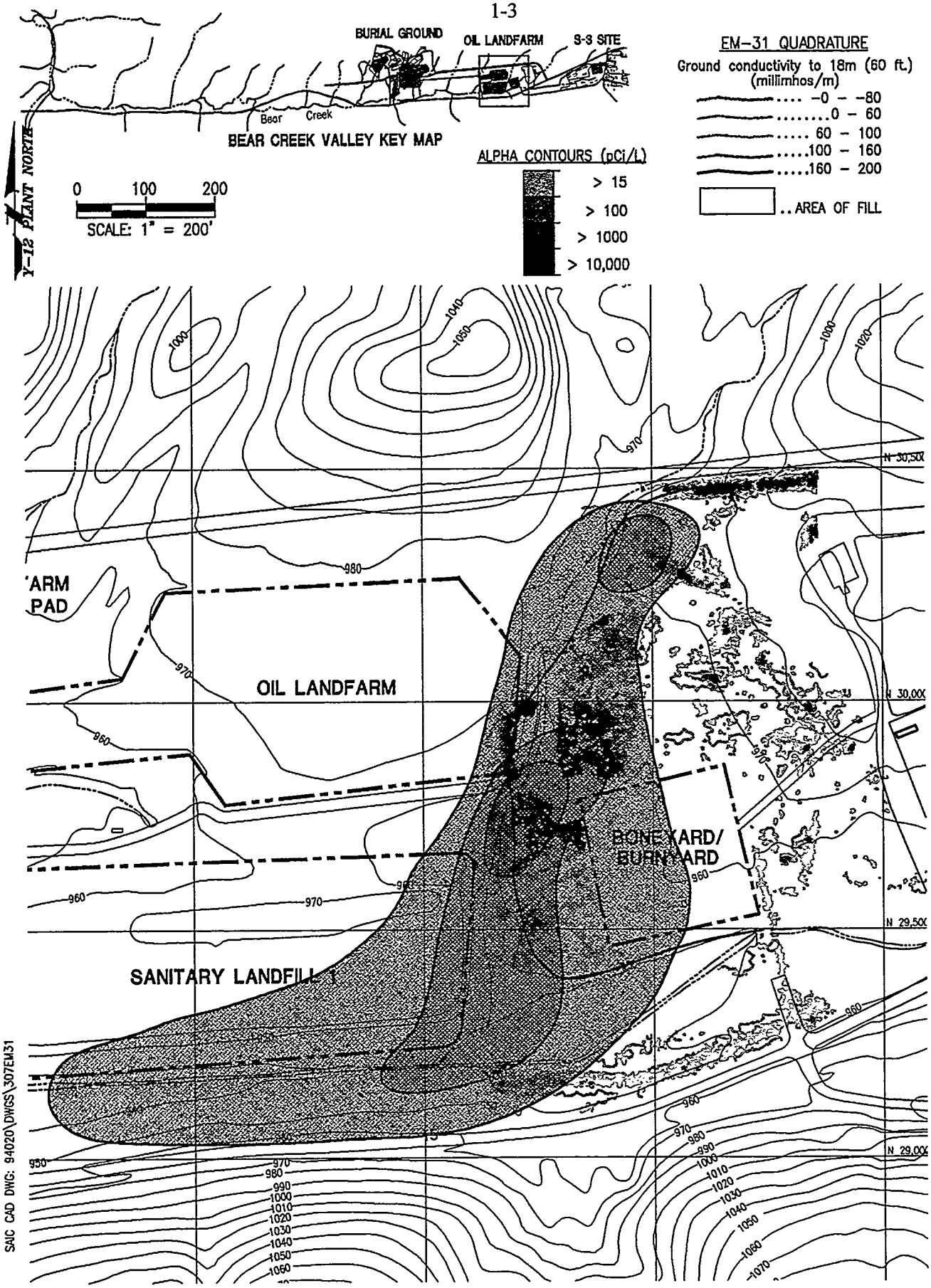

Fig. 1.2. Distribution of groundwater contamination at BYBY and associated geophysical anomaly.

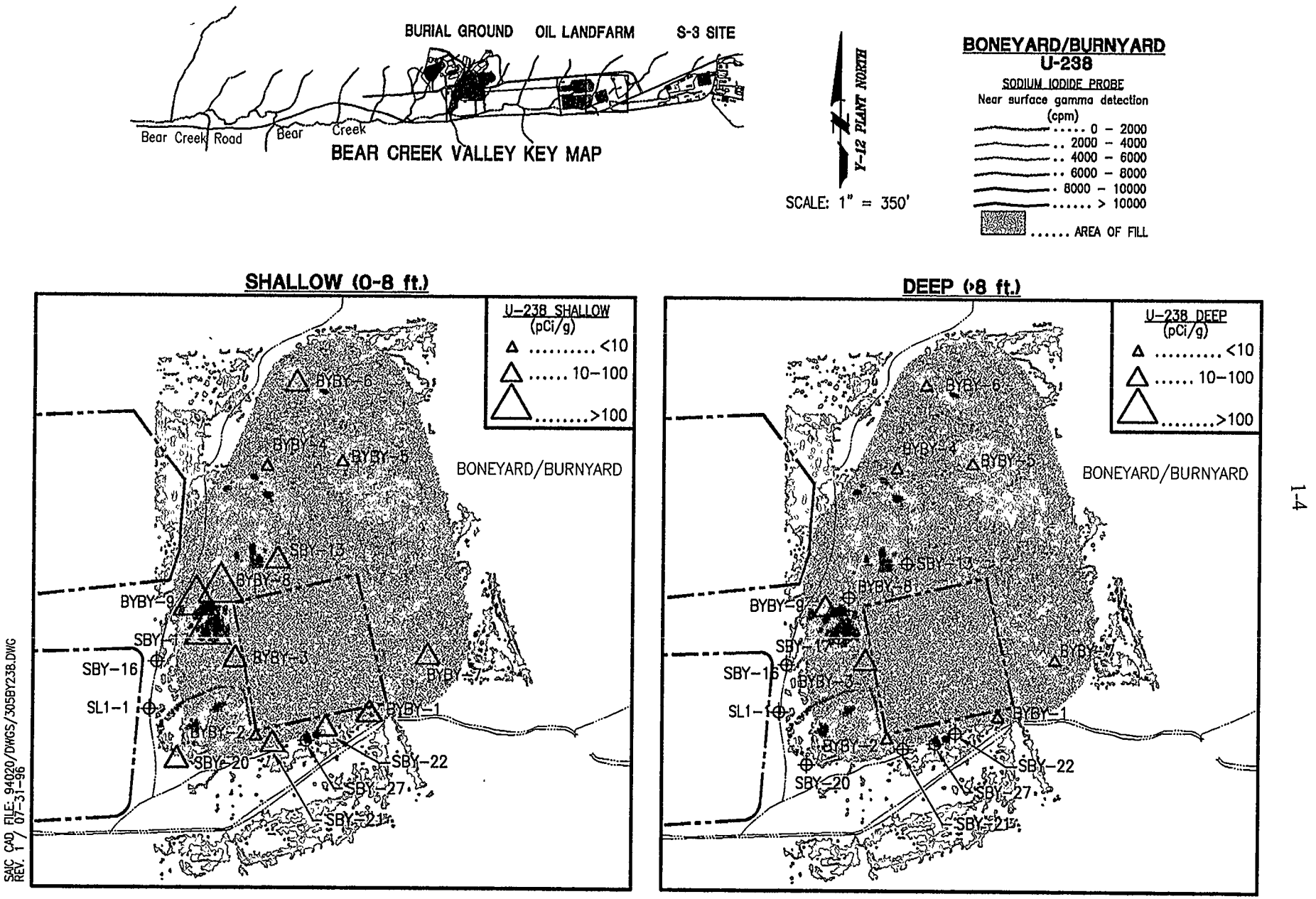

Fig. 1.3. Location of soil contamination of BYBY relative to surface radiological anomalies.

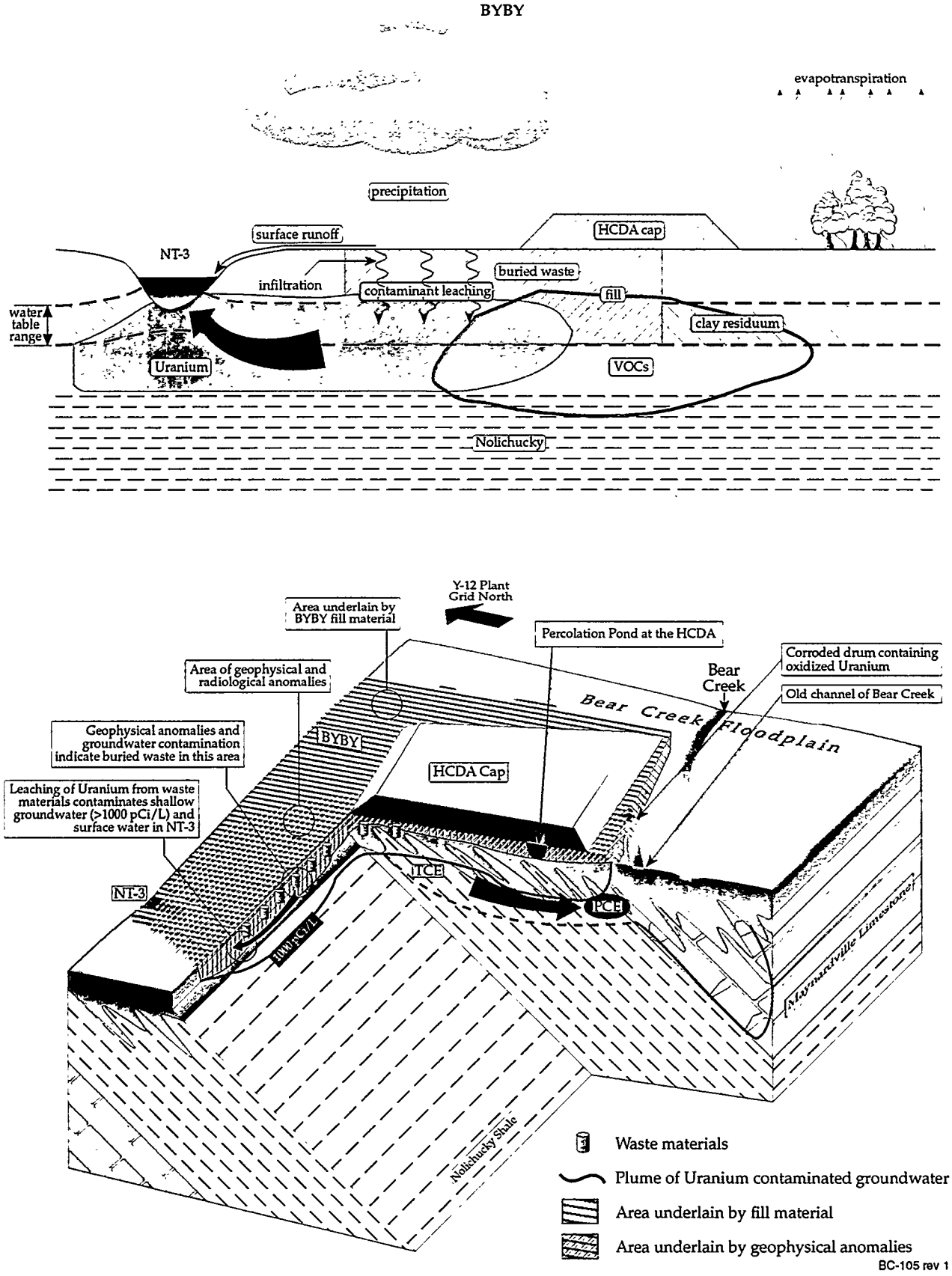

Fig. 1.4. Conceptual model for contaminant migration at BYBY.

1.2 DATA QUALITY OBJECTIVE PROCESS OVERVIEW

A DQO meeting for this project was held on January 8, 1998. The introduction to the SAP constitutes the minutes for this meeting. Attendees of the meeting represented the parties involved in the project: U.S. Department of Energy (DOE), Tennessee Department of Environment and Conservation, U.S. Environmental Protection Agency (EPA), Lockheed Martin Energy Systems, Inc. (Energy Systems), Jacobs Engineering, and Science Applications International Corporation (SAIC). The attendance list is included in Appendix A.

In general, the DQO process is used as a planing tool that identifies an environmental problem(s) and defines the data collection necessary to make decisions to solve the problem(s). The process includes seven steps: (1) state the problem, (2) identify the decision, (3) identify inputs to the decision, (4) define the study boundaries, (5) develop a decision rule, (6) specify limits on decision errors, and (7) optimize the design for obtaining data (EPA 1993).

The DQO process is being implemented for the BYBY project through the use of a phased approach. The intent of the January 8 DQO meeting was to follow the first four steps of the DQO process and to provide guidance to the project team in developing the remaining three steps of the process.

1.2.1 State the Problem

Characterization work for the BCV Characterization Area RI identified BYBY as the main contributor of uranium in surface water and groundwater at the Integration Point in BCV. As part of the final remedy for the Bear Creek Watershed, the planned Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remedial action for BYBY is (1) excavation of hot spots that are a source of uranium contamination in groundwater and surface water in BCV, (2) stabilization of excavated materials, (3) disposal of excavated material in a disposal cell on the Oak Ridge Reservation or other suitable facility, and (4) capping of the BYBY.

The scope of the problem to be addressed by field investigation at BYBY is captured by the project vision statement (Energy Systems 1998) that was defined by the project team at the project kick-off meeting on December 9, 1997. The project vision statement reads as follows:

> ... conduct field sampling to reduce uncertainties ... associated with remedial actions that remove uranium at the Boneyard/Burnyard, which is the source of contamination for groundwater and surface water in Bear Creek Valley, and to prepare an engineering document that defines the performance criteria upon which a competitive bid for remedial design and action can be based.

Table 1.1 identifies the uncertainties that need to be addressed at BYBY before conducting the remedial action at this site. The Remedial Action Work Plan (RAWP) will describe the performance criteria for the remedial action: volumes of contaminated material that require excavation, the extent of the area to be capped, and the performance criteria for a cap. The objective of the field investigation outlined in this SAP is to reduce the uncertainties in Table 1.1 to a manageable level such that the specific scope of remedial action activities can be defined. The uncertainties identified in Table 1.1 can be addressed by answering the following questions:

1. What material at BYBY is a source for uranium contamination of groundwater and surface water?

2. What is the volume and location of source material?

3. What is the areal extent and approximate volume of uranium-contaminated material that does not constitute a source?

4. What are the physical and chemical characteristics of the source material?

These questions form the basis for the decisions that need to be made for this field investigation.

Table 1.1. BYBY remedial action method of accomplishment and uncertainties

Remedial activity	Uncertainty	Potential ramifications	Cost impact
Excavation—conventional excavation equipment	Specific location and volume of hot spots	Additional excavation may be required; may leave significant sources behind	High
	Presence of pyrophoric uranium	Additional health and safety requirements	Moderate
Treatment—dewatering and chemical stabilization for RCRA metals	Presence of RCRA organics	Additional Land Disposal Restrictions treatment	High
	Presence of pyrophoric uranium	Unique treatment requirements	High
Disposal—on-site disposal cell	Radionuclide concentrations	High levels may require off-site disposal	High
	Pyrophoric materials	Treatment required before disposal	High
	RCRA constituents	Treatment required before disposal	High
Capping—multilayer cap	Horizontal extent of waste	Larger cap may be required	Low

1.2.2 Identify the Decision and Inputs to the Decision

Multiple decisions need to be made concerning this site that are specific to the proposed remedial actions. The decisions to be made are centered around the questions outlined in Sect. 1.2.1.

1. What material at BYBY is a source for uranium contamination of groundwater and surface water?

A quantitative definition of what material constitutes a source for contamination of groundwater and surface water (i.e., what material will require excavation) will be provided in the RAWP and Remedial Design Report. A number of factors combine to cause buried wastes and/or contaminated soils at BYBY to be source(s) to downgradient contamination. The principle factors are the concentration of uranium, the physical and chemical form of uranium, the location of uranium-contaminated material relative to groundwater, and the relationship of groundwater to adjacent surface water features.

The approach to defining the source material adopted at the DQO meeting was to identify uranium contamination in the surface water and groundwater at BYBY and track the contamination in these exit pathway media to the sources. The extent of contamination in these media will define

the location of the source material. Additional data from soil sampling will be used to further define the source material. The inputs to making this decision are the extent of uranium contamination in surface water and groundwater at BYBY and bulk samples of material taken after identification of source(s) that will be used to further define what material constitutes that source.

2. What is the volume and location of source material?

The total volume of soil to be excavated as part of the remedial action will be defined in the RAWP and Remedial Design Report. Sampling conducted to resolve decision 1 will provide most of the inputs for defining the volume and location of source material. Inputs will be groundwater data from borings that defined the extent of uranium-contaminated groundwater and the results of in-field radiological screening of soils sampled during boring for groundwater samples. The depth of material will be confirmed during sampling for bulk samples.

3. What is the areal extent and approximate volume of uranium-contaminated material that does not constitute a source?

The remedy for material that does not constitute a uranium source to groundwater and surface water is to consolidate and cap this material. This will be used to define the areas of BYBY that will be addressed by the final cap. The aerial extent and the volume of material that is not a source will define the need for consolidation and the extent of the cap. Inputs to this decision will be provided from existing data and from data taken to resolve decisions 1 and 2. Inputs will be (1) the existing geophysical and radiological survey data from BYBY that were taken during the RI, (2) groundwater data from borings that defined the extent of uranium-contaminated groundwater (and thus also define the extent of noncontaminated groundwater), and (3) soil radiological screening conducted during boring for groundwater samples.

4. What are the physical and chemical characteristics of the source material?

The parameters where most uncertainty has been identified in the physical and chemical characteristics of the source material are (1) the presence of pyrophoric uranium, (2) the presence of RCRA organics, (3) the concentrations of radionuclides, and (4) the concentrations of RCRA constituents. The decisions to be made concern the final disposition of the waste material and the amount of treatment required before waste disposal.

The inputs to this decision will be provided from bulk samples of material taken after identification of source(s). These will be described and photographed in the field and will also be analyzed for chemical parameters that meet the needs of the decision concerning final placement of the waste material, such as presence of RCRA constituents and total activity of radionuclides or other waste acceptance criteria.

1.2.3 Define the Study Boundaries

The study boundaries include the boundaries of the BYBY as defined in the BCV RI (Fig. 1.4). A feature of this site are two caps, one on the HCDA and one at the adjacent Oil Landfarm (OLF), which may cover some of the areas that require investigation. There are no restrictions from DOE on penetrating the cap on HCDA or the OLF. However, the OLF cap is regulated under the Bear Creek Valley RCRA permit, and there may be restrictions to penetrating the cap under these regulations. In addition, the HCDA cap is covered by an approved RCRA closure plan that may need modification before penetrating the cap. A post-closure permit modification has been requested from

the Tennessee Department of Environment and Conservation to allow penetration of the OLF cap for the purpose of sampling in a CERCLA investigation. In addition, concurrence has been requested from the Tennessee Department of Environment and Conservation on penetrating the HCDA cap for the purpose of sampling in a CERCLA investigation. It is anticipated that both requests will be approved.

The temporal boundaries for this study are defined by the schedule for this project (Fig. 1.5). This provides constraints on the timing of field activities.

1.2.4 Decision Rule and Sampling Design

The remaining three steps of the DQO process were not completed at the DQO meeting. The information generated from the DQO meeting was used by the technical team to complete the remaining steps of the DQO process, the decision rules, and decision error (as appropriate) and optimize the sampling design for the SAP.

At the DQO meeting, an observational approach to data collection was adopted that incorporates field screening and in-field decisions for selecting sample locations. On the basis of the rationale for sampling that will provide inputs to the decisions, a general approach to decision making was defined (Fig. 1.6). This decision rule process identifies decision points, incorporates the decision rules, and identifies the decision makers for each decision to be made.

1.3 UNRESOLVED ISSUES FROM THE DQO MEETING

The following issues arose during the BYBY DQO meeting that were considered unresolvable during the meeting. These issues do not affect the scope of the field investigation and will be resolved during the development of the RAWP and the Remedial Design Report. These issues are as follows:

- The location for disposition of the excavated waste has not been determined. The likelihood of the waste going to the Environmental Management Waste Management Facility is uncertain because of ongoing negotiations between DOE, the Tennessee Department of Environment and Conservation, and EPA Region IV. The team resolved to provide sufficient characterization of source materials such that the expected composition of the excavated material can be evaluated against multiple waste acceptance criteria.

- When specified risk reduction goals are met during the excavation process, does the field team continue to dig?

- Before deciding if and when a cap is installed, a period of post-excavation performance monitoring is recommended; however, this was not defined.

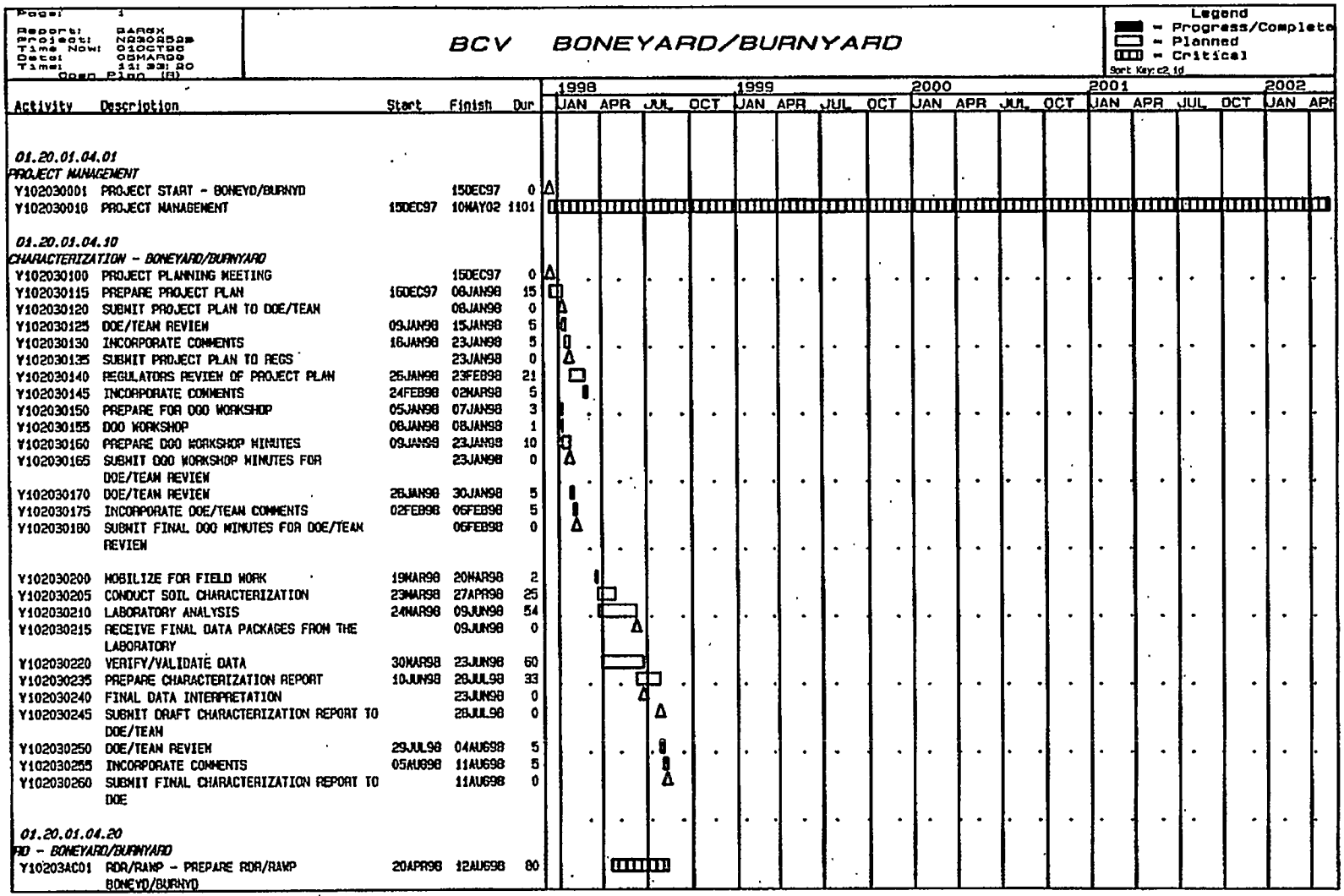

Fig. 1.5. Schedule for the BYBY Accelerated Action Project.

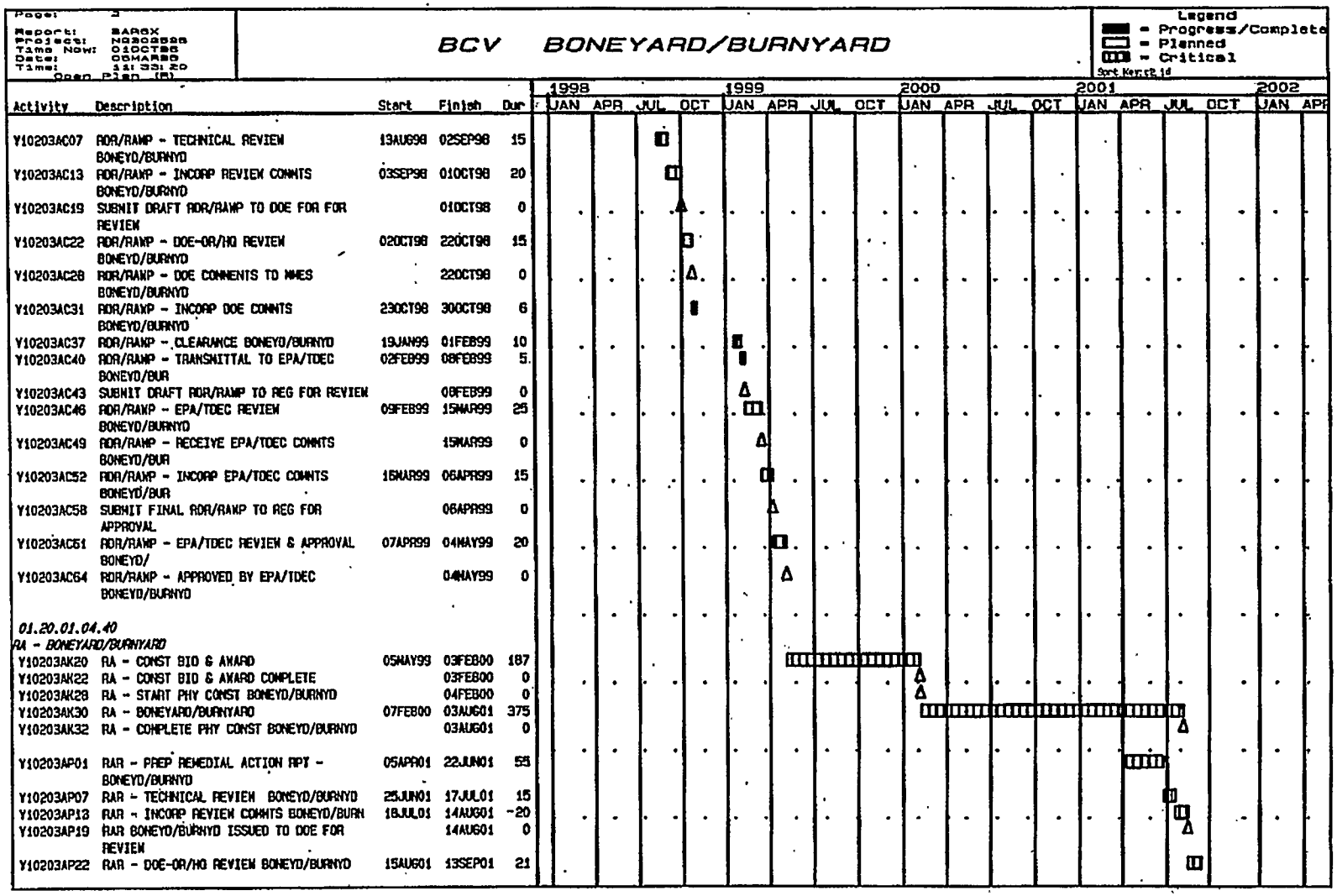

Fig. 1.5 (continued)

Page: 3
Report: BARGX
Project: N3300B0B
Time Now: 03OCT00
Date: 08MAR00
Time: 11:32:20
Open Plan (R)

BCV BONEYARD/BURNYARD

Legend
- Progress/Complete
- Planned
- Critical

Sort Key:C2_1f

Activity	Description	Start	Finish	Dur
Y10203AP28	RAR - DOE COMMENTS TO MMES BONEYD/BURNYD		13SEP01	0
Y10203AP31	RAR - INCORP DOE COMMTS BONEYD/BURNYD	14SEP01	11OCT01	20
Y10203AP37	RAR - CLEARANCE BONEYD/BURNYD	12OCT01	25OCT01	10
Y10203AP40	RAR - TRANSMITTAL TO EPA/TDEC BONEYD/BUR	25OCT01	01NOV01	5
Y10203AP43	RAR BONEYD/BURNYD ISSUED TO REG FOR REVIEW		01NOV01	0
Y10203AP48	RAR - EPA/TDEC REVIEW BONEYD/BURNYD	02NOV01	08FEB02	65
Y10203AP49	RAR - RECEIVE EPA/TDEC COMMTS BONEYD/BUR		08FEB02	0
Y10203AP52	RAR - INCORP EPA/TDEC COMMTS BONEYD/BURN	11FEB02	11APR02	43
Y10203AP58	RAR BONEYD/BURNYD ISSUED TO REG FOR APPROVAL		11APR02	0
Y10203AP61	RAR - EPA/TDEC REVIEW & APPVL BONEYD/BUR	12APR02	10MAY02	21
Y10203AP64	RAR - APPROVED BY EPA/TDEC BONEYD/BURNYD		10MAY02	0
Y10203AP99	PROJECT COMPLETE - BONEYD/BURNYD		10MAY02	0

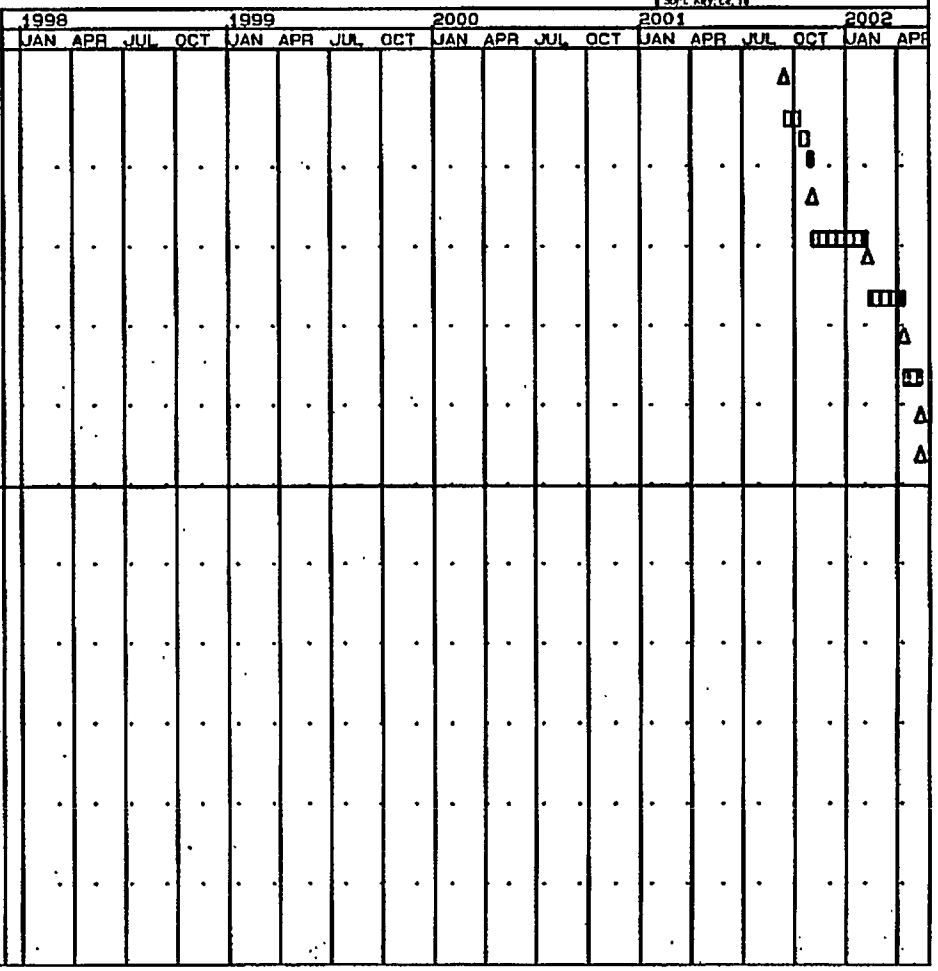

Fig. 1.5 (continued)

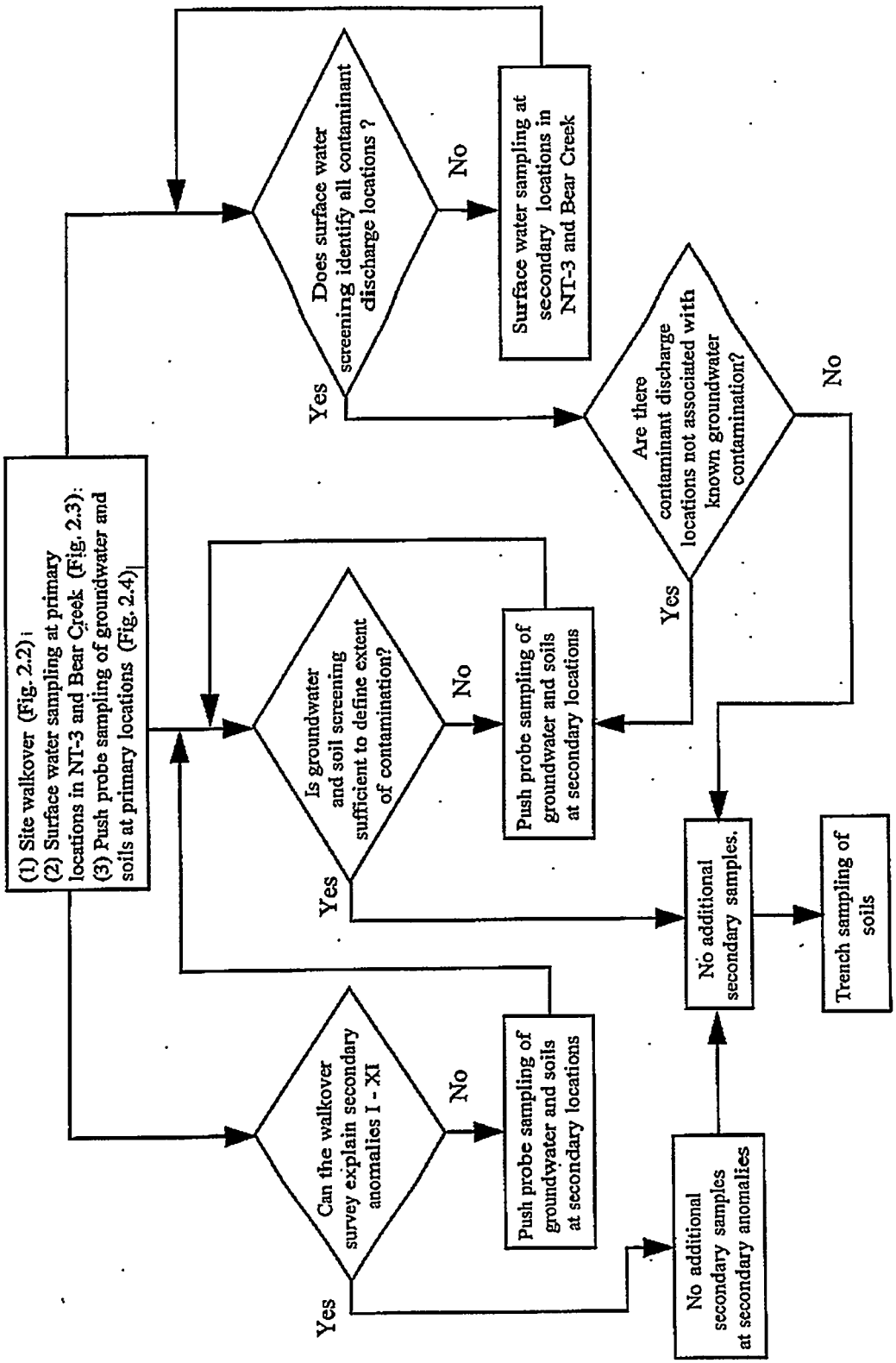

Fig. 1.6. General decision rule for the BYBY Accelerated Action Project.

2. SAMPLING AND ANALYSIS PLAN

2.1 SAMPLING STRATEGY

At the DQO meeting an observational approach to data collection was adopted that incorporates field screening and in-field decisions for selecting sample locations. To guide decision making in the field, detailed objectives for sampling and sample strategies designed to meet these objectives were developed. This section describes the sampling objectives and strategy. In addition, the initial sampling locations and the decision process for selecting subsequent sampling are described.

The overall strategy for sampling is to define the extent of source areas by screening the affected media—surface water and groundwater—for uranium contamination to define the location of sources and to conduct soil screening in push probes to further define the source boundaries. This screening step will be followed by test pit excavation at the location(s) of sources identified in the screening to provide a more detailed description of the source material and an analysis of the physical and chemical characteristics of the source material.

Using existing data, likely source areas at BYBY have been identified and the site was divided into four areas, A through D (Fig. 2.1). These areas are defined by the likelihood that they contain material that is acting as a source for downgradient contamination and require removal. There are separate objectives for sampling within each area (Table 2.1). In addition, surface water screening in NT-3 and Bear Creek will be conducted to test the hypothesis that the main pathways for uranium exiting BYBY are related to the areas that are expected to be the sources and to identify additional sources to surface water, if they exist. Table 2.1 provides a brief description of each area and the objectives for sampling in the areas. The following sections provide details of the proposed sampling activities.

2.2 SAMPLING ACTIVITIES

Following the observational approach to sampling at BYBY, the following sections describe only the initial series of samples to be taken for these field activities. The objective for sampling each media is described and the decision point is identified. The decision team consists of representatives from DOE, Energy Systems, Bechtel Jacobs Company LLC, and SAIC. The initial samples planned for BYBY are termed the "primary" samples. "Secondary" samples are those that will be obtained by making decisions based on the results of primary samples. Primary samples and quality assurance (QA) samples are listed in Table 2.2. Sample containers and holding times are listed in Table 2.3; analytes, analytical methods, and detection limits are listed in the quality assurance project plan (Table 4, Appendix B); quantitation levels of toxicity characteristic leaching procedure (TCLP) analysis are listed in the quality assurance project plan (Table 5, Appendix B).

2.2.1 Initial Site Walkover

An initial site walkover will be conducted before mobilization of the field crew. This walkover will be for the purpose of identifying the primary sample locations and to inspect the land surface at locations where secondary geophysical and radiological anomalies occur in the RI data (labeled I through XI on Fig. 2.2). Eleven anomalies have been identified that will be investigated by field observations. The surface feature inspection will determine if secondary borings are necessary in these areas (Fig. 1.6). In addition, debris on the surface of BYBY will be identified and its position noted.

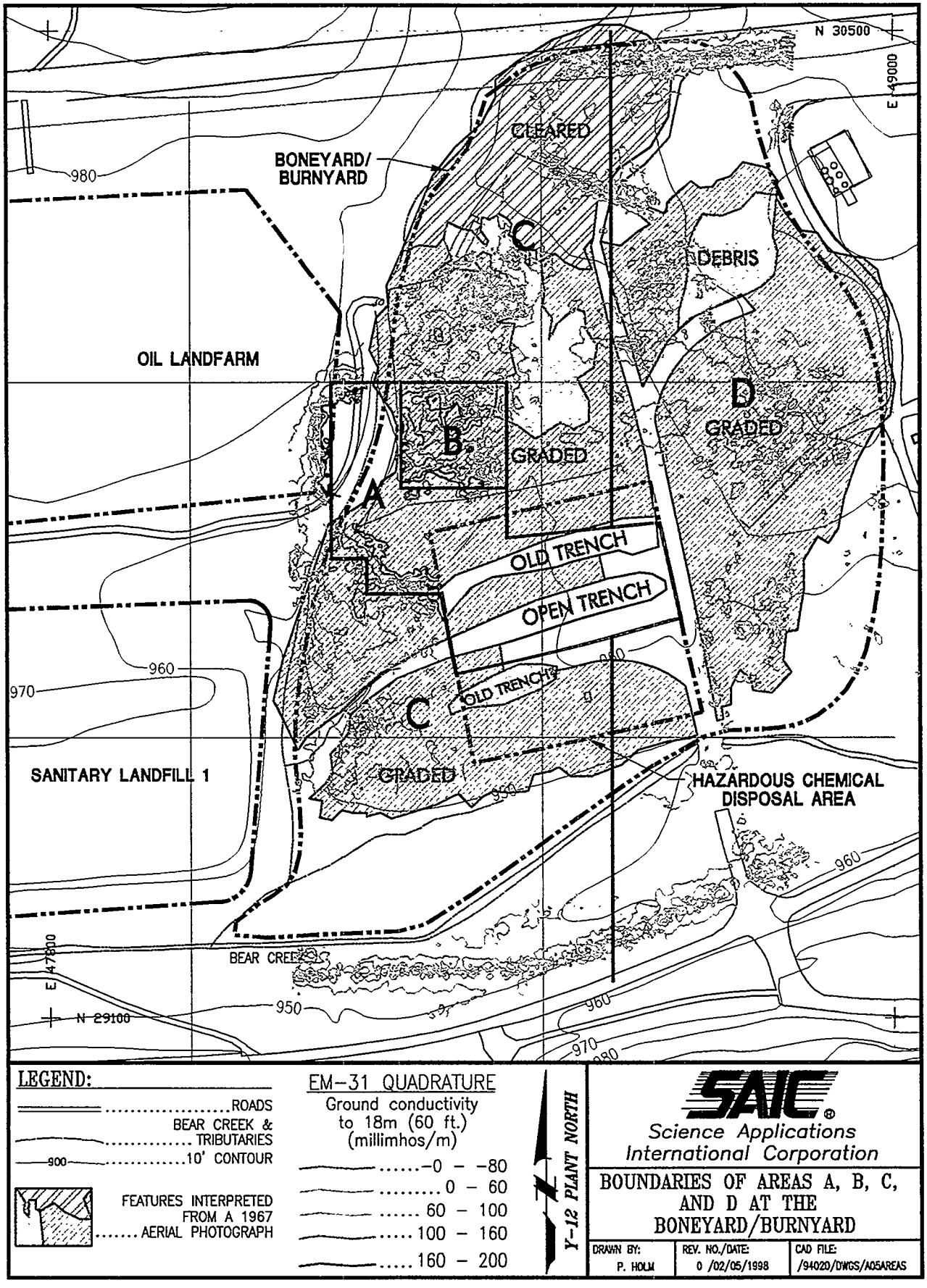

Fig. 2.1. Boundaries of Areas A, B, C, and D at the BYBY relative to the 1994 geophysical survey and features identified from a 1967 aerial photograph.

Table 2.1. Description of sampling areas at BYBY and the objectives for sampling in each area

Area	Description	Objective
Area A	On the basis of geophysical evidence, soil sampling data, and aerial photography, this is the area of BYBY most likely to be underlain by source material. It is likely that most of the volume underlying Area A will require removal. Total area is ~10,500 yd^2, which equates to a total volume of ~38,500 yd^3 assuming a depth of excavation of 11 ft	(1) Define volumes of waste material in Area A by (a) defining the northwest and southwest boundaries of Area A (i.e., where the geophysical anomaly in Fig. 2.1 is truncated by the caps), and (b) identifying location of known trenches under HCDA cap and determining if these trenches are a source (2) Characterize the physical and chemical properties of buried waste materials
Area B	Adjacent to Area A and probably contains smaller volumes of source material. Only part of the volume underlying Area B will require removal. Total area is ~2500 yd^2, which equates to a total volume of ~9200 yd^3 assuming a depth of excavation of 11 ft. The current estimated volume for removal (based on geophysical surveys) is ~2000 yd^3	(1) Define the volumes in Area B acting as a source for uranium contamination (2) Characterize the physical and chemical properties of buried waste materials
Area C	Constitutes most of the western half of BYBY. On the basis of the presence of geophysical anomalies, this area may contain some isolated "hot spots" that are sources of contamination. Groundwater underlying this area is contaminated with uranium. In addition, surface soils are contaminated and contaminated debris is scattered on the surface in some parts of the area. Total area is ~40,000 yd^2	(1) Determine if any of the geophysical anomalies in this area are sources of contamination of groundwater and surface water (2) Determine the extent of groundwater contamination below the portions of the HCDA cap that lie in Area C (3) Define the extent of surface soil contamination
Area D	Constitutes the eastern half of BYBY. This area contains some geophysical anomalies that may not be related to subsurface contamination. It is not anticipated that soils in this area are a source for contamination. Radiological surveys indicate that surface soils are not contaminated. Groundwater is not radiologically contaminated	(1) Increase the size of the area known not to be radiologically contaminated (Area D) during sampling activities to define the extent of contamination in Areas B and C

Table 2.2. BCV BYBY Accelerated Action Project sampling and analytical requirements for primary samples

Parameter	Methods	Field samples	Field duplicate samples	Site source water	Sampler rinsates	Trip blanks	Total samples
Soils (soil borings)							
Rapid Turnaround Uranium (234, 235, 238)	TIMS, Y-12 ASO	40	4	--	--	--	44
Field Parameters	Alpha emissions	300	30	--	--	--	330
Soil (test pits)							
Volatile Organics, TCL	SW-846, 8260	48	5	--	5	6	64
Semivolatile Organics, TCL	SW-846, 8270	48	5	--	5	--	58
PCBs, TCL	SW-846, 8081	48	5	--	5	--	58
Metals, TAL + Li and U	SW-846, 6010A/6020/7471	48	5	--	5	--	58
Gross Alpha	Proportional Ctr.	48	5	--	5	--	58
Gross Beta	Proportional Ctr.	48	5	--	5	--	58
Gamma Spectral Scan (K-40)	Gamma Spec.	48	5	--	5	--	58
Iso-U (233/234, 235, 236, 238)	Alpha Spec.	48	5	--	5	--	58
Iso-Th (228, 230, 232, 234)	Alpha Spec.	48	5	--	5	--	58
Iso-Pu (238, 239/240)	Alpha Spec.	48	5	--	5	--	58
Np-237	Alpha Spec.	48	5	--	5	--	58
Am-241	Alpha Spec.	48	5	--	5	--	58
Pa-234m	Gamma Spec.	48	5	--	5	--	58
Ra-226	Alpha Spec.	48	5	--	5	--	58
Sr-89/90	Proportional Ctr.	48	5	--	5	--	58
Tc-99	Liquid Scint.	48	5	--	5	--	58
Tritium	Liquid Scint.	6	--	--	--	--	6
Carbon-14	Liquid Scint.	6	--	–	--	–	6
TCLA Characteristics							
TCLP Zero headspace extraction	SW-846, 1311	6	--	--	--	--	6
TCLP Volatile Organics	SW-846, 8260	6	--	--	--	--	6
TCLP extraction	SW-846, 1311	6	--	--	--	--	6
TCLP Semivolatile Organics	SW-846, 8270	6	--	--	--	--	6
TCLP Pesticides	SW-846, 8081	6	--	--	--	--	6
TCLP Herbicides	SW-846, 8150	6	--	--	--	--	6
TCLP Metals + Cu, Zn	SW-846, 6010A/6020/7470	6	--	--	--	--	6
Additional Waste Characteristics							
pH	SW-846, 9045	6	--	--	--	--	6
Corrosivity to steel	DOT E-10904	6	--	--	--	--	6
Paint filter liquid test	SW-846, 9095	6	--	--	--	--	6
Cyanide Reactivity	SW-846, Chap. 7	6	--	--	--	--	6
Sulfide Reactivity	SW-846, Chap. 7	6	--	--	--	--	6

Table 2.2 (continued)

Parameter	Methods	Field samples	Field duplicate samples	Site source water	Sampler rinsates	Trip blanks	Total samples
Ignitability	SW-846, 1010	6	--	--	--	--	6
Total petroleum hydrocarbons (TPH)	EPA 418.1 Mod.	6	--	--	--	--	6
Total organic halides (TOX)	SW-846, 9020	6	--	--	--	--	6
Moisture content	ASTM D2216	6	--	--	--	--	6
Ash content	ASTM D483-87	6	--	--	--	--	6
Bulk density	ASTM D5057-90	6	--	--	--	--	6
Surface water							
Field Parameters (pH, temperature, conductivity, Eh, flow)	EPA series	22	--	--	--	--	22
Rapid Turnaround Uranium (234, 235, 238)	TIMS, Y-12 ASO	20	2	--	--	--	22
Volatile Organic, TCL	SW-846, 8260	22	2	--	--	2	24
Groundwaters							
Field Parameters (pH, temperature, conductivity, Eh)	EPA series	30	3	2	2	--	37
Rapid Turnaround Uranium (234, 235, 238)	TIMS, Y-12 ASO	40	4	2	2	--	48
Volatile Organics, TCL	SW-846, 8260	40	4	2	2	10	58
Metals, TAL + Li and U	SW-846, 6010A/6020/7470	3	1	1	--	--	5
Anions (Br, Cl, F, So_4)	EPA 9056	4	1	2	1	--	8
Phosphate	EPA 9056	4	1	2	1	--	8
Nitrate/Nitrite	EPA 9056	4	1	2	1	--	8
Alkalinity	EPA 310.1	4	1	2	1	--	8

Table 2.3. Container requirements for BYBY Accelerated Action Project, Oak Ridge, Tennessee

Analyte group	Container	Minimum sample size	Preservative	Holding time
		Soil samples		
Rapid TAT U (TIMS)	125-mL, p or g	50 g	4C +/- 2C	180 d
VOCs	125- mL g/Teflon® lid, no headspace	50 g	4C +/- 2C	14 d
SVOAs and PCBs	500-mL g/Teflon® lid	300 g	4C +/- 2C	14 d
Metals	250-mL, p or g	100 g	4C +/- 2C	180 d
Radionuclides	2 - L wide mouth, p or g		4C +/- 2C	180 d
TCLP	1-L wide mouth, g	300 g	4C +/- 2C	14 d
pH		10 g	4C +/- 2C	0.25 h
Corrosivity		10 g	4C +/- 2C	NA
Paint filter	2L, p or g	250 g	4C +/- 2C	NA
Ignitability		100 g	4C +/- 2C	NA
TPH		100 g	4C +/- 2C	28 d
Cyanide and sulfide reactivity	125 mL, g/Teflon® no headspace	40 g	4C +/- 2C	7 d
TOX	125 mL, g/Teflon®, no headspace	25 g	4C +/- 2C	28 d
Percent moisture		100 g	4C +/- 2C	28 d
Ash content	1 L, p or g	10 g	4C +/- 2C	NA
Bulk density		100 g	4C +/- 2C	NA
		Water samples		
Rapid TAT U (TIMS)	125 mL, p	125 mL	HNO_3 to pH <2	180 d
VOCs	2 40-mL g/Teflon® lined septum, no headspace	5 mL	pH <2, HCl	14 d
Metals	1 L, p	500 mL	pH <2, HNO_3	6 months
Anions	250 mL, p or g	25 mL	4C +/- 2C	48 h
Alkalinity	250 mL, p or g	25 mL	4C +/- 2C	14 d
SVOAs	1 L, ag/Teflon®	1000 mL	4C +/- 2C	7d
PCBs	1 L, ag/Teflon®	1000 mL	4C +/- 2C	7d
Rad (except H^3)	1 gal, p	2 L	pH < 2, HNO_3	6 months
Tritium	1 250 mL, g	250 mL	4C +/- 2C	6 months

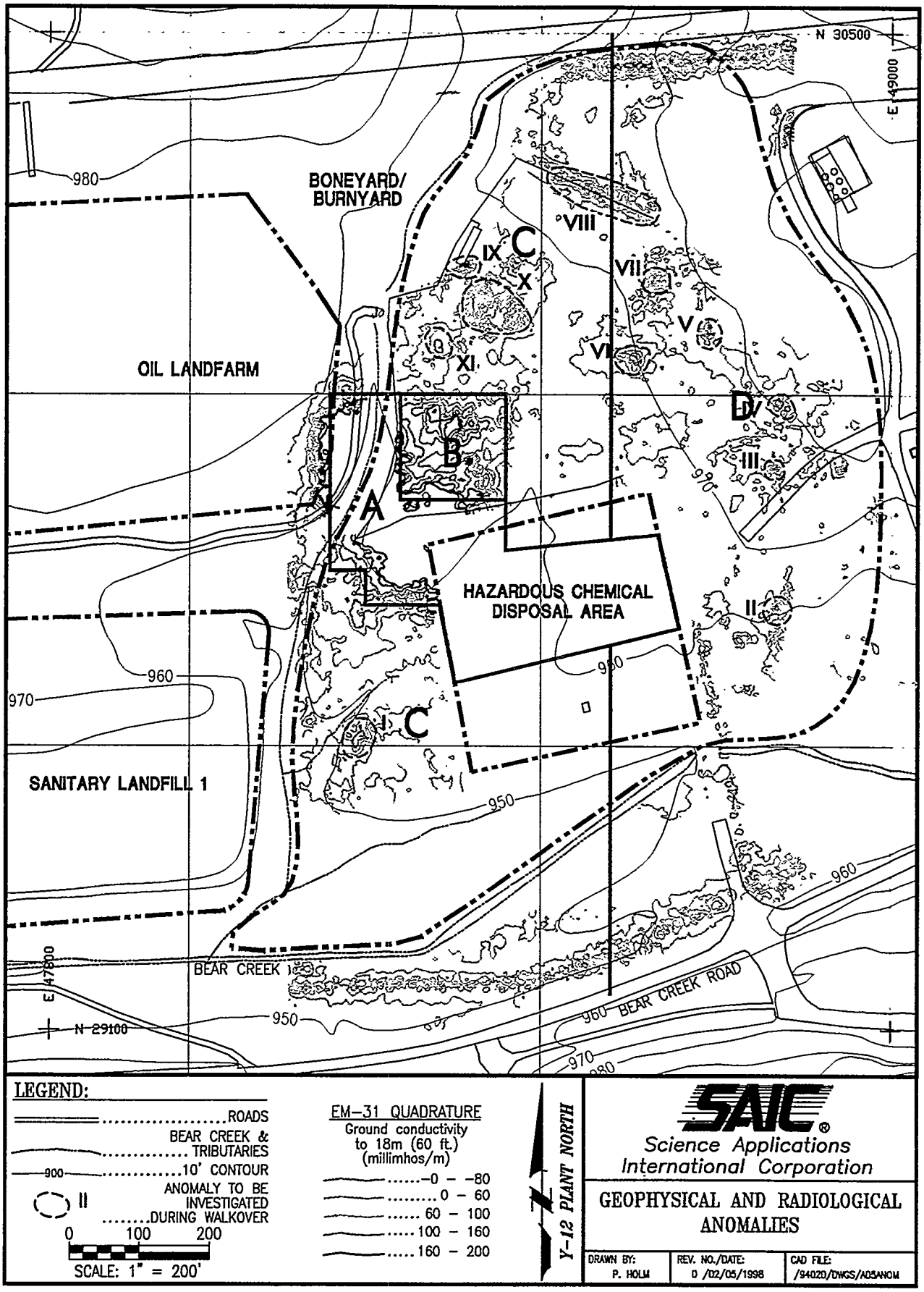

Fig. 2.2. Geophysical and radiological anomalies that will be reviewed by the initial site walkover.

2.2.2 Surface water

The objective for surface water sampling is to identify exit pathways to surface water in NT-3, Bear Creek, and minor tributary channels to these streams. Primary surface water samples will be collected at 100-ft intervals along NT-3 and its tributaries and at 200-ft intervals along Bear Creek (Fig. 2.3). These constitute 22 primary sample locations. All primary sample locations will be sampled within a 48-h period during which there is no rainfall. Sampling will not occur within 48 h of a rainfall event. Surface water at each sample location will be analyzed for field parameters—pH, specific conductance, temperature, Eh, and flow. Samples will be sent to an on-site laboratory for rapid turnaround analysis for uranium isotopic activity.

Secondary surface water sampling may be conducted to provide a smaller scale resolution for identification of outfalls to the surface streams. This decision will be taken after receipt of the results from the analysis of the primary samples.

2.2.3 Groundwater

The objective of groundwater sampling is to identify the extent of contaminated groundwater that is discharging to identified surface water discharge locations. Primary sample locations are based on the anticipation that the reach of NT-3 adjacent to Area A will be where most contaminated discharge occurs. This is based on the existing data from the RI. In addition, primary sample locations address groundwater contamination identified by the RI in Area C. Three primary groups of groundwater are planned (Fig. 2.4) with a total of 30 primary borings (BY10–BY39). These are as follows:

- twenty-one locations in Areas A and B (BY10–BY30) to delineate the extent of uranium-contaminated groundwater in these areas;
- five locations located approximately along the geological boundary between the Nolichucky Shale and the Maynardville Limestone (BY31–BY35). These borings are designed to identify pathways for groundwater migration directly to the Maynardville Limestone and the potential for sources under the HCDA cap; and
- four locations in the north of Area C (BY36–BY39) to delineate the extent of groundwater contamination identified in the RI at boring BYBY 6 (Fig. 1.3).

Groundwater samples will be collected in each of the 30 primary direct push boreholes and will be analyzed for field parameters—pH, specific conductance, temperature, and Eh. Samples will be sent to an on-site laboratory for rapid turnaround analysis for uranium isotopic activity and to a yet to be determined laboratory for analysis for volatile organic compounds (VOCs). Boring depths will be determined by the following conditions: (1) natural material, below any waste, is reached and shows no radiological contamination when scanned with field screening meters and (2) direct push refusal. Boring depths are anticipated to be 25 ft or less based on previous experience at BYBY. A 1-in. polyvinyl chloride piezometer, with a 1-ft section of screen, will be temporarily installed in each primary borehole except those that penetrate the HCDA cap. Borings that penetrate the HCDA cap will be plugged and abandoned following an approved procedure for repairing the cap (to be determined).

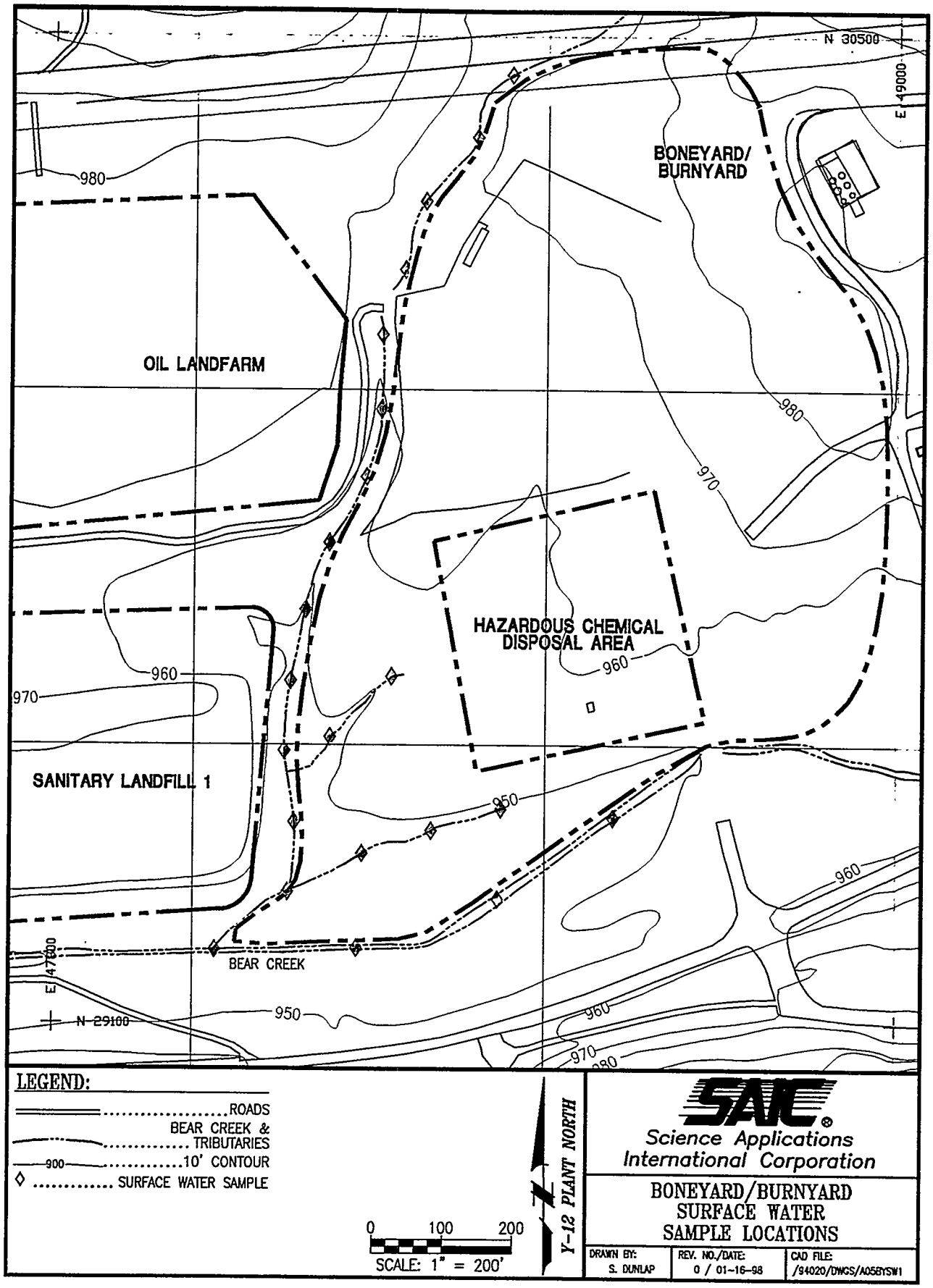

Fig. 2.3. Primary surface water sampling locations.

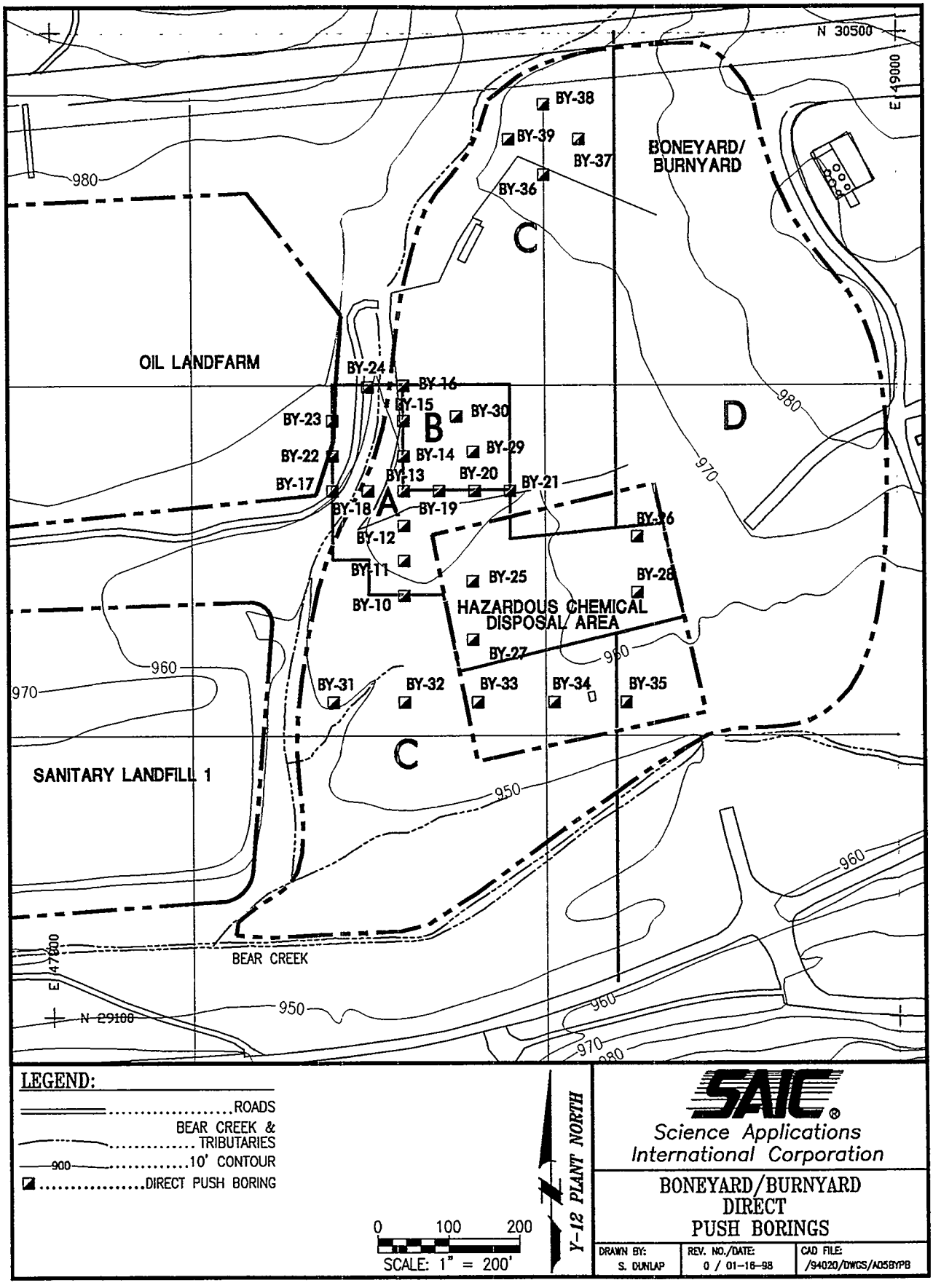

Fig. 2.4. Primary groundwater and soil sampling locations.

Secondary sampling will be conducted for the following reasons.

- To provide closer resolution on the extent of source areas or if the primary samples are unable to identify the edges of the source area. The sampling strategy will be to close isopleth for uranium concentration above maximum concentration levels in groundwater upgradient of Areas A and B. Additional secondary sampling in Areas A and B may also be dictated by decisions based on soil screening data.

- If sampling in NT-3 or Bear Creek identifies significant discharges for uranium-contaminated groundwater that are not associated either with Areas A or B. A significant discharge is defined as a flux of uranium that is greater than 10% of the total uranium flux in the stream. For these secondary samples, the sampling strategy will focus on identifying the location of the plume of contaminated groundwater and "plume chasing" to the source.

- Geophysical anomalies are encountered that cannot be explained by observations from the field walk over. A boring will be made at each anomaly determined to be a potential source and a groundwater sample taken and analyzed for uranium.

In addition to uranium isotopic activity and VOC analysis, 10% of the groundwater sample locations will be analyzed for RCRA metals and anions. The purpose of this analysis is to provide information on the geochemical conditions for mobilization of uranium at BYBY and the potential for mobilization of RCRA constituents in the water. These data will be a factor in deciding which material acts as a source for uranium-contaminated groundwater.

2.2.4 Soil Screening

The objective of soil screening is to correlate groundwater contamination to soils with radiological contamination. Soils from each of the direct push borings for groundwater sampling (Fig. 2.3) will be sampled. Continuous soil samples will be collected at 2-ft intervals and screened for radiological and organic contamination. Soil samples will be screened in the field for alpha radiation by using an alpha scintillation detector. One sample with the highest field activity reading from each boring will be sent to the laboratory for total alpha activity and uranium isotopic activity analysis. Assuming a total depth of 20 ft for each boring, a total of 280 soil screening samples will be screened in the field and 28 will be sent to the laboratory for analysis.

Secondary screening samples will be conducted for the following reasons:

- where additional borings are being made to sample groundwater, additional soil samples will be taken in these borings, and

- to provide closer resolution on the extent of source areas or if the primary samples are unable to identify the edges of the source area.

2.2.5 Test Pit Samples

Up to six test pits will be opened at locations determined from the direct push borings. Test pits will be dug with a backhoe and will extend to natural material below any fill or waste. It is estimated that the pits will be no deeper than 15 ft. Test pits will be excavated in 2-ft intervals with each 2-ft placed separately on plastic sheeting. Excavated material will be described and photographed. To the extent possible, the faces of each pit will be described and photographed during excavation. A

soil sample from each 2-ft interval will be collected and analyzed for selected radioisotopes, RCRA metals, semivolatile organic compounds, PCBs, and VOCs. In addition, six samples, one sample from each pit, will be collected for TCLP analysis.

Upon completion, the test pits will be backfilled with excavated material, put back into the pit from the same depth from which it was excavated. The size of the test pits will be as small as possible to achieve the desired sampling objectives. It is assumed that each pit will require one day to open, sample, and backfill. Any pit where problems are experienced as a result of cave-in, or other reasons, will only be worked on for one day and will be considered complete at the end of this time. This will ensure no pit is left open overnight or longer.

2.2.6 Surveying

All direct push borehole locations and test pit locations and one in five surface water locations will be surveyed following the completion of field work by a licensed Tennessee surveyor. All surveying will be within the nearest 0.1 ft horizontally and 0.01 ft vertically.

2.2.7 Equipment Decontamination

All sampling equipment will be decontaminated before initial use and between each sample. The direct push drill rig will be decontaminated before the start of drilling. Drill rig tools, rods, and any other downhole equipment will be decontaminated before the start of drilling and between each borehole. The backhoe will also be decontaminated before use on the first test pit and the backhoe bucket will be decontaminated between test pits. The backhoe arm will be wrapped in plastic to try to keep it from contacting soil material. Energy Systems established procedures [ESP-801, -802, and -803 (Kimbrough 1994)] will be used for all decontamination.

2.3 QUALITY ASSURANCE/QUALITY CONTROL

QA/quality control (QC) activities have been developed for use in the sample collection and sample analysis associated with the BYBY Accelerated Action field investigation to ensure that appropriate levels of QA and QC are achieved. A detailed description of QA/QC activity is provided in the accompanying quality assurance project plan (Appendix B). All QA/QC procedures will be in accordance with applicable professional technical standards, EPA requirements, government regulations, DOE orders, and Y-12 Plant requirements.

QA objectives for data collection and analysis are to generate data that will withstand scientific and technical scrutiny; to use appropriate procedures for sampling, analysis, chain-of-custody, data documentation, and reporting; and to produce data of known precision, accuracy, and sensitivity. Analytical data will be reported in accordance with definitive data deliverable consistent with the EPA Contract Laboratory Program process and Energy Systems "Analytical Services Master Specifications."

2.3.1 Field Quality Control

To ensure the quality and consistency of data, specific approved sample collection and handling procedures will be followed in accordance with the current version of *Environmental Surveillance Procedures Quality Control Program*, Rev. 4, ES/ESH/INT-14 (Kimbrough et al. 1994) unless otherwise approved by Energy Systems.

The selection criteria for appropriate sample containers, sample preservatives, and holding times shall be in accordance with ESP-701, *Sample Preservation and Container Materials*, and is listed in Table 2.3. Types of sample containers and sample preservation methods used will be documented in the sampling logbook. Handling, shipping, and storage of samples and data resulting from field activities will adhere to chain-of-custody procedures and will ensure that sample integrity for analytical purposes is maintained. The procedures required to properly preserve, package, ship, handle, and store containers of environmental samples will be based on *Sample Classifying, Packaging, Marking, Labeling, and Shipping for Analysis through the K-25 and Y-12 Environmental Restoration Programs*, ESP-505.

Each environmental sample collected during this project will be assigned a unique sample identifier, which will be permanently affixed to the sample container and recorded in the field logbook and chain-of-custody record.

Chain-of-custody procedures require documentation of sample possession from the time of collection to time of disposal. These procedures allow the possession and handling of samples from the time of collection through analysis and final disposal to be traced. Chain of custody shall be maintained in accordance with ESP-501, *Chain of Custody* (Field SAP Procedures Manual). After sample receipt and throughout analysis, the laboratory will maintain custody of all samples, aliquots, resultant extracts, and digestions. Tracking and internal chain-of-custody will be recorded by the laboratory; however, this documentation will not be required as part of the analytical deliverable.

Field instrumentation will be calibrated according to the procedures specified in the manufacturer's operating manual or more frequently should the conditions dictate it for the particular instrument.

Screening of organic vapors, alpha radiation, and beta/gamma radiation may be conducted at the sample location or field sample handling area for health and safety purposes as well as screening-level investigation data. Organic vapor screening will follow SAIC FTP-750. Screening for alpha and beta/gamma radiation will follow FTP-451. Water quality parameters (specific conductance, pH, temperature, etc.) will be measured in the field during sampling and will follow the *Environmental Surveillance Procedures Quality Control Program*, Rev. 4, ES/ESH/INT-14 (Kimbrough et al. 1994).

Data collected during field activities will be evaluated by checking the procedures used and comparing the data to previous measurements. The SAIC QA/QC Officer, or designee and appropriate field personnel, will be responsible for checking field QC sample results to ensure that field measurement and sampling protocols have been observed.

Field QC samples will include field duplicates (10%) and trip blanks (one per shipment).

2.3.2 Laboratory Quality Control

Organic, inorganic, and radiochemical analytical methods prescribed for use in the project have been taken from EPA SW-846 Method Guidance 3rd Edition, other EPA procedures, and DOE manuals. Table 2.3 provides analyte container, preservative, and holding time information; parameter-specific methodologies and reporting levels are located in the quality assurance project plan (Appendix B, Tables 4 and 5).

All analytical instrumentation will be calibrated against certified equipment and/or standards having known valid traceability to nationally recognized standards. Laboratory equipment will be calibrated according to the procedures specified in the analytical methods and in the operating manual for the particular instrument. Calibration frequency will be based on the analytical methods used, type of equipment, inherent stability, manufacturer's recommendations, values given in national standards, intended use, and experience.

Laboratory review is responsible for ensuring that data reduction and calculations follow correct procedures, are documented, and are checked by qualified personnel. All information, including reduced and summarized data, will be retained with the raw data. Specific calculations used for data reduction will also be included. The laboratory is responsible for maintaining comprehensive documentation for all data produced.

The laboratory will be responsible for hard-copy deliverables as defined by Energy Systems "Analytical Services Master Specifications." Electronic data deliverables will be submitted for each sample grouping and be consistent with the hard copy provided. Electronic data deliverable formats will be arranged during laboratory procurement to provide information that can be used by the project database to produce an Oak Ridge Environmental Information System data deliverable. All project data will be evaluated to ensure a complete, consistent, and usable project data set. The data will be delivered to the Oak Ridge Environmental Information System within 30 d of completing the Final Characterization Report.

Laboratory QC samples will be analyzed to check and monitor laboratory performance, precision, and accuracy. The laboratory must follow specific quality processes as defined by the methods and include appropriate QC measures such as calibration verification samples, instrument blank analysis, surrogate determinations, internal standards, and tracer analysis.

2.3.3 QA and Reports to Management

Procedures cannot fully encompass all conditions encountered during a field investigation. Variances from the operating procedures, SAP, and/or the health and safety plan (Appendix C) will, therefore, likely occur and must be documented on a field change order form or a nonconformance report and be noted in the appropriate logbooks. The approach to controlling a documenting field changes will follow ERWM/ER-2303.

All documents concerning the project (e.g., internal and external correspondence, sampling and analysis plan, field logbooks and forms, chain-of-custody forms, data packages, audit reports, surveillance reports, nonconformance reports, corrective action reports) will be submitted to the project manager for appropriate storage and retrieval. Records concerning the project will be forwarded to the Energy Systems project manager upon request for placement in the Environmental Management Enrichment Facilities Document Management Center.

2.4 WASTE MANAGEMENT

The waste management plan is in Appendix D of this SAP. Efforts will be made to minimize the quantities of any wastes generated. It is anticipated that the majority of waste will consist of trash and used personal protective equipment (PPE). It is also anticipated that no waste will be put into drums. All excess soil from direct push drilling, any excess or purge water from groundwater sampling, and decontamination water and sludge will be left at the area of concern. The entire

BYBY, including the HCDA, is considered the area of concern. All trash and used PPE will be scanned for radiological contamination and, if clean, will be bagged for disposal by Energy Systems as sanitary waste. Any radiological contaminated trash or used PPE will be put into rad bags for disposal by Energy Systems.

2.5 HEALTH AND SAFETY

A project-specific health and safety plan was developed under the direction of a Certified Industrial Hygienist and is in Appendix C of this SAP. The health and safety plan contains assessments and controls for anticipated significant chemical and physical hazards. The health and safety plan also addresses radiological hazards and includes general hazard controls for these hazards. Specific controls for radiological hazards will be provided in Radiological Work Permits prepared by Y-12 Plant personnel. At a minimum, the controls for radiological hazards will include radiation worker training, appropriate PPE, real-time monitoring performed by health physics technicians, and personnel dosimetry.

The test pit component of this field investigation poses the greatest risk of injury and overexposure to radiological and chemical contamination. Physical hazards associated with the equipment will be controlled by excluding unauthorized personnel and by excavating carefully. Physical hazards associated with the excavation itself will be controlled by minimizing the size of the excavation and excluding personnel from the excavation. To control risks posed by reactive material, no intact containers will knowingly be brought to the surface or opened. The site health and safety officer or field manager will be present continuously during excavation and will observe the operation for signs of reactions, liquid chemicals, or other indicators of imminent hazard. If a reaction or free liquid chemicals are observed, the excavation will be stopped and the immediate area evacuated while the project manager and health and safety manager are contacted for consultation. The Plant Shift Supervisor will also be contacted immediately if any indication of reaction is observed. Excavation will not be resumed until adequate hazard controls are instituted. Chemical exposure hazards will be controlled by PPE, washing face and hands before eating or drinking, exposure monitoring, and medical surveillance. Exposure to radiological contamination is also a possibility and will be controlled through adherence to Y-12 Plant Radiological Work Permits. Exposure controls are expected to include at least anti-c gloves, access control, personnel dosimetry, and radiological surveys before exiting controlled areas.

2.6 PROJECT AUDITS

SAIC's Certified Industrial Hygienist will conduct two Health and Safety audits of field activities. These audits are planned to coincide with the beginning of the direct push and excavation tasks. In addition to normal audit functions, these audits are intended to include any additional professional assessment of site hazards to verify that hazard controls are adequate. Any significant deficiencies will be corrected immediately.

3. REFERENCES

DOE (U.S. Department of Energy) 1997. *Report on the Remedial Investigation of Bear Creek Valley at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee*, DOE/OR/01-1455/D2, Lockheed Martin Energy Systems, Inc., Oak Ridge, Tenn.

EPA (U.S. Environmental Protection Agency) 1993. *EPA 1993 Guidance for the Data Quality Objectives Process*, EPA QA/G-4.

Kimbrough et al. 1994. *Environmental Surveillance Procedures Quality Control Program*, Rev. 4, ES/ESH/INT-14.

Science Applications International Corporation 1998. *Bear Creek Valley Boneyard/Burnyard Accelerated Action Project Plan, Oak Ridge Y-12 Plant, Oak Ridge, Tennessee*, Y/ER-307, Lockheed Martin Energy Systems, Inc., Oak Ridge, Tenn.

APPENDIX A

LIST OF ATTENDEES AT THE BYBY ACCELERATED ACTION FIELD INVESTIGATION DQO MEETING

Boneyard/Burnyard DQO Meeting
January 8, 1998

Name	Representing	Tel.#	E-Mail
Duncan Moss	SAIC	481-4752	philip.d.moss@cpmx.saic.com
Steve Kucera	Jacobs	220-4907	stephen.kucera@jacobs.com
John Patterson	Jacobs	220-4965	john.patterson@jacobs.com
John Vanderlan	LMES	576-2745	jav@ornl.gov
Dianna Altom	LMES	574-8383	d3a@ornl.gov
Teresa Pierce	LMES	574-7562	iij@ornl.gov
Jim Davis	LMES	241-5066	j9d@ornl.gov
Jason Darby	DOE	241-6343	darbyjo@oro.doe.gov
Dawn Miller	PWT	241-4776	MillerDE@ornl.gov
Victor Weeks	EPA	404/562-8547	
Jeff Henninger	TDEC	481-0995	JHenninger@mail.st.th.l
Andy Phelps	Bechtel Jacobs	423-220-2500	AKPhelps@Bechtel.com
Karen Catlet	DOE	423-241-2224	catlettk@oro.doe.gov
Mick Wiest	LMES	574-3390	mxy@ornl.gov
Greg Schank	SAIC	481-8760	gregory.schank@cpmx.saic.com
Jerry Archer	Jacobs	220-4917	jarcher@gmgw.com
Virginia Forsberg	LMER	574-7000	vmf@ornl.gov
Mike Higgins	SAIC	481-4746	michael.d.higgins@cpmx.saic.com

SAIC = Science Applications International Corporation; Jacobs = Jacobs Engineering Group; LMES = Lockheed Martin Energy Systems, Inc.; DOE = U.S. Department of Energy; PWT = Pacific Western Technologies, Ltd.; EPA = Environmental Protection Agency; TDEC = Tennessee Department of Environment and Conservation; Bechtel Jacobs = Bechtel Jacobs Company LLC; LMER = Lockheed Martin Energy Research Corporation.

APPENDIX B

QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN APPROVALS

Dianna Altom
Dianna Altom, LMES QA Manager

3/19/98
Date

Greg Schank for
Duncan Moss, SAIC, Project Manager

3/19/98
Date

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EXECUTIVE SUMMARY

This quality assurance project plan (QAPjP) has been developed for use in the sample collection and sample analysis activities during the Bear Creek Valley Boneyard/Burnyard Accelerated Action Project to ensure that appropriate levels of quality assurance and quality control are achieved. This QAPjP defines procedures that will be followed in the collection, custody, and handling of data used in the project. These procedures are intended to define the methods applied to achieve the quality assurance/quality control (QA/QC) goals established for these actions. The background, scope, and objectives for this work are defined in the associated sampling and analysis plan (SAP).

This document further establishes QA requirements and responsibilities applicable to project participants and establishes methods through which project participants implement the requirements of the project. Where no appropriate procedure exists, this QAPjP requires that one be developed by a cognizant individual(s) or organization(s).

All QA/QC procedures will be in accordance with applicable professional technical standards, U.S. Environmental Protection Agency (EPA) requirements, government regulations, U.S. Department of Energy (DOE) Orders, guidelines, and requirements. This section has been prepared to meet the requirements of the *Environmental Restoration Quality Program Plan* [ES/ER/TM-4/R4 (Energy Systems 1994)] and its guidance document, EPA's *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans* [EPA-600/4-83-004, QAMS-005/80 (Stanley and Verner 1983)].

1. PROJECT ORGANIZATION

Each organization performing work on this project will adhere to the appropriate requirements of this plan and will prepare implementing procedures where needed. All project team personnel have the right, obligation, and authority to STOP WORK if imminent risks to safety, environment, or mission are identified. The employee should notify responsible management of the apparent risk so that appropriate action can be taken (refer to S.P.-5204, Stop Work Authority). If activities are stopped as a result of unsatisfactory work or through S.P.-5204, an internal Readiness Assessment must be conducted before restarting work activities. Each individual assigned to the project is responsible for the quality of his or her work. Key project personnel are listed in Table 1.

1.1 PROJECT PERSONNEL RESPONSIBILITIES

Sampling and analytical activities will be implemented throughout the life of the project to ensure that quality objectives are met. All project personnel are responsible for QA/QC processes during implementation of sampling and analysis plans.

Energy Systems Project Manager

The Project Manager will report project progress and results to the EM Program Manager and DOE Program Manager and is responsible for

- ensuring that appropriate QA/QC requirements are included in subcontracts and that subcontractor technical commitments are met;
- incorporating the appropriate QA requirements for this project in all sampling and analytical activities;
- consulting with the QA Specialist on all quality-related matters;
- investigating quality problems during sampling operations, determining their root cause, proposing solutions, implementing corrective actions, and obtaining the concurrence of the QA Specialist on the appropriateness of the corrective action;
- initiating stop-work actions when conditions or procedures adverse to quality warrant immediate action; and
- conducting operational readiness reviews according to ER/C-P1610, "Conducting Project Readiness Reviews."

Energy Systems QA Specialist

The QA Specialist reports to the EM Program Manager and the Project Manager and is responsible for

- helping the Project Manager establish and implement the QA measures outlined in this SAP,

Table 1. Boneyard/Burnyard Team Roster

Responsibility	Name	Phone No.
LMES Project Manager	John Vanderlan	576-2745
LMES Program Manager	Steve Haase	576-5790
LMES Data Manager	Virginia Forsberg	574-7000
LMES Sample Manager	Jim Davis	241-5066
LMES Compliance	Mick Wiest	574-3390
LMES Waste Management	Angela Flemming	574-9551
SAIC Project Manager	Duncan Moss	481-4752
SAIC Quality Assurance and Data Manager	Nile Luedtke	481-8751
SAIC Health and Safety Manager	Steve Davis	481-4755
SAIC Field Team Leader	Greg Schank	481-8760

- evaluating the effectiveness of QA activities through audits and surveillances and reporting results to the QA Manager and Project Manager,
- providing guidance to resolve quality problems encountered during sampling and/or decontamination operations and ensuring that corrective action is taken and appropriately documented,
- participating in the operational readiness review; and
- initiating stop-work actions when the severity of conditions adverse to quality warrants immediate action.

Science Applications International Corporation (SAIC) Project Manager

The SAIC Project Manager will oversee environmental sampling and will be responsible for site accessibility, safety, and QA measures, delegating specific responsibilities in areas to other members of the sampling team, specifically the Field Operations Manager (FOM). The SAIC Project Manager will

- coordinate on-site operations, including logistics;
- interface with Site and project personnel;

- assist the Site Health and Safety (H&S) Officer when necessary;
- participate in on-site sampling activities;
- determine in-field procedural variances necessary to respond to site-specific conditions and obtain concurrence of the EM Project Manager; and
- document and report to the EM Project Manager unforeseen site-specific changes and corrective actions.

SAIC Field Operations Manager

The FOM will report to the SAIC Project Manager and will have the following responsibilities:

- ensuring the QA requirements as outlined in this SAP are adhered to;
- ensuring that sampling and decontamination procedures are effectively implemented;
- ensuring that appropriate QA/QC requirements and technical commitments as outlined in subcontractor contracts are met;
- ensuring that all applicable state and federal codes, standards, and regulations are appropriately specified and effectively implemented;
- interfacing with the assigned EM QA Specialist on all quality-related matters; and
- initiating stop-work actions when conditions or procedures adverse to quality warrant immediate action.

SAIC Sampling Team personnel

The responsibilities of the Energy Systems and subcontracted sampling teams are

- ensuring the QA requirements as outlined in this SAP for sampling operations and decontamination are adhered to,
- ensuring that appropriate QA/QC requirements and technical commitments as outlined in the respective subcontractor contracts are met,
- interfacing with the FOM on all quality-related matters, and
- initiating stop-work actions when conditions or procedures adverse to quality warrant immediate action.

Laboratory Coordination

A critical link with respect to sample analysis revolves around the analytical laboratory support services. Laboratory analysis for this project will be arranged through the Oak Ridge Sample Management Office (OR SMO) as administered by the Analytical Services Organization of Energy

Systems. SAIC will interface with the OR SMO regarding contract statements of work, selection, oversight, and coordination of analytical support to this project.

SMO responsibilities will include

- development and dissemination of statements of work for analytical services;
- selection of appropriate analytical facilities to perform the required project analysis;
- identification of appropriate analytical protocols to the selected laboratory organization(s);
- identification of technical and quality standards for the requested analytical services to the selected laboratory organization;
- negotiation of analytical costs and schedule for provision of analytical services, with oversight to assure costs and schedules are maintained;
- oversight and assessment of laboratory(s) systems to assure compliance with project quality and technical standards;
- receipt and dissemination of laboratory analytical data deliverables to SAIC and EM Project Management; and
- verification of laboratory data deliverables relative to laboratory payment.

SAIC responsibilities will include

- review statements of work for analytical services;
- definition of appropriate analytical protocols required by the project;
- definition of technical and quality standards required by the project;
- coordination with the laboratory through the SMO during sample collection and shipment;
- validation of hard copy and electronic data deliverables from the laboratory; and
- data and data base management for all project information.

1.2 PERSONNEL TRAINING AND QUALIFICATION

Personnel shall receive the necessary indoctrination and performance-based training. Each organization participating in the project is responsible for ensuring that requirements are met and for maintaining training records for their personnel.

2. QA OBJECTIVES FOR DATA MEASUREMENT

QA objectives for data collection and analysis are developed as Data Quality Objectives (DQOs) for this project. Project DQOs are defined in Sect. 1.2 of the SAP.

General QA objectives for the analytical data are as follows:

- data generated will withstand scientific and technical scrutiny;
- data will be generated using appropriate procedures for analysis, chain of custody, data documentation, and reporting; and
- data will be of known precision, accuracy, and sensitivity.

Goals for data precision, accuracy, and completeness are presented in Tables 2 and 3, while sensitivity goals have been identified in Tables 4 and 5.

While the laboratory for this project has not yet been specified, the QC criteria included here should be considered minimum requirements. When the laboratory or laboratories have been specified, the QC requirements defined here will be communicated to those facilities in analytical services statements of work. Any necessary changes to these requirements will be documented and approved through the project FCO system. Requirements for analytical documentation by the selected laboratory(s) for this project will be similar to the documentation requirements outlined under the EPA Contract Laboratory Program (CLP) protocol. These requirements are identified throughout this quality assurance project plan (QAPjP). Analyses will be scheduled according to site investigation needs and will be consistent with sample analytical holding times. These requirements will be included in any contractual agreement between OR SMO and the laboratory(s) used for the studies.

QA objectives for all analytical data are to obtain reproducible, precise, and accurate measurements consistent with the intended use of the data and the limitations of the sampling and analytical procedures. The purpose of quality control is (1) to screen out data of unacceptable precision, accuracy, or sensitivity and (2) to document the viability of the data used to accomplish the objectives of this project. All analyses for this project will require analytical QC to be implemented, documented, and reported as part of the data deliverable. Analytical data will be reported in accordance with a standard data deliverable as defined in this QAPjP and with QC procedures consistent with the EPA Methods and Energy Systems "Analytical Services Master Specifications."

3. SAMPLE COLLECTION PROCEDURES

3.1 SAMPLING PROCEDURES

The SAP describes sampling activities, locations, and populations. Sampling data generated during all phases of this investigation must be of acceptable quality and must be comparable to similar environmental data. To ensure the quality and consistency of data, specific approved sample collection and handling procedures will be followed as identified in this QAPjP. The procedures to be followed during this investigation will be in accordance with the current version of *Environmental Surveillance Procedures Quality Control Program,* Rev. 4, ES/ESH/INT-14 (Kimbrough et al. 1994); *Environmental Restoration Waste Management (ERWM) Programs*

Table 2. Soils investigative DQO summary for BCV BYBY accelerated action plan

Data use	Sample type	Analytical method	Precision field dups	(RPD[1]) lab dups	Accuracy laboratory (MS)	Completeness
Screening for sample site selection	Discrete	FID/PID volatile org.	+/- comparison	NA	+/- 0.1ppm	95%
		Radiological monitoring	+/- cpm	NA	NA	95%
Confirmation of contamination extent	Discrete	SW-8260A volatile org.	<50 RPD	<35 RPD	50-150% recovery	90%
	Discrete or composite	SW-8270B semivolatile organics	<50 RPD	<35 RPD	30-140% recovery	90%
		SW-8081 pesticides/PCBs	<50 RPD	<35 RPD	35-135% recovery	90%
		SW-6010A/7000 or SW-6020 metals	<50 RPD	<35 RPD	75-125% recovery	90%
		Radiochemical various	<50 RPD	<35 RPD	75-125% recovery	90%
Determination of waste characteristics	Discrete or composite	SW-1311 TCLP analytes	NA	<40 RPD	75-125% recovery	90%
		SW-8081 PCBs total	<50 RPD	<40 RPD	35-135% recovery	90%
		Waste characteristics	NA	<40 RPD	50-150% recovery	90%
		Physical testing	NA	<40 RPD	NA	90%
		Waste characteristics	NA	<40 RPD	50-150% recovery	90%

[1]RPD = Relative Percent Difference, at values within five times the reporting level comparison is acceptable if values are plus or minus twice the reporting level.

Table 3. Surface water/groundwater investigative DQO summary for BCV BYBY Accelerated Action Plan

Data use	Sample type	Analytical method	Precision field dups	(RPD[1]) Lab dups	Accuracy laboratory (MS)	Completeness
Screening for sample site selection	Discrete	FID/PID volatile organics	NA	NA	+/- 0.1 ppm	95%
Determination of basic water characteristics	Discrete	EPA-120.1 conductivity	<10 RPD	NA	+/- 10 μmhos/cm	95%
		EPA-150.1 pH	<10 RPD	NA	+/- 0.1 s.u.	95%
		EPA-170.1 temperature	<10 RPD	NA	NA	95%
Confirmation of contamination extent	Discrete	SW-8260A volatile organics	<30 RPD	<20 RPD	50-100% recovery	90%
	Discrete or composite	SW-8270B semivolatile organics	<30 RPD	<20 RPD	35-140% recovery	90%
		SW-8081 pesticides/ PCBs	<30 RPD	<20 RPD	35-135% recovery	90%
		SW-6010A/7000 or SW-6020 metals	<30 RPD	<20 RPD	75-125% recovery	90%
		Anions various	<30 RPD	<20 RPD	75-125% recovery	90%
		Radiochemical various	<30 RPD	<20 RPD	75-125% recovery	90%

[1]RPD=Relative Percent Difference, at values within five times the reporting level comparison is acceptable if values are plus or minus twice the reporting level.

Table 4. Analytical/methods, parameters, and project quantitation limits for BCV BYBY Accelerated Action Plan

	Analytical methods		Project quantitation levels[a]	
Parameters	**Water**	**Soil/sediment**	**Water**	**Soil/sediment**
Volatile organic compounds	SW 846-8260	SW846-8260	(μg/L)	(μg/kg)
Chloromethane			10	10
Bromomethane			10	10
Vinyl chloride			5	5
Chloroethane			10	10
Methylene chloride			5	5
Acetone			10	10
Carbon disulfide			5	5
1,1-Dichloroethene			5	5
1,1-Dichloroethane			5	5
1,2-Dichoroethene (total)			5	5
Chloroform			5	5
1,2-Dichloroethane			5	5
2-Butanone			10	10
1,1,1-Trichloroethane			5	5
Carbon tetrachloride			5	5
Bromodichloromethane			5	5
1,2-Dichloropropane			5	5
cis-1,3-Dichloropropene			5	5
Trichloroethene			5	5
Dibromochloromethane			5	5
1,1,2-Trichloroethane			5	5
Benzene			5	5
trans,1,3-Dichloropropene			5	5
Tribromomethane			5	10
4-Methyl-2-pentanone			10	10
2-Hexanone			10	10
Tetrachloroethene			5	5

Table 4 (continued)

Parameters	Analytical methods		Project quantitation levels[a]	
	Water	Soil/sediment	Water	Soil/sediment
Toluene			2	2
1,1,2,2-Tetrachloroethane			5	5
Chlorobenzene			5	5
Ethylbenzene			5	5
Styrene			5	5
Xylenes (total)			5	5
Semivolatile organic compounds (SVOCs)	SW 846-3520/8270A[b]	SW 846-3550/8270A[b]		Low soil/sediment[a]
Phenol			10	330
bis(2-Chloroethyl) ether			10	330
2-Chlorophenol			10	330
1,3-Dichlorobenzene			10	330
1,4-Dichlorobenzene			10	330
1,2-Dichlorobenzene			10	330
2-Methylphenol			10	330
2,2'-oxybis(1-Chloropropane)			10	330
4-Methylphenol			10	330
N-nitroso-di-n-dipropylamine			10	330
Hexachloroethane			10	330
Nitrobenzene			10	330
Isophorone			10	330
2-Nitrophenol			10	330
2,4-Dimethylphenol			10	330
bis(2-chloroethoxy) methane			10	330
2,4-Dichlorphenol			10	330
1,2,4-Trichlorobenzene			10	330
Naphthalene			10	330

Table 4 (continued)

Parameters	Analytical methods		Project quantitation levels[a]	
	Water	Soil/sediment	Water	Soil/sediment
4-Chloroaniline			10	330
Hexachlorobutadiene			10	330
4-chloro-3-methylphenol			10	330
2-Methylnaphthalene			10	330
Hexachlorocyclopentadiene			10	330
2,4,6-Trichlorophenol			10	330
2,4,5-Trichlorophenol			25	800
2-Chloronaphthalene			10	330
2-Nitroaniline			25	800
Dimethylphthalate			10	330
Acenaphthylene			10	330
2,6-Dinitrotoluene			10	330
3-Nitroaniline			25	800
Acenaphthene			10	330
2,4-Dinitrophenol			25	800
4-Nitrophenol			25	800
Dibenzofuran			10	330
2,4-Dintrotoluene			10	330
Diethylphthalate			10	330
4-Chlorophenyl-phenyl ether			10	330
Fluorene			10	330
4-Nitroaniline			25	800
4,6-Dinitro-2-methylphenol			25	800
N-nitrosodiphenylamine			10	330
4-bromophenyl-phenylether			10	330
Hexachlorobenzene			10	330
Pentachlorophenol			25	800

Table 4 (continued)

Parameters	Analytical methods		Project quantitation levels[a]	
	Water	Soil/sediment	Water	Soil/sediment
Phenanthrene			10	330
Anthracene			10	330
Carbazole			10	330
Di-n-butylphthalate			10	330
Fluoranthene			10	330
Pyrene			10	330
Butylbenzylphthalate			10	330
3,3'-Dichlorobenzidine			10	330
Benzo(a)anthracene			10	330
Chrysene			10	330
bis(2-Ethylhexyl)phthalate			10	330
Di-n-octylphthalate			10	330
Benzo(b)fluoranthene			10	330
Benzo(k)fluoranthene			10	330
Benzo(a)pyrene			10	330
Indeno(1,2,3-cd)pyrene			10	330
Dibenzo(a,h)anthracene			10	330
Benzo(g,h,i)perylene			10	330
PCBs	SW 846 3520/8081[b]	SW 846 3540 or 3550/8081[b]		
Arochlor-1016			0.5	33
Arochlor-1221			0.5	67
Arochlor-1232			0.5	33
Arochlor-1242			0.5	33
Arochlor-1248			0.5	33
Arochlor-1254			0.5	33
Arochlor-1260			0.5	33

Table 4 (continued)

Parameters	Analytical methods		Project quantitation levels[a]	
	Water	Soil/sediment	Water	Soil/sediment
Metals (Target analyte list)	SW 846 3010A/6010A, 6020A, or 7000 series[b]	SW 846-3050A/6010A, 6020A, or 7000 series[b]		(mg/Kg)[c]
Arsenic			5	0.5
Barium			5	0.5
Cadmium			0.1	0.1
Calcium			50	5
Chromium			5	0.5
Copper			5	0.5
Iron			10	1.0
Lead			3	0.3
Magnesium			50	5
Mercury (CVAA)	SW 846-7470	SW 846-7471	0.2	0.1
Nickel			10	1.0
Potassium			50	5
Selenium			5	0.5
Silver			5	0.5
Sodium			50	5
Zinc			5	0.5
Uranium			50	5
Anions			(mg/L)	
Bromide	SW846 EPA 9056[d]	—	0.2	—
Chloride	SW846 EPA 9056[d]	—	1.0	—
Fluoride	SW846 EPA 9056[d]	—	0.1	—
Sulfate	SW846 EPA 9056[d]	—	5.0	—

Table 4 (continued)

Parameters	Analytical methods		Project quantitation levels[a]	
	Water	Soil/sediment	Water	Soil/sediment
Phosphate	SW846 EPA 9056[d]	—	0.1	—
Nitrate/Nitrite	SW846 EPA 9056[d]	—	0.2	—
Alkalinity	EPA 310.1[d]	—	NA	—
Radiochemical parameters			pCi/L	pCi/g
Gross alpha	Proportl. Ctr.[e]	Proportl. Ctr.[e]	5	5
Gross beta	Proportl. Ctr.[e]	Proportl. Ctr.[e]	5	5
Gamma spectroscopy (^{137}Cs, ^{60}Co)	Gamma spec.[e]	Gamma spec.[e]	1 ea.	1 ea.
Isotopic uranium ($^{234, 235, 236, 238}$U)	Alpha spec.[e]	Alpha spec.[e]	1 ea.	1 ea.
Isotopic thorium ($^{228, 230, 232, 234}$Th)	Alpha spec.[e]	Alpha spec.[e]	1 ea.	1 ea.
Isotopic plutonium ($^{238, 239/240}$Pu)	Alpha spec.[e]	Alpha spec.[e]	1 ea.	1 ea.
Neptunium 237 (^{237}Np)	Alpha spec.[e]	Alpha spec.[e]	1	1
Americium 241 (^{241}Am)	Alpha spec.[e]	Alpha spec.[e]	1	1
Protactinium 234m (^{234m} Pa)	Gamma spec.[e]	Gamma spec.[e]	100	100
Radium isotopes ($^{226, 228}$Ra)	Alpha spec.[e]	Alpha spec.[e]	1	1
Strontium 89/90 ($^{89/90}$Sr)	Proportl. Ctr.[e]	Proportl. ctr.[e]	1	1
Technetium 99 (^{99}Tc)	Liquid scint.[e]	Liquid scint.[e]	10	10

Table 4 (continued)

Parameters	Analytical methods		Project quantitation levels[a]	
	Water	Soil/sediment	Water	Soil/sediment
Tritium (^3H)	Liquid. Scint.[e]	Liquid. Scint.[e]	300	100
Carbon 14 (^{14}C)	Liquid. Scint.[e]	Liquid. Scint.[e]	500	20

[a]These are expected quantitation limits based on reagent grade water or a purified solid matrix. Actual quantitation limits may be higher depending on the nature of the sample matrix. The limit reported on final laboratory reports will take into account the actual sample volume or weight, percent solids (where applicable), and the dilution factor, if any. The quantitation limits for additional analytes to this list may vary, depending on the results of laboratory studies. All solids will be reported on a dry weight basis, with the associated sample percent moisture reported separately.

[b]*Test Methods for Evaluating Solid Waste,* U.S. EPA, SW-846 Third Edition.

[c]Estimated detection limits for metals in soil are based on a 2-gram sample diluted to 200 mL.

[d]*Methods for Chemical Analysis of Water and Wastes,* U.S. EPA-600/4-79-020.

[e]Laboratory specific procedures, which are consistent with DOE Environmental Measurements Laboratory (EML) Procedure Manual (HASL-300), will be submitted for the project files.

Table 5. Analytical/methods, parameters, and project quantitation limits for BCV BYBY Accelerated Action Plan waste characteristics

Parameters	Analytical methods Soil waste	Project quantitation levels[a]
Volatile organic compounds (VOCs) *(TCLP analyte list)*	SW846-1311 (zero headspace ext.) SW 846-5030/8260[b]	Leachate (μg/L)[c]
Vinyl chloride		20[d]
1,1-Dichloroethene		7
Chloroform		60
1,2-Dichloroethane		5
2-Butanone		2000
Carbon tetrachloride		5
Trichloroethene		5
Benzene		5
Tetrachloroethene		7
Chlorobenzene		1000
Semivolatile organic compounds *(SVOCs)* *(TCLP analyte list)*	SW 846-1311 (extraction) SW 846-3520/8270A[b]	Leachate (μg/L)[c]
1,4-Dichlorobenzene		75
2-Methylphenol (o-cresol)		2000
3-Methylphenol (m-cresol)		2000
4-Methylphenol (p-cresol)		2000
Hexachloroethane		30
Nitrobenzene		20
Hexachlorobutadiene		50[d]
2,4,6-Trichlorophenol		20
2,4,5-Trichlorophenol		4000
2,4-Dinitrotoluene		13[d]
Hexachlorobenzene		13[d]
Pentachlorophenol		1000
Pyridine		500[d]

Table 5 (continued)

Parameters	Analytical methods Soil waste	Project quantitation levels[a]
Pesticides *(TCLP analyte list)*	SW 846-1311 (extraction) SW 846-3520/8081[b]	Leachate (μg/L)
gamma-BHC (Lindane)		1
Heptachlor		1
Heptachlor epoxide		1
Endrin		2
Methoxychlor		100
Chlordane (total)		10
Toxaphene		50
Herbicide compounds *(TCLP analyte list)*	SW 846-1311 (extraction) SW 846-8150[b]	Leachate (μg/L)
2,4-D		120
2,4,5-TP (silvex)		40
Metals *(TCLP analyte list)*	SW 846-1311 (extraction) 3010A/6010A, 6020, or 7000 series[b]	Leachate (μg/L)
Arsenic		50
Barium		100
Cadmium		10
Chromium		50
Copper		50
Lead		30
Mercury (CVAA)	SW 846-7470[b]	20
Selenium		10
Silver		50
Zinc		50
PCB total	SW 846-8081[b]	0.5 mg/kg

Table 5 (continued)

Parameters	Analytical methods Soil waste	Project quantitation levels[a]
Waste Characteristics		
pH	SW 846-9045[b]	NA
Corrosivity (to steel)	DOT E-10904[b]	corrosion rate
Paint filter liquid test (free liquids)	SW 846-9095[b]	0.1%
Cyanide reactivity	SW 846-Chap. 7[b]	50 mg/kg
Sulfide reactivity	SW 846-Chap. 7[b]	50 mg/kg
Ignitability	SW 1010[b]	NA
Total petroleum hydrocarbons (TPH)	EPA 418.1 Mod.[b]	100 mg/kg
Total organic halides (TOX)	SW 846-9020[b]	25 mg/kg
Physical testing		
Moisture content	ASTM D2216[f]	0.5%
Ash content	ASTM D483-87[f]	0.5%
Bulk density	ASTM D5057-90[f]	NA

[a]These are expected quantitation limits based on reagent grade water or a purified solid matrix. Actual quantitation limits may be higher depending on the nature of the sample matrix. The limit reported on final laboratory reports will take into account the actual sample volume or weight, percent solids (where applicable), and the dilution factor, if any. The quantitation limits for additional analytes to this list may vary, depending on the results of laboratory studies.

[b]*Test Methods for Evaluating Solid Waste,* U.S. EPA, SW-846 Third Edition.

[c]Quantitation goals are set at 0.01X the regulatory action level.

[d]Quantitation goals are set at 0.1X the regulatory action level.

[e]Methods of Soil Analysis, No. 9, Part 2, 2nd edition, 1982: 5-2.4.4 = X-ray fluorescence spectrometry; 26-4.3.4 = sulfuric acid distillation followed by titration.

[f]American Society for Testing and Materials, ASTM Standards, Vol. 04.08, Soil and Rock, 1995 and Vol. 11.04, Water and Environmental Technology, 1993.

Intersite Procedures Manual, ES/ER/INT-26/R1 (Energy Systems 1994); and the SAIC Field Technical Procedures Manual unless otherwise approved by Energy Systems. Basic procedures required for sampling activities, field measurements, decontamination, sample shipping, etc., are listed in Table 6. Sample locations and analyses to be performed for each location are identified in the SAP.

3.2 FIELD DOCUMENTATION

An integral part of the QAPjP for the field activities will be to maintain current, accurate, and complete field records including logbooks, chain-of-custody forms, and appropriate field data forms. Field logbooks shall be bound and of hardcover construction. All information pertinent to field activities will be recorded. Each page must be signed and dated. Entries in the logbooks or on the data forms will be made in water-resistant black ink and will include the information specified in *Chain of Custody* ER/K-I1600. Corrections must be marked out with a single line, dated, and initialed. All field records will be reviewed by a qualified field team member other than the person completing the record. No blank spaces should appear on completed forms. If information requested is not applicable, the space shall be marked "N/A". All field logbooks and field data forms will be handled and controlled in accordance with *Handling and Control of Sampling Documentation* (ER/K-I1607).

3.3 SAMPLE CONTAINERS AND HOLDING TIMES

The selection criteria for appropriate sample containers, sample preservatives, and holding times shall be in accordance with ESP-701, *Sample Preservation and Container Materials*. Types of sample containers and sample preservation methods used will be documented in the sampling logbook. Field and laboratory records will indicate the sample holding time before analysis. Sample containers and holding times are summarized in Table 7 of this document.

3.4 SAMPLE PACKAGING AND PRESERVATION

Handling, shipping, and storage of samples and data resulting from field activities will adhere to chain-of-custody procedures and will ensure that sample integrity for analytical purposes is maintained. The procedures required to properly preserve, package, ship, handle, and store containers of environmental samples will be based on *Sample Classifying, Packaging, Marking, Labeling, and Shipping for Analysis through the K-25 and Y-12 Environmental Restoration Programs*, ER/C-P2303 (IAD). Field checks will be conducted and documented to ensure compliance with this procedure. Sample cooler temperature will be checked and recorded before the cooler is sealed for delivery to the analytical lab. Upon receipt of sample coolers, the lab will check and record the temperature of the cooler. Field alpha and beta/gamma radiation screenings of individual samples and of coolers containing samples will be conducted to ensure compliance with Department of Transportation requirements and to ensure that Nuclear Regulatory Commission licensee limits of the labs are not exceeded.

Table 6. BCV BYBY Accelerated Action Plan

ESP-102, Rev. 2	Field Quality Control
ESP-501, Rev. 2	Sample Chain of Custody
ESP-503, Rev. 0	Field Logbooks and Data Forms
ERWM/ER-P2303 Rev. 0	Controlling and Documenting Field Changes to Approved FSPs
QA 301	Control of Nonconforming Items (and Services)
	Sample preparation and management
ESP-503	Field Logbooks and Data Forms
ESP-401, Rev. 1	Field Quality Control Samples
ESP-701, Rev. 0	Sample Preservation and Container Materials
ESP-505, Rev. 1	Preparing Samples and Laboratory Standards for Transport and Shipping
	Surface water sampling
ESP-301-1, Rev. 1	Liquid Sampling Using a Dipper
ESP-301-2, Rev. 1	Sampling Liquids with an Automatic Sampler
ESP-308-1, Rev. 0	Composite Procedures
K-901-566	Storm Event Sampling for Low Volume Seeps and Springs
	Field measurements
ESP-307-1, Rev. 1	Field Measurement: Temperature, pH, Specific Conductance
ESP-307-6, Rev. 1	Field Measurement: Organic Vapor Detection
ESP-307-7, Rev. 1	Field Measurement: Operation of Radiation Survey Instruments
ESP-504, Rev. 0	Field Monitoring Equipment Calibration Records
	Waste management/decontamination
ESP-105, Rev. 1	Waste Management
ESP-801, Rev. 0	Cleaning and Decontaminating Sample Containers and Sampling
ESP-802, Rev. 0	Devices
	Equipment Decontamination
	Soil/sediment sampling
ESP-303-1, Rev. 1	Collection of Soil Samples
ESP-303-2, Rev. 0	Soil Sampling with an Auger
ESP-304-1, Rev. 0	Collection of Sediment Samples
ESP-308-1, Rev. 0	Composite Procedures

Table 7. Container requirements for BYBY Accelerated Action Project, Oak Ridge, Tennessee

Analyte group	Container	Minimum sample size	Preservative	Holding time
		Soil samples		
Rapid TAT U (TIMS)	125-mL, p or g	50 g	4C +/- 2C	180 d
VOCs	125- mL g/Teflon® lid, no headspace	50 g	4C +/- 2C	14 d
SVOAs and PCBs	500-mL g/Teflon® lid	300 g	4C +/- 2C	14 d
Metals	250-mL, p or g	100 g	4C +/- 2C	180 d
Radionuclides	2 - L wide mouth, p or g		4C +/- 2C	180 d
TCLP	1-L wide mouth, g	300 g	4C +/- 2C	14 d
pH		10 g	4C +/- 2C	0.25 h
Corrosivity		10 g	4C +/- 2C	NA
Paint filter	2L, p or g	250 g	4C +/- 2C	NA
Ignitability		100 g	4C +/- 2C	NA
TPH		100 g	4C +/- 2C	28 d
Cyanide and sulfide reactivity	125 mL, g/Teflon® no headspace	40 g	4C +/- 2C	7 d
TOX	125 mL, g/Teflon®, no headspace	25 g	4C +/- 2C	28 d
Percent moisture		100 g	4C +/- 2C	28 d
Ash content	1 L, p or g	10 g	4C +/- 2C	NA
Bulk density		100 g	4C +/- 2C	NA
		Water samples		
Rapid TAT U (TIMS)	125 mL, p	125 mL	HNO_3 to pH <2	180 d
VOCs	2 40-mL g/Teflon® lined septum, no headspace	5 mL	pH <2, HCl	14 d
Metals	1 L, p	500 mL	pH <2, HNO_3	6 months
Anions	250 mL, p or g	25 mL	4C +/- 2C	48 h
Alkalinity	250 mL, p or g	25 mL	4C +/- 2C	14 d

3.5 DECONTAMINATION OF EQUIPMENT AND DEVICES

Decontamination of sample containers and sampling devices will follow that prescribed in the Standard Operating Procedure for Decontamination (Field Activities Manual). Sampling equipment will be decontaminated before use and between sampling locations and intervals. Each decontamination activity will be recorded in the field logbook.

3.6 SAMPLE IDENTIFICATION AND TRACEABILITY

Each environmental sample collected during this project will be assigned a unique sample identifier, which will be permanently affixed to the sample container and recorded in the field logbook and chain-of-custody record. The identifiers used for samples will be established and maintained in accordance with ER/K-I1600 (ESP-501). Identification systems will assure traceability of samples to the appropriate source. Refer to SAP.

3.7 FIELD VARIANCE SYSTEM

Procedures cannot fully encompass all conditions encountered during a field investigation. Variances from the operating procedures, SAP, and/or H&S plan will, therefore, likely occur and must be documented on a field change order (FCO) form or a nonconformance report and be noted in the appropriate logbooks. The approach to controlling and documenting field changes will follow ER/C-P1719. If a variance is anticipated (e.g., because of a change in field instrumentation), the applicable procedure should be modified and the change noted in the field logbooks.

As appropriate, regulatory agencies will be notified of any variances that significantly affect project scope or objectives, and approval from the agencies will be obtained as necessary. Any variances from the health and safety plan must be approved by the ER H&S Officer. Copies of the FCO form will be maintained by the FOM or designee until the field work is complete and will then be forwarded to the SAIC Project Manager for inclusion in the project file. The Energy Systems Project Manager must also review and approve these forms.

4. SAMPLE CUSTODY

Chain-of-custody procedures require documentation of sample possession from the time of collection to time of disposal. These procedures allow the possession and handling of samples from the time of collection through analysis and final disposal to be traced. Chain of custody shall be maintained in accordance with ER/K-I1600, *Chain of Custody* (Field SAP Procedures Manual).

Samples will be accompanied by an original completed chain-of-custody record (Fig. 1). As the samples are transferred, the present custodian and the new custodian will complete the required sections of the record as well as noting any discrepancies. This chain-of-custody record will be initiated at the time of sample collection and remain with the sample from the field, while being transported to the laboratory, and into the laboratory. The laboratory will retain a copy of the record, and a copy will be sent to SAIC data management personnel and Energy Systems SMO. Original COCs will be reported with their associated analytical data deliverables.

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CHAIN-OF-CUSTODY RECORD

Nº S00928

PROJECT NAME:	#	GC/MS					GC						INORGANICS				OTHER									SAMPLING/INFO		REMARKS
PROJECT NUMBER:	No. of Bottles/Vials:	624-8240	625-8270	CLP-VOA	CLP-SVOA	Other:	601-8010	602-8020	608-8080	8140	CLP Pest/PCBs	Herbicides	Other:	Metals	Cyanide	CLP Metals	Other:	TOC	TOX	Oil & Grease	Pet. Hydro.	Phenols	Neutron Activation					MATRIX: Water/Soil/Sediment		
SAMPLERS (SIGNATURE)																											DATE	TIME	
PRINTED NAME																													
CLIENT ID (9 CHARACTERS)																													
1 2 3 4 5 6 7 8 9																													
RELINQUISHED BY:	Date/Time	RELINQUISHED BY:	Date/Time	RELINQUISHED BY:	Date/Time	SHIPPING INFORMATION
COMPANY NAME:		COMPANY NAME:		COMPANY NAME:		Number of Shipping Containers:
RECEIVED BY:	Date/Time	RECEIVED BY:	Date/Time	RECEIVED BY:	Date/Time	Method of Shipment
COMPANY NAME:		COMPANY NAME:		COMPANY NAME:		
RELINQUISHED BY:	Date/Time	RELINQUISHED BY:	Date/Time	RELINQUISHED BY:	Date/Time	Special Handling Requirements
COMPANY NAME:		COMPANY NAME:		COMPANY NAME:		

Fig. 1. Sample chain-of-custody.

Sample shipments will be examined immediately upon receipt by the laboratory, to determine damage, loss, or inconsistencies. A sample receiving report will be completed by the laboratory indicating sample condition, cooler temperature, documentation consistency, and any problems discovered. If samples are damaged or the shipment has been otherwise compromised, the laboratory will notify the SMO by telephone immediately. Samples will be logged into the laboratory and maintained at appropriate temperatures throughout the analytical process. After appropriate information and required signatures have been added to the chain-of-custody and sample receiving report, the laboratory will return signed copies to the SMO contact within two days. The laboratory shall include a copy of the sample receiving report and documentation of the analytical log-in (project sample number; lab sample number; analysis scheduled, etc.) in this sample receiving report.

After sample receipt and throughout analysis, the laboratory will maintain custody of all samples, aliquots, resultant extracts, and digestions. Tracking and internal chain-of-custody will be recorded by the laboratory, however, this documentation will not be required as part of the analytical deliverable. Internal COC information will be verified during on-site audits by the OR SMO.

5. CALIBRATION PROCEDURES AND FREQUENCY

All M&TE will be calibrated against certified equipment and/or standards having known valid traceability to nationally recognized standards. M&TE shall be calibrated, adjusted, and maintained at prescribed intervals or before use. If no nationally recognized standards exist, the basis for calibration will be documented.

5.1 FIELD INSTRUMENT CALIBRATION PROCEDURES AND FREQUENCY

Field instrumentation will be calibrated according to the procedures specified in the manufacturer's operating manual or more frequently should the conditions dictate it for the particular instrument. Table 8 lists all M&TE to be used, detection limits, and a schedule for calibration. Instrument logbooks or notebooks will be established and maintained by the cognizant field team members, the FOM, or the H&S Officer, as appropriate.

All instruments will be maintained within factory calibration, in accordance with applicable manufacturers' recommendations and specifications described in the manufacturers' operation manuals. Daily calibration will be recorded on the Daily Instrument Calibration Check Sheet, located in the field logbook in a section dedicated to calibration and vital information about the instruments.

5.2 LABORATORY INSTRUMENT CALIBRATION PROCEDURES AND FREQUENCY

All analytical instrumentation will be calibrated against certified equipment and/or standards having known valid traceability to nationally recognized standards. Instrumentation shall be calibrated, adjusted, and maintained at prescribed intervals or before use. If no nationally recognized standards exist, the basis for calibration will be documented.

Laboratory equipment will be calibrated according to the procedures specified in the analytical methods and in the operating manual for the particular instrument. Calibration frequency will be based on the analytical methods employed, type of equipment, inherent stability, manufacturer's recommendations, values given in national standards, intended use, and experience.

For volumetric laboratory measurements, Class A volumetric glassware shall be used to prepare calibration standards, bench standards, samples for analysis, etc. Class A glassware may be purchased with known accuracy per federal and ASTM specifications. For gravimetric measurements, calibration of analytical balances must be performed by trained and qualified instrument technicians using weights traceable to National Institute of Standards and Technology (NIST) specifications.

It should be noted that other nonanalytical instrumentation (such as thermometers) must be properly maintained and calibrated. The temperatures of ovens and refrigerators used in sample handling shall be recorded and the control limits shall be defined. When these limits are not met, corrective action will be required.

Table 8. Field instrument uses, detection limits, and calibration

Instrument	Uses	Detection limits	Calibration	Comments
Total organic vapor meters	Sample screening for VOCs	PID - 0.2 ppm benzene or	1 point - PID benzene daily	Action level must be stated in health and safety plan
	Health and safety screening	FID - 1.0 ppm methane	1 point - FID methane daily	Instrument cannot differentiate naturally occurring compounds from contaminants
			Verification check every 20 samples	PID cannot detect compounds with ionization potentials > 11 eV
Radiological monitoring	Monitoring of beta-gamma surface, gross gamma, alpha surface contamination levels	Daily calibration check varies by equipment	Daily source check per manufacturer	Validation labels include minimum and maximum acceptable levels
pH meters	Field screening of waters	N/A	2 point with standards at pH 7.0 and 4.0 or pH 7.0 and 10.0 daily	Accuracy is to ± 0.5 pH units
Temperature (in-line)	Determining water temperature	N/A	To manufacturer instructions	
Conductivity meter	Determining conductivity of water	N/A	1 point in KCL solution	Calculations and acceptance criteria must be available in the field

PID = photoionization detector
FID = flame ionization detector
N/A = not applicable

5.3 CALIBRATION FAILURES

Scheduled periodic calibration of equipment will not relieve personnel of the responsibility of employing properly functioning equipment. If an individual suspects an equipment malfunction, he/she should remove the device from service, initiate a nonconformance report, tag it so it is not inadvertently used, and notify project management. If equipment is found to be out of calibration, the appropriate project management personnel shall evaluate and document (in the instrument logbook) the validity of previous inspection or test results and the acceptability of similar equipment previously inspected or tested. The FOM or laboratory management shall ensure the devices that are out of calibration are (1) tagged or segregated from other equipment and (2) disposed of or not used until they are calibrated. Any equipment that is consistently found to be out of calibration shall be repaired or replaced. Any such action should be recorded in the instrument logbook or notebook.

All standards used for equipment calibration will be traceable to the EPA, National Institute of Standards and Technology, or a commercially available certified standard. The source of the standard used must be documented in a calibration logbook.

5.4 CALIBRATION RECORDS

Calibration data will be recorded in the instrument logbook or notebook. The information shall include the date, operator, signature, and standard that was used. Records will be prepared and maintained for each piece of calibrated equipment to indicate that established calibration procedures have been followed. Records shall be kept that demonstrate traceability of all calibration standards used in full or daily calibrations to the certified source. The appropriate project management personnel will ensure that records of calibration data are kept current. Records for field equipment used will be maintained by the FOM and the project H&S Officer and kept in the project files. Records for laboratory equipment used will be maintained by the laboratory and will be kept with the equipment if practicable. Otherwise, they will be maintained by the laboratory QA personnel.

An appropriate unique instrument identification number or name must be assigned to each individual piece of analytical equipment and the due date of the next calibration will be attached to the equipment or documented in its equipment log. If this identification is not possible, records traceable to the equipment will be readily available for reference.

All standards used for equipment calibration will be traceable to the EPA, NIST, or a commercially available certified standard. The source of the standard used must be documented in a calibration logbook.

6. ANALYTICAL PROCEDURES

6.1 FIELD ANALYTICAL METHODS

Screening of organic vapors and alpha and beta/gamma radiation may be conducted at the sample location or field sample handling area for health and safety purposes as well as screening-level investigation data. Organic vapor screening will follow SAIC FTP-750. Screening for alpha and beta/gamma radiation will follow FTP-451. Water quality parameters (specific conductance, pH,

temperature, and Eh) will be measured in the field during sampling and will follow the IMP FSP Manual.

6.2 LABORATORY ANALYTICAL METHODS

Organic, inorganic, and radiochemical analytical methods prescribed in this section for use in the project have been taken from EPA SW-846 Method Guidance 3rd Edition, other EPA procedures, and DOE manuals. The approved methods and protocols that are to be employed by the analytical laboratory are provided in

- *Test Methods for Evaluating Solid Wastes,* EPA SW-846, 3rd Ed.;
- *Methods for Chemical Analysis of Waters and Wastes Manual,* EPA-600-4-79-020;
- *Prescribed Procedures for Measurement of Radioactivity in Drinking Water,* EPA-600/4-80-032;
- *Eastern Environmental Radiation Facility Radiochemistry Procedure Manual;*
- *EPA CLP SOWs for Organics and Inorganics;*
- *Inductively coupled plasma (ICP)/AAS Method for Trace Elements Analysis of Water and Wastes,* 40 *CFR* 136, Appendix C;
- *Methods for Determination of Organic Compounds in Finished Drinking Water and Raw Source Water,* EPA, 40 *CFR* 141.30;
- *Methods for Chemical Analysis for Municipal and Industrial Wastewater,* EPA, 40 *CFR* 136, Appendix A;
- *APHA, Standard Methods for the Analysis of Water and Wastewater;*
- *Environmental Measurement Laboratory Procedures Manual,* HASL-300; and
- *Annual Book of American Society for Testing and Materials Standards.*

The method detection limit is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the value is greater than zero. The method detection limit actually achieved in a given analysis varies depending on instrument sensitivity and interferences. Contracts will be established with analytical laboratories to analyze environmental samples collected during this project. Each contract laboratory that analyzes samples will provide quantification limits for each constituent analyzed. Specific analytical methods, parameters, and quantitation level goals are presented in Tables 4 and 5.

In the event that analyte concentrations or sample matrices hinder analyses, the methods may be adapted to compensate for documented interferences. Specifically, sample analysis could be altered by

- adjustment of the sample size prepared for analysis;
- adjustment of instrument injection volumes;
- dilution or concentration of sample aliquots; or
- elimination of concentration steps prescribed.

All such adaptations of analytical procedures must be documented through FCOs or NCRs, and be clearly discussed in all associated laboratory case narratives.

7. DATA REDUCTION, VERIFICATION/VALIDATION, AND REPORTING

The data reduction will follow guidelines of CLP organic and inorganic protocols and EPA SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, 3rd Edition. Generally, results must be expressed to two significant figures. Results of aqueous samples must be expressed in milligrams per liter, micrograms per liter, or picoCuries per liter. Results of solid samples will be expressed in micrograms per gram, milligrams per kilogram, or picoCuries per gram based on the sample's dry weight. Appropriate units will be employed for all parameters where these do not apply.

Data reduction, verification/validation, and reporting will be in accordance with the *ER Division Quality Program Plan,* ES/ER/TM-4/R4 (Energy Systems 1994) and the *Analytical Master Specifications,* (OR SMO). Data will be entered into common standardized formats. In addition to following field and laboratory documentation and QA/QC procedures, data may be verified using a variety of computerized checks for reasonableness. These procedures will ensure that data are entered, encoded, manipulated in a consistent way, and available in a usable format.

7.1 FIELD DATA REDUCTION AND EVALUATION

Data collected during field activities will be evaluated by checking the procedures used and comparing the data to previous measurements in accordance with ER/K-I1604 *Field Data Validation.* The SAIC QA/QC Officer, or designee and appropriate field personnel, will be responsible for checking field QC sample results to ensure that field measurement and sampling protocols have been observed. These reviews will check date and time sampled, preservation, standard operating procedures, calibration method and frequency, and chain-of-custody documentation.

Reviewers are responsible for ensuring that data reduction calculations are documented and checked by qualified personnel. Written reports including reduced and summarized data may include the raw data in appendixes. Specific calculations used for data reduction may also be included.

7.2 ANALYTICAL LABORATORY DATA REDUCTION AND EVALUATION

In general, the analyst will process the data, either manually or by inputting the data into a computer. For manually processed data, all the steps in the computation must be provided, including

equations used and the source of input parameters such as response factors, dilution factors, and calibration constants. If calculations are not performed directly on the data sheet or chromatogram, the calculations must be provided on company letterhead paper and attached to the data sheets. All pages of the calculations must be signed and dated by the analyst performing the calculations.

For data input by an analyst and processed using a computer, a copy of the input must be kept and uniquely identified with the project number and other pertinent information as necessary. The samples to which the data processing refers must be clearly stated, and the input must be signed and dated by the analyst performing the input. When processing data acquired from instrumentation, the analyst must verify that the correct project, sample numbers, calibration constants, response factors, units, and numerical values used for detection limits are present.

Upon completion of required chemical analyses, the samples will be maintained at a temperature of 4°C (± 2°C) for at least 2 weeks after expiration of the appropriate holding time for those analytes that require maintenance at 4°C.

7.2.1 Laboratory Data Review

Laboratory review is responsible for ensuring that data reduction and calculations follow correct procedures, are documented, and are checked by qualified personnel. All information, including reduced and summarized data will be retained with the raw data. Specific calculations used for data reduction will also be included. The laboratory is responsible for maintaining comprehensive documentation for all data produced.

Once processed, data will be reviewed by the laboratory prior to delivery of the analytical data package for the following:

- appropriateness of equations employed;
- correctness of numerical input (both hard-copy and electronic);
- numerical correctness of all calculations;
- correct interpretation of all chromatograms, spectra, digital output, etc.;
- comparability and correctness of initial and continuing calibration results;
- evaluation of all laboratory control standards (LCS);
- evaluation of all method blank results;
- evaluation of all surrogate, internal standard, or tracer results;
- traceability of samples from receipt to data reporting by internal custody and tracking procedures; and
- evaluation of data deliverable completeness and legibility.

7.2.2 Data Reporting and Deliverables

The laboratory will be responsible for hard-copy deliverables as defined by OR SMO and identified in Table 9. These deliverables are considered a standard data deliverable or a "Forms-only Deliverable". Electronic data deliverables (EDD) will be submitted for each sample grouping and be consistent with the hard-copy provided. EDD formats will be arranged during laboratory procurement to provide information which can be utilized by the project data base to produce an OREIS data deliverable.

7.2.3 Contract Verification

Laboratory contract verification is performed to ensure completeness and consistency with the project deliverable requirements and the SMO Analytical Master Specifications. The SMO will review all laboratory deliverables, hard copy and electronic, and contact the laboratory to resolve issues when contractual requirements are not met. A report detailing the results of contract verification will be forwarded by the SMO to the project for each related data package. The guidelines for contract verification are defined in ORO SOM procedure LMES-ASO-AP-206.

7.3 DATA VALIDATION APPROACH

Data validation will be consistent with the specifications as outlined in Energy Systems Data Verification and Validation Procedures, 1996 (ERWM/ER-P2209, ERWM/ER-P2210, ERWM/ER-P2211, ERWM/ER-P2212, and ERWM/ER-P2213) and be implemented through SAIC Data Validation Procedure TP-DM-300-7. All project data will be evaluated to ensure a complete, consistent, and usable project data set.

Data validation will be performed to ensure that the precision and accuracy of the analytical data are adequate for their intended use. Because the greatest uncertainty in a measurement is often a result of the sampling process and inherent variability in the environmental media rather than the analytical measurement, validation will be performed only to the level necessary to minimize the potential of using false positive or false negative concentrations in the decision-making process (i.e., to assure accurate identification of detected vs nondetected compounds). This approach is consistent with the DQOs for the project.

Table 9. Summary of Analytical Hard-copy Data Deliverables

Method requirements	Deliverables
Requirements for all methods	
Holding time information and methods requested	Signed chain-of-custody forms
Discussion of laboratory analysis, including any laboratory problems	Case narratives
Organics: GC/MS analysis	
Sample results, including TICs	CLP Form 1 or equivalent
Surrogate recoveries	CLP Form 2 or equivalent
Matrix spike/spike duplicate data	CLP Form 3 or equivalent
Method blank data	CLP Form 4 or equivalent
GC/MS tune	CLP Form 5 or equivalent
GC/MS initial calibration data	CLP Form 6 or equivalent
GC/MS continuing calibration data	CLP Form 7 or equivalent
GC/MS internal standard area data	CLP Form 8 or equivalent
Organics: GC analysis	
Sample results	CLP Form 1 or equivalent
Surrogate recoveries	CLP Form 2 or equivalent
Matrix spike/spike duplicate data	CLP Form 3 or equivalent
Method blank data	CLP Form 4 or equivalent
Initial calibration data	CLP Form 6 or equivalent
If calibration factors are used	A form listing each analyte, the concentration of each standard, the relative calibration factor, the mean calibration factor, and %RSD
Calibration curve if used	Calibration curve and correlation coefficient
Continuing calibration data	CLP Form 9 or equivalent
Positive identification (second column confirmation)	CLP Form 10 or equivalent
Metals	
Sample results	CLP Form 1 or equivalent
Initial and continuing calibration	CLP Form 2 or equivalent, dates of analyses and calibration curve, and the correlation coefficient factor
Method blank	CLP Form 3 or equivalent and dates of analyses
ICP interference check sample	CLP Form 4 or equivalent and dates of analyses
Spike sample recovery	CLP Form 5A or equivalent
Postdigestion spike sample recovery for ICP metals	CLP Form 5B or equivalent
Postdigestion spike for GFAA	CLP Form 5B or equivalent
Duplicates	CLP Form 6 or equivalent
LCS	CLP Form 7 or equivalent that includes acceptable range or window
Standard additions (when implemented)	CLP Form 8 or equivalent
Holding times	CLP Form 13 or equivalent
Run log	CLP Form 14 or equivalent

Table 9 (continued)

Method requirements	Deliverables
Wet chemistry	
Sample results	Report result
Matrix spike recovery	%Recovery
Matrix spike duplicate or duplicate	%Recovery and %RPD
Method blank	Report results
Initial calibration	Calibration curve and correlation coefficient
Continuing calibration check	Recovery and % difference
LCS	LCS result and control criteria
Run log	Copy of run log
Radiochemical analysis	
Sample results	Report results
Initial calibration	%Difference from calibration
Efficiency check	Efficiency determination
Background determinations	Report results
Spike recover results	Spike added and %Recovery
Internal standard results (tracers or carriers)	Standard added and %Recovery
Duplicate results	Report results and %RPD
Self-absorption factor (α,β)	Report factors
Cross-talk factor (α,β)	Report factors and control criteria
LCS	LCS results and control criteria
Run log	Copy of run log

CLP – contract laboratory program
GC – gas chromatography
GFAA – graphite furnace atomic absorption
ICP – inductively coupled plasma
LCS – laboratory control sample
MS – mass spectrometry
RPD – relative percent difference
RSD – relative standard deviation
TIC – tentatively identified compound

7.3.1 Data Validation Rationale

The data validation criteria listed below have been determined as critical in the evaluation of analytical data usability. These are a subset of the Energy Systems data validation procedures that, based on analytical process knowledge, contribute significantly to the qualification and associated uncertainty of the reported results. Evaluation of this subset will allow identification of potential false positive or negative results. Because these criteria are associated with random rather than systematic error, they require evaluation throughout the analytical measurement process. They cannot be comprehensively determined by reviewing only a portion of the data. Consistent with the data quality requirements as defined in the DQOs and based on the above rationale, all project data and associated QC must be evaluated on these criteria and qualified as per the outcome of the review. The criteria by which the data will be evaluated are discussed in Sect. 2.7.3.2.

Data validation criteria are as follows:

Organics	Inorganics	Radiochemistry
Holding Times	Holding Times	Holding Times
Blanks	Blanks	Blanks
Surrogate Recovery	Laboratory Control Sample	Laboratory Control Sample
Internal Standards	Furnace Atomic Absorption QC	Sample Specific Chemical or Tracer Recovery
Calibration	Calibration	Calibration
Sample Reanalysis		
Secondary Dilutions		
Case Narrative	Case Narrative	Case Narrative

7.3.2 Data Validation Criteria

Holding Times. Evaluation of holding times ascertains the validity of results based on the length of time from sample collection to sample preparation or sample analysis. Verification of sample preservation must be confirmed and accounted for in the evaluation of sample holding times. The evaluation of holding times is essential to establishing sample integrity and representativeness. Concerns regarding physical, chemical, or biochemical alteration of analyte concentrations can be eliminated or qualified through this evaluation.

Blanks. The assessment of blank analyses is performed to determine the existence and magnitude of contamination problems. The criteria for evaluation of blanks applies to any blank associated with the samples, including field, trip, equipment, and method blanks. Contamination during sampling or analysis, if not discovered, results in false positive data.

Surrogate Recovery. System monitoring compounds are added to every sample, blank, matrix spike (MS), matrix spike duplicate (MSD), and standard. They are used to evaluate extraction, cleanup, and analytical efficiency by measuring recovery on a sample-specific basis. Poor system performance as indicated by low surrogate recoveries is one of the most common reasons for data qualification. Evaluation of surrogate recovery is critical to the provision of reliable sample-specific analytical results.

Calibration. The purpose of initial and continuing calibration verification analyses is to verify the linear dynamic range and stability of instrument response. Relative instrument response is used to quantify the analyte results. If the relative response factor is outside acceptable limits, the data quantification is uncertain and requires appropriate qualification.

Internal Standards. Internal standards are utilized to evaluate and compensate for sample-specific influences on the analyte quantification. They are evaluated to determine whether data require qualification due to excessive variation in acceptable internal standard quantitative or qualitative performance measures. For example, a decrease or increase in internal standard area counts for organics may reflect a change in sensitivity that can be attributed to the sample matrix. Because quantitative determination of analytes is based on the use of internal standards, evaluation is critical to the provision of reliable analytical results.

Sample Reanalysis. When instrument performance-monitoring standards indicate an out-of-control analysis, the laboratory is required to re-analyze the sample. If the re-analysis does not solve the problem (i.e., surrogate compound recoveries are outside the limits for both analyses), the laboratory is required to submit data from both analyses. An independent review is required to determine which is the appropriate sample result.

Secondary Dilutions. When the concentration of any analyte in any sample exceeds the initial calibration range, a new aliquot of that sample must be diluted and reanalyzed. The laboratory is required to report data from both analyses. When this occurs, an independent review of the data is required to determine the appropriate results to be used for that sample. An evaluation of each analyte exceeding the calibration range must be made, including a review of the dilution analysis performed. Results chosen in this situation may be a combination of both the original results (i.e., analytes within initial calibration range) and the secondary dilution results.

Laboratory Control Samples. The LCS serves as a monitor of the overall performance of the analytical process, including sample preparation, for a given set of samples. Evaluation of this standard provides confidence in or allows qualification of results based on a measurement of process control during each sample analysis.

Furnace Atomic Absorption QC. Duplicate injections and furnace post-digestion spikes are evaluated to establish precision and accuracy of individual analytical determinations. Because of the nature of the furnace atomic absorption technique and because of the detailed decision tree and analysis scheme required for quantitation of the elements, evaluation of the QC is critical to assuring reliable analytical results.

Sample Specific Chemical or Tracer Recovery. Laboratory performance on individual samples subject to chemical process and separation is established by means of spiking with tracer quantities of other radioisotopes of the same element or carrier quantities of an inactive isotope of the same or a chemically similar element. This process is analogous to surrogate or internal standard recovery, dependent on the analyte and method being evaluated, and is a common reason for data qualification.

7.4 PROJECT DATA QUALITY ASSESSMENT

Data quality indicator parameters, PARCC, will be used to evaluate data quality and quantity. Both qualitative and quantitative criteria are used as indicators of the quality of the data. In determining data usability, especially in the decision-making process, the integrity and authenticity of the data must be evaluated and the analytical uncertainty must be determined. Parameters used to assess data quality for this investigation are precision, accuracy, representativeness, comparability, completeness, and sensitivity. These parameters will be evaluated as directed by project management.

8. QC CHECKS

8.1 FIELD QC CHECKS

QC samples will be collected at a frequency as identified in this QAPjP to assess the quality of sampling. Field QC samples include blanks, rinsates, and duplicates.

8.1.1 Trip Blanks

A trip blank is a sample bottle filled with analyte-free reagent water, which accompanies VOC samples during shipment to the laboratory. They are used to detect contamination by VOCs during the time the samples are handled and shipped. The number of trip blanks will equal the number of coolers containing VOC samples, delivered to the laboratory. Trip blanks will be analyzed for VOCs only.

8.1.2 Field Blanks

Field blanks are samples of the field source waters, used in the decontamination and cleaning of sampling equipment. Primary decontamination water and final decontamination rinse waters are both considered field source waters. Field blanks will consist of one ASTM final rinsate water per ASTM Lot # used, plus a minimum of two samples form the potable water source employed during decontamination processes. This will tentatively produce no more than four to six field blanks for this project.

8.1.3 Equipment Rinsates

An equipment rinsate is a sample of the last rinse using ASTM water that has been pumped into or poured through the sampling equipment. These equipment rinsates will be collected at a rate of approximately 5% of the samples collected. The purpose of these rinsates is to check for residual contamination as a measure of the effectiveness of decontamination. The equipment associated with the unique sample identifier should be identified in the field logbook. Equipment rinsates are analyzed for the same analytes as samples collected.

8.1.4 Field Duplicates

Field duplicates will be collected concurrently with primary samples. Duplicates will be sent to the laboratory responsible for analyses. Field duplicates will be collected at a frequency of 10%

of the samples collected (i.e., 1 to 10 samples collected equals 1 field duplicate; 11 to 20 samples collected equals 2 field duplicates).

8.2 LABORATORY QC PROCEDURES

A number of laboratory QC samples will be analyzed to check and monitor laboratory performance, precision, and accuracy. Laboratory QC is necessary to assess potential impacts of interferences and contaminants during the analytical process.

8.2.1 Laboratory Duplicates

Laboratory duplicates are separate aliquots of a single sample that are prepared and analyzed concurrently at the laboratory. This duplicate sample should not be a method blank, trip blank, or field blank. The primary purpose of the laboratory duplicate is to check the precision of the laboratory analyst, the sample preparation methodology, and the analytical methodology. If there are significant differences between the duplicates, the affected analytical results will be re-examined. One in 20 samples will be laboratory duplicates, with fractions rounded to the next whole number.

8.2.2 Method Blanks

A method blank is a sample made up of a pure, noncontaminated substance of the matrix of interest (usually distilled/deionized water or silica sand) that is then subjected to all of the sample preparation (digestion, distillation, extraction) and analytical methodology applied to the samples. The purpose of the method blank is to check for contamination from within the laboratory that might be introduced during sample preparation and analysis that would adversely affect analytical results. A method blank must be analyzed with each analytical sample batch.

8.2.3 LCSs

The LCS contains known concentrations of analytes representative of the contaminants to be determined, or are added to laboratory analyte-free water and carried through the entire preparation and analysis process. Commercially available LCSs or those from EPA may be used. LCS standards that are prepared in-house must be made from a source independent of that of the calibration standards. For methods using surrogates, the method blank may be used as the LCS. Each LCS analyte must be plotted on a control chart. The primary purpose of the LCS is to establish and monitor the laboratory's analytical process control. An LCS must be analyzed with each analytical sample batch.

8.2.4 MSs and MSDs

An MS is an aliquot of a sample spiked with known quantities of analytes and subjected to the entire analytical procedure. It is used to indicate the appropriateness of the method for the matrix by measuring recovery or accuracy. Accuracy is the nearness of a result or the mean of a set of results to the true or accepted value. An MSD is a second aliquot of the same sample as the MS with known quantities of compounds added. The purpose of the MSD, when compared to the MS, is to determine method precision. Precision is the measure of the reproducibility of a set of replicate results among themselves or the agreement among repeat observations made under the same conditions. MSs and MSDs are performed per 20 samples of similar matrix.

8.2.5 Method-Specific QC

The laboratory must follow specific quality processes as defined by the method. These will include measures such as: calibration verification samples; instrument blank analysis; surrogate determinations; internal standards; tracer analysis; etc.

9. AUDITS AND SURVEILLANCES

9.1 AUDITS

Audits are performed to review and evaluate the adequacy of field and laboratory performance and to ascertain whether the QAPjP is being completely and uniformly implemented. There are no scheduled audits for the project at this time. Audits may be implemented at the direction of Energy Systems or the DOE. These audits shall be conducted in accordance with written procedures and checklists and shall be performed by personnel who do not have direct responsibility for performing the activities being audited. Energy Systems audits will be conducted in accordance with ESS-QA-18.0 and ESS-QA-18.1. Any SAIC audit will be conducted in accordance with SAIC QAAP 18.1. The project QA/QC Officer is responsible for audits and may perform them as directed by project management.

Laboratory audits are performed annually by the OR SMO to review and evaluate the adequacy of laboratory practices, procedures, and systems. These planned and scheduled audits are performed to verify compliance with all aspects of the Energy Systems QA program and to determine the program's effectiveness. These audits shall be conducted in accordance with written procedures and checklists and shall be performed by trained technical personnel . Energy Systems audits will be conducted in accordance with ESS-QA-18.0 and ESS-QA-18.1 and in conjunction with DOE OR Operations.

In the event SAIC personnel participate in these systematic audits during the project time frame or SAIC is task through the project to implement a laboratory performance audit, the SAIC audit will be conducted in accordance with SAIC QAAP 18.1 and focus on project specific performance issues.

9.2 SURVEILLANCES

Surveillance activities include monitoring and observing documents and work activities to provide an effective real-time means of evaluating the adequacy and effectiveness of methods for achieving quality, health and safety, and for assessing the quality of final results. Energy Systems surveillances will follow ER/C-P1600 *Performance of Surveillance Activities*, as applicable. SAIC surveillances will follow SAIC QAAP 18.3.

One field surveillance is planned during the initiation of direct push borehole activities and a second will be conducted at the beginning of test pit sampling operations. This field surveillance will be conducted as early in the sampling event as practical for the project. A field surveillance is also required for a major change in personnel or change in method of sampling.

Laboratory activities are not scheduled for project surveillances at this time. In the event issues arise during the course of the investigation which indicate a surveillance is warranted, such tasks will be conducted in accordance with Energy Systems ER/C-P1600 *Performance of Surveillance Activities* and SAIC procedure QAAP 18.3.

10. PREVENTIVE MAINTENANCE PROCEDURES/SCHEDULES

Any equipment (an inclusive term for tools, gauges, instruments, and other items that have specific preventive maintenance) will be serviced and documented as specified by the manufacturer's recommended schedule. All service will be performed by qualified and trained individuals. The operators are responsible for seeing that the equipment is scheduled for service, serviced, and properly maintained. Properly maintained equipment helps reduce unnecessary "downtime." A complete list of equipment will be developed by the operator and the parts or replacement equipment will be immediately available (either from the supplier/manufacturer or on site). Having replacement equipment or critical spare parts available minimizes "downtime."

The implementation of a preventive maintenance program depends on the specific instruments and equipment used for the field. Both field and laboratory efforts will ensure a preventive maintenance program that includes

- a listing of the instruments and equipment in the program, including backup alternatives;
- the frequency of maintenance considering manufacturer's recommendations and/or previous experience with equipment;
- external service contracts;
- checklists of items to be serviced and directions for maintenance or manufacturer's instrument manuals; and
- records of periodic and routine maintenance performed.

11. SPECIFIC ROUTINE PROCEDURES

The analytical data assessment objectives for laboratory analysis will produce data of known and sufficient quality to support the investigation and its resulting decisions. Appropriate procedures and QC checks will be employed to assess the level of acceptance of these parameters. All QC data will be reported for the project along with the sample results. When the analytical sample set is completed, QC data will be reviewed and evaluated to validate the information. Acceptance criteria and evaluation of laboratory analytical results for the PARCC parameters will be determined according to the following outline.

Procedures to attain sensitivity objectives include (1) measurement of analyte levels in field and laboratory blanks; (2) uniform training and certification for staff; (3) standard provisions for

inspection, maintenance, and repair; (4) provision of standard operating procedures to technical staff; (5) reference to standard operating procedures in the Field and Laboratory QAPjPs; and (6) field/laboratory QA inspections to determine compliance with the items specified in the support plans.

11.1 PRECISION

Precision is defined as the reproducibility or degree of agreement among duplicate measurements under a given set of conditions. The closer the measurements approach each other, the more precise the measurement. The level of precision is determined by calculating the RPD between the two measurements, using the following formula:

$$RPD = \frac{[S-D]}{(S+D)/2} \; x \; 100\%$$

where

S = analyte concentration of the original sample,
D = analyte concentration of the duplicate sample.

Precision is determined relative to field duplicate pairs, laboratory duplicate pairs, and laboratory MS/MSD analyses. In the event analytical precision goals are exceeded, a determination will be made through the data validation process relative to the usability of that information.

11.2 ACCURACY

Accuracy is defined as the degree of difference between measured values and the true values. Sampling accuracy will be maximized by adhering to the QA program presented in the QAPjP. Accuracy will be assessed by splitting a sample into two portions, spiking (i.e., adding known quantity of the constituents of interest to one of the portions), and then analyzing both portions for these parameters. The difference in the concentration levels of the constituents of interest should be equal to the quantity of the spike added to one of the two portions. The following equation will be used to calculate percent recovery (%R):

$$\%R = \frac{A_r - A_0}{A_f} \; x \; 100\%$$

where

A_r = total compound or element concentration detected in the spiked sample,
A_o = concentration of the compound or element detected in the unspiked sample,
A_f = concentration of the compound or element added to the sample.

For situations in which a standard reference material (SRM) is used rather than or in addition to MSs, the following formula is used:

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

where

C_m = measured concentration of SRM,
C_{srm} = actual concentration of SRM.

11.3 REPRESENTATIVENESS

Representativeness expresses the relative degree to which the data depict the characteristics of a population, parameter, sampling point, process condition, or environmental condition. The objective of this study is to accurately represent the chemical concentrations of target analytes.

Representative samples for this investigation will be acquired through implementation of approved sampling and analytical procedures that will generate data representative of the sampling point location. Sampling procedures are designed to minimally impact the sample obtained, so that conditions representative of the sampling location will be maintained. Analytical methods will be selected that most accurately represent the true concentration of the parameter of interest. The accumulation of QC procedures and information (i.e., RPD values, blank QC concentrations, MS percent recoveries, etc.) employed for a given analysis combine to exhibit the representativeness of the data generated.

The goal for representative sample data will therefore be met through the proper documentation of field and analytical protocols. If these procedures and methods cannot be implemented, the appropriate corrective action documentation will encompass the impact on the representativeness of the information. Review of the data, documentation, and field information will also be implemented to identify sample population, parameter, or process characteristics relative to representativeness.

11.4 COMPLETENESS

Completeness is defined as the percentage of valid data obtained from a measurement system. For data to be considered valid, it must have met all acceptance criteria, including accuracy and precision, as well as any other criteria specified by the analytical methods used. Percent completeness (%C) is calculated as follows:

$$\%C = \frac{V}{n} \; x \; 100\%$$

where

V = the actual number of valid measurements obtained,
n = the number of sample points planned.

To meet the objectives of this project, all data will be validated against the data validation guidance (Sect. 2.7.3) to determine its usability. For determination of completeness in this project, all data not flagged as rejected by the validation process will be considered valid. When review of the data and documentation determines the data to be incomplete, the impact relative to the project objectives will be assessed and documented.

11.5 COMPARABILITY

Comparability expresses the confidence with which one data set can be compared with another. Comparability of the data generated in this investigation will be obtained through the implementation of the identified protocols for sampling and analysis of samples. Use of traceable reference materials as laboratory standards, expression of results in standard concentration units, and successful participation by the laboratories in external performance evaluation programs will enable the data produced through this investigation to be compared with future groundwater sampling data sets.

12. CORRECTIVE ACTION

Energy Systems corrective actions to audit/surveillance findings and nonconformance will be managed in accordance with ESS-QA-16.0, 16.1, 16.2, 16.3, 16.4, and ESS-QA-15.0 and 15.1. SAIC corrective actions to audit/surveillance findings and nonconformances will be managed in accordance with SAIC QAAP 15.1 and 16.1. The Energy Systems Project Manager will be notified when a nonconformance is documented and furnished a copy as soon as possible. Copies of nonconformances and their dispositions will be forwarded to the Energy Systems Project Manager for placement in the EM Records Center. Nonconformance reports issued as a result of an audit or surveillance will identify the root cause of the problem.

13. QA REPORTS TO MANAGEMENT

All QA records concerning the project (e.g., internal and external correspondence, sampling and analysis plan, QAPjP, field logbooks and forms, chain-of-custody forms, data packages, audit reports, surveillance reports, nonconformance reports, corrective action reports, etc.) will be submitted to the SAIC Central Records Facility for dual storage and retrieval. Records concerning the project will be forwarded to the Energy Systems Project Manager upon request for placement in the EM Records Center during the project. A complete copy of the project file will be submitted to the Energy Systems Project Manager at the end of the period of performance.

APPENDIX C

HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN APPROVAL

Michael A. Cox — 3/11/98

Michael A. Cox, LMES — Date

Stephen L Davis — 3/11/98

Steve Davis, SAIC, H&S Officer — Date

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1. INTRODUCTION

This section sets forth the basic procedures required to protect the personnel involved in the field work associated with this project. It is tiered under SAIC's corporate Environmental Compliance and Health and Safety (EC&HS) Program. This plan will be available on site during all field work. During fieldwork, the SHSO will carefully consider the potential hazards and will prepare an amendment or FCO to this plan if the hazards will not be controlled by the existing procedures. Each amendment or field change order will be reviewed and approved by the SAIC Health and Safety Manager.

The field tasks will take place at and around the Y-12 Boneyard/Burnyard (BYBY). The BYBY is located at the west end of the Y-12 Plant and is ~ 1200 by 700 ft in size. This location is known to have received radioactively contaminated material, reactive material, and chemical wastes, including PCBs. Additional site information is contained elsewhere in this document.

This plan has been written to address the following tasks:

- initial site walkover,
- subsurface soil sampling using direct push equipment at 40 locations,
- groundwater sampling from direct push holes,
- surface water sampling from NT3 and Bear Creek,
- test pit sampling into the disposal area, and
- equipment decontamination.

The field work will be performed in Level D PPE unless one of several action levels specified in the plan are exceeded or the potential for increased risk becomes apparent during the investigation. Protective procedures, including protective clothing, will be upgraded as necessary by the SHSO based on established action levels or judgment.

2. KEY PERSONNEL

2.1 EMEF PROJECT MANAGER

The EMEF Project Manager is responsible for managing the project (see Table 1 for key personnel). This includes:

- maintaining project costs and schedule;
- coordinating efforts with various plant organizations;
- providing budget forecasts and resource commitments;

- coordinating the support personnel required for field activities and ensuring that these personnel have received appropriate training;
- notifying the Shift Superintendent of plans and scheduled activities for the site;
- defining sampling and analysis parameters for investigation;
- ensuring adherence to the HSP throughout the field investigation;
- ensuring that all permits such as the penetration/excavation, safety work, radiation work, etc. have been generated and approved;
- ensuring development/approval of an RI work plan and an HSP before initiation of field activities; and
- ensuring that the appropriate safety documentation [i.e., Safety Reviews (SR) or Safety Assessment (SA)] is prepared for this project.

Table 1. Key project personnel and affiliations

Responsibility	Name	Telephone
EMEF Project Manager	John Vanderlan	576-2745
Y-12 Plant Shift Superintendent	[a]	911 from plant phone; 574-7172 from cellular phone
SAIC Project Manager	Duncan Moss	481-4752
SAIC Field Operations Manager	Greg Schank	481-8760
SAIC Health and Safety Manager	Steve Davis	481-4755
SAIC Site Health and Safety Officer	Greg Schank	481-8760

[a] No individual has been designated because this office operates 24 h a day with rotating superintendents.

2.2 SAIC PROJECT MANAGER

The SAIC Project Manager is responsible for overall project execution. The responsibilities of the Project Manager include:

- coordinating with EMEF personnel, including project manager and field coordinator manager;
- ensuring implementation of the work plan and HSP;
- maintaining auditable project documentation of all required records;
- ensuring that a qualified SHSO is designated; and
- maintaining a current copy of the HSP.

2.3 SAIC FIELD OPERATIONS MANAGER

The Field Operations Manager will oversee the field activities associated with this project and will be responsible for site accessibility, safety, and QA and will delegate further responsibilities to other members of the sampling team. He/she is responsible for implementing and enforcing the field requirements of this HSP. Specific responsibilities of the Field Operations Manager are listed below:

- implementing the work plan and HSP;
- ensuring that all personnel on site follow the requirements of the HSP;
- coordinating on-site operations, including logistics;
- interfacing with plant and project personnel;
- participating in on-site characterization activities;
- maintaining auditable project documentation of all required records;
- maintaining a current copy of the HSP; and
- minimizing the number of personnel and the amount of equipment in the exclusion zone, but only to the extent consistent with safe site operations.

2.4 SAIC HEALTH AND SAFETY MANAGER

The responsibilities of the Health and Safety Officer include:

- coordinating with Energy Systems Health and Safety personnel;
- reviewing and approving project health and safety documents; and
- approving downgrades in PPE or protective procedures.

2.5 SITE HEALTH AND SAFETY OFFICER

The SHSO is responsible for making health and safety decisions and for specific health and safety activities. The SHSO has primary responsibility for the following:

- verifying compliance with this HSP, RWPs, and other H&S requirements, and reporting to the Field Operations Manager, Project Manager, and/or SAIC Health and Safety Manager, any deviations from anticipated conditions;
- stopping work or upgrading protective measures (including protective clothing) if uncontrolled health and safety problems are encountered. The SHSO must also authorize resumption of work following correction of the adverse condition(s);
- ensuring that site personnel have access to this plan and are aware of its provisions;

- conducting a site-specific pre-entry health and safety briefing and appropriate follow-on briefings covering potential chemical, physical, and radiological hazards, safe work practices, and emergency procedures;

- maintaining on-site auditable documentation of
  - Material Safety Data Sheets (MSDSs) for applicable materials utilized at the site;
  - training for site workers;
  - calibration of field instruments such as photoionization detectors, combustible gas indicators, etc.;
  - site visitors;
  - exclusion zone entrants;
  - exposure monitoring; and
  - medical surveillance for subcontractor employees;

- confirming that all on-site personnel have received the training listed in the Training Requirements section;

- issuing site access badges to approved site workers and routine visitors;

- issuing respirators, as necessary, and ensuring that all respirator users have been properly trained and fitted for respiratory protection. Note that this requires training to comply with 29 *CFR* 1910.134 and ANSI Z88.2;

- verifying that the emergency points of contact are correct;

- ensuring that all monitoring equipment is operating according to the manufacturer's specifications and performing field checks of instrument calibration;

- ensuring monitoring for potential on-site exposures is conducted in accordance with Chap. 6;

- verifying that all permits, such as the penetration/excavation, safety work, radiation work, etc., have been generated and that signed copies are available on site, prior to commencing intrusive field work;

- ensuring that all chemicals are in appropriate, properly labeled containers;

- ensuring that a qualified substitute is on site when the SHSO is absent during hazardous waste operations and activities;

- verifying currency of exposure limits prescribed in this HSP;

- assessing investigation-derived data, such as groundwater sample analyses, to verify appropriateness of hazard control measures;

- maintaining, or ensuring the maintenance of, a log listing entrants to the exclusion zone;

- maintaining, or ensuring the maintenance of, a log listing site visitors;

- conducting "tailgate" safety briefings;

- controlling visitor access to the exclusion zone; and
- documenting field changes to the HSP;
- ensuring that all personnel and equipment leaving radiologically contaminated portions of the site are monitored to preclude the spread of contamination;
- ensuring that personal radiation dosimeters are worn by all site personnel; and
- ensuring that radiological exposures are maintained "As Low as Reasonably Achievable."

2.6 FIELD PROJECT PERSONNEL

Project personnel involved in on-site investigations and operations are responsible for:

- performing only those tasks that they believe they can do safely;
- notifying the SHSO of any medical conditions (e.g., allergies, diabetes, pregnancy) that require special consideration;
- abiding by a buddy system so that each on-site worker is responsible for keeping track of his or her partner in the event of an incident;
- reporting to the Radiological Control technician for frisking or monitoring themselves for radioactive contamination prior to entering the Support Zone from the Contamination Reduction (Control) zone;
- wearing personnel monitoring devices where required by Radiological Work Permits, signs, procedures, this HSP, or by radiological control personnel. Reporting immediately the loss, damage, or unexpected exposure of personnel monitoring devices or off-scale readings of self-reading dosimeters to the Radiological Control Department; and
- keeping track of their radiation exposure status, notifying radiological control personnel of off-site occupational radiation exposures, and avoiding exceeding radiological Administrative Control Levels.

3. HAZARD ASSESSMENT

Site tasks present a variety of physical hazards as well as the potential for exposure to chemical and radiological contamination. This section of the plan presents hazard assessments for the anticipated tasks.

3.1 SUSPECTED CONTAMINANTS

Discussions of the suspected contaminants and their characteristics are provided in this document. If additional contaminants that pose a new or significantly greater hazard are identified prior to, or during, site activities, they will be provided as an addendum to this document. A listing

of the more hazardous contaminants identified to date has been provided in Table 2. Hazardous chemicals used in site activities also appear in the table. Contaminants listed are based on data from previous investigations and site history.

3.2 TASK-SPECIFIC HAZARD ASSESSMENTS

Each of the planned project tasks is discussed briefly below. The discussion includes potential hazards as well as the planned hazard controls measures. For additional information, see the following Hazard Analysis table.

An initial site walkover survey will be conducted to verify site conditions and confirm accessibility of sampling locations. The hazards associated with this task are relatively minimal. Radiological contamination is a possibility and the requirements of applicable radiological work permits will be followed.

Direct push equipment (drill rig) will be used to collect subsurface soil and water samples at ~40 locations. Physical hazards associated with the equipment will be controlled by excluding unauthorized personnel, careful operation, hearing protection, and weekly drill rig inspections. Chemical exposure hazards will be controlled by PPE, washing face and hands prior to eating or drinking, exposure monitoring, and medical surveillance. Exposure to radiological contamination is also a possibility and will be controlled through adherence to Y-12 radiological work permits. Exposure controls are expected to include at least anti-c gloves, access control, personnel dosimetry, and radiological surveys prior to exiting controlled areas.

Surface water samples will be collected from NT3 and Bear Creek. Hazards associated with this activity are expected to be minimal. There is some potential for exposure to radiological contaminants and this will be controlled through adherence to relevant radiological work permits.

Test pits will be dug into the disposal area using a backhoe. The excavated soil will be sampled at regular intervals. The pits will be ~ 15 ft deep and no wider and longer than necessary to allow the planned sampling (~ 1 ft. wide by 4 ft. long). Physical hazards associated with the equipment will be controlled by excluding unauthorized personnel and by excavating carefully. Physical hazards associated with the excavation itself will be controlled by minimizing the size of the excavation and excluding personnel from the excavation. Disposal data indicate that the site received radiologically contaminated material, reactive material, and waste oils. The data further indicate that the reactive materials were exposed to the air, burned, or otherwise reacted. It is possible that reactive material is still present. In order to control this potential hazard, no intact containers will knowingly be brought to the surface or opened. The SHSO or Field Manager will be present continuously during excavation and will observe the operation for signs of reactions, liquid chemicals, or other indicators of imminent hazard. If a reaction or free liquid chemicals are observed, the excavation will be stopped and the immediate area evacuated while the project manager and H&S manager are contacted for consultation. The PSS will also be contacted immediately if any indication of reaction is observed. Excavation will not be resumed until adequate hazard controls are instituted. Chemical exposure hazards will be controlled by PPE, washing face and hands prior to eating or drinking, exposure monitoring, and medical surveillance. Exposure to radiological contamination is also a possibility and will be controlled through adherence to Y-12 radiological work permits. Exposure controls are expected to include at least anti-c gloves, access control, personnel dosimetry, and radiological surveys prior to exiting controlled areas.

Table 2. Potential chemical/radiological exposures

Chemical[a]	TLV/PEL/Activity or DAC/STEL/IDLH[b]	Health effects/potential hazard[c]	Chemical and physical properties[c]	Exposure route(s)[c]
Acetone	TLV/TWA: 750 ppm STEL: 1000 ppm	Dermatitis, respiratory irritant	Clear liquid, FP: 1.4°F; IP: 9.69 eV	Inhalation Ingestion Contact
Cadmium	TLV: 0.01 mg/m^3 PEL: 005 mg/m^3	Chemical pneumonia, headache, vomiting, cancer	Metal; VP: 0MM; FP: NA	Inhalation Ingestion
Carbon tetrachloride	PEL: 10 ppm TLV: 5 ppm, A2 IDLH: Ca (200 ppm)	Carcinogen, CNS depression, nausea, skin irritation, liver, kidney damage	Colorless liquid with ether-like odor; FP: NA; IP: 11.47 eV	Inhalation Ingestion Absorption Contact
Copper	TLV: 1 mg/m^3 PEL: 1 mg/m^3	Eye, nose and lung irritation; liver and kidney damage	Metal; VP: 0MM; FP: NA	Inhalation Ingestion Contact
1,1-Dichloroethane	PEL: 100 ppm TLV: 100 ppm, A4 IDLH: 3000 ppm	CNS depression, skin irritant, liver, kidney damage	Colorless oily liquid with a chloroform-like odor; FP: 2°F; IP: 11.06 eV	Inhalation Ingestion Contact
Gasoline (used for fuel)	TLV: 300 ppm, A3 IDLH: Ca (N.D.)	Dizziness, eye irritation, dermatitis	Liquid with aromatic odor, FP: -45°F	Inhalation Absorption Ingestion Contact
Hydrochloric acid (used to preserve some water samples)	TLV: C5 ppm IDLH: 50 ppm	Irritation, tissue damage	Liquid with pungent odor, FP: NA, IP: 12.74 eV	Inhalation Ingestion Contact
Isopropyl alcohol (used for equipment decontamination)	TLV/TWA: 400 ppm STEL: 500 ppm	CNS depression, eye and skin irritant	Colorless liquid; VP: 33 mm; IP: 10.10 eV; FP: 53°F	Inhalation Ingestion Contact

Table 2 (continued)

Chemical[a]	TLV/PEL/Activity or DAC/STEL/IDLH[b]	Health effects/potential hazard[c]	Chemical and physical properties[c]	Exposure route(s)[c]
Lead	PEL: 0.050 mg/m^3 TLV: 0.05 mg/m^3, A3 IDLH: 100 mg/m^3	Weakness, insomnia, malnutrition	Heavy soft metal	Inhalation Ingestion Contact
Liquinox (used for decontamination)	TLV/TWA: NA	Contact may cause local irritation to mucus membranes	Odorless, nonflammable, aqueous liquid	Ingestion
Mercury	TLV: 0.025 mg/m^3 PEL: C0.01 mg/m^3	Irritation of eyes and throat, headache, weakness, tremors	Heavy silver liquid, VP: 0.0012 mm; FP: NA	Inhalation Absorbtion Ingestion Contact
Nitric acid (used to preserve some water samples)	TLV: 2 ppm STEL: 4 ppm IDLH: 25 ppm	Irritation of eyes, skin, mucous membranes	Liquid with pungent odor; FP: NA; IP: 11.95 eV	Inhalation Ingestion Contact
Tetrachloroethene	TLV: 25 ppm, A3 STEL: 100 ppm, A3 IDLH: Ca (150 ppm)	Potential human carcinogen, irritation, dizziness, liver damage	Colorless liquid with chloroform odor, FP: NA, IP: 9.32 eV	Inhalation Absorption Ingestion Contact
1,1,1-Trichloroethane (methyl chloroform)	TLV: 350 ppm, A4 STEL: 450 ppm, A4 IDLH: 700 ppm	CNS depression, eye, skin irritant; headaches, drowsiness, impaired judgment	Colorless liquid, mild chloroform-like odor; IP: 11.00 eV; FP: 0°F	Inhalation Ingestion Contact
Trichloroethene	TLV: 50 ppm, A5 STEL: 100 ppm, A5 IDLH: Ca (1000 ppm)	Carcinogen, headaches, vertigo, visual disturbance, tremors, irritant, dermatitis	Colorless liquid, mild chloroform-like odor, LEL: 8%, UEL: 10.5%, IP: 9.45 eV; FP: 90°F	Inhalation Absorption Ingestion Contact
Technetium-99	3 × 10^{-7} μCi/mL	Carcinogenic, mutagenic, teratogenic	Variable, depends on compounds	Inhalation Ingestion Absorption Injection

Table 2 (continued)

Chemical[a]	TLV/PEL/Activity or DAC/STEL/IDLH[b]	Health effects/potential hazard[c]	Chemical and physical properties[c]	Exposure route(s)[c]
Uranium-234	2×10^{-11} μCi/mL	Carcinogenic, mutagenic, teratogenic, renal injury	Variable, depends on compounds	Inhalation Ingestion Absorption Injection
Uranium-235	2×10^{-11} μCi/mL	Carcinogenic, mutagenic, teratogenic, renal injury	Variable, depends on compounds	Inhalation Ingestion Absorption Injection
Uranium-238	2×10^{-11} μCi/mL	Carcinogenic, mutagenic, teratogenic, renal injury	Variable, depends on compounds	Inhalation Ingestion Absorption Injection

[a] The potential chemicals were obtained from one or more of the following sources: disposal records, groundwater data, soil data, surface water data, and storm drain data.
[b] From 1997 Threshold Limit Values, NIOSH Pocket Guide to Chemical Hazards, and ICRP 30.
[c] From NIOSH Pocket Guide to Chemical Hazards.

CNS = central nervous system
CVS = central vascular system
DAC = derived air concentration
FP = flashpoint
GI = gastrointestinal tract
IDLH = immediately dangerous to life and health
IP = ionization potential
LEL = lower explosive limit
NA = not available
PEL = permissible exposure limit
SOL = solubility
STEL = short-term exposure limit
TLV = threshold limit value
TWA = time-weighted average
UEL = upper explosive limit
VP = vapor pressure

Sampling equipment will be decontaminated as needed to preclude cross contamination of samples or clean areas. This task poses a minimal potential for chemical and radiological contaminant exposure which will controlled by PPE and washing face and hands prior to taking anything by mouth.

Table 3 is a detailed job hazard analysis of the hazards and control measures for the currently planned tasks. The table presents the significant hazards, hazard-specific controls, any required monitoring, and the probability of harm presented by each hazard for each major project task. The probability column provides a subjective assessment of the risk of harm posed by the uncontrolled hazard. Probability codes are very low, low, moderate, and high.

3.3 GENERAL HAZARD CONTROLS

This section presents those general safety rules that apply to the entire project. The provisions of this section are mandatory for all on-site employees and visitors. This includes employees engaged in initial site reconnaissance, preliminary field investigations, mobilization, project operations, and demobilization.

- Daily "tailgate" meetings will be held during field activities to inform personnel of new hazards or procedures.

- Contact with potentially contaminated substances will be avoided. Site personnel in the exclusion zone will avoid walking through puddles, pools, mud, kneeling on the ground, and leaning or sitting on equipment or the ground. Site personnel will not place monitoring equipment on a potentially contaminated surface.

- Spills will be prevented to the extent possible. In the event that a spill occurs, the material will be contained.

- Splashing of contaminated materials will be prevented or minimized.

- Field crew members must be familiar with the physical characteristics of investigations, including:
  - wind direction in relation to the individual's location;
  - accessibility to associates, equipment, and vehicles;
  - communications;
  - the exclusion zone and any areas of known or suspected contamination;
  - site access; and
  - the nearest drinking water sources.

- All injuries will be reported, no matter how minor.

- All field workers will abide by a buddy system. Members of a buddy team will maintain verbal or visual contact while in an exclusion zone.

- Each person will make his/her presence known to the Field Operations Manager daily, and changes in personnel will be noted. A list of workers on the job site will be maintained in the field logbook for accountability.

Table 3. Hazards analysis

Safety and health hazards	Controls	Monitoring	Probability
	Direct push subsurface soil and water sampling		
General hazards (moving machinery, suspended loads, moving equipment, slips, falls, hot work)	PPE (level D) minimum for task is: hard hat (as appropriate), safety glasses, safety boots, field work clothes, hearing protection HAZWOPER training, exclusion zone around rig, buddy system	Site inspection by SHSO or FOM Weekly drill rig inspection	Low
Noise	Hearing protection within 25 ft of rig	If sound level measurement indicates distances other than 25 ft, the requirement may be altered	High for drill rig operations
Fire/explosion	Fuels stored in closed safety cans Fire extinguisher(s) rated at least 5B and D No ignition sources within 75 feet of flammables storage area	Site inspection by SHSO or FOM CGI monitoring	Low
Exposure to chemicals (see Table 10.2)	PPE (level D) plus nitrile or similar gloves when handling potentially contaminated materials Minimize contact Chemical inventory and MSDSs on site Medical clearance for HAZWOPER work 15 minute emergency eyewash within 100' when corrosive sample preservatives are being poured	PID or equivalent and other sampling as appropriate	Moderate
Temperature extremes	If ambient temperature >77°F, routine breaks, chilled liquids readily available If ambient temperature <30°F, dry clothing available, warm break area available (see temperature extremes)	Temperature monitoring, heart rate monitoring as appropriate	Varies by season
Electric shock	Identification and clearance of overhead and underground utilities (see general hazard controls) penetration permit, ground drill rig	Visual of all work areas	Low

Table 3 (continued)

Safety and health hazards	Controls	Monitoring	Probability
Radiation	Rad Worker 2 training Compliance with RWPs PPE as required for area Decontamination (as required) Minimize contact	Survey for radioactivity, dosimetry	High
	Surface water sampling from NT3 and Bear Creek (scoop or other water sampler operation, auger operation, sample processing)		
General sampling hazards (slips, falls)	PPE (level D) minimum for task is: hard hat (as appropriate), safety glasses, safety boots, field work clothes HAZWOPER training, buddy system	Site inspection by SHSO or FOM	Low
Exposure to chemicals (see Table 10.2)	PPE (level D) nitrile gloves for handling potentially contaminated materials Minimal contact Medical clearance for HAZWOPER work Chemical inventory and MSDSs on site 15 minute eyewash nearby when pouring corrosives/preservatives	None	Very low
Animal hazards (bees, wasps, snakes)	PPE (boots, work clothes) Insect repellant as needed	Visual survey	Low
Temperature extremes	If ambient temp. >77°F, routine breaks, chilled liquids readily available If ambient temp. <30°F, dry clothing available, warm break area available (see temperature extremes section)	Temperature monitoring, heart rate monitoring as appropriate	Varies by season
Radiation	Compliance with RWPs Decontamination (as appropriate) PPE as appropriate for area	Survey for radioactivity, dosimetry	Low

Table 3 (continued)

Safety and health hazards	Controls	Monitoring	Probability
	Nonintrusive tasks (visual survey)		
General survey hazards (slips, falls)	PPE (level D) minimum for task is: hard hat (as appropriate), safety glasses, safety boots, field work clothes HAZWOPER training, buddy system		
Exposure to chemicals (see Table 10.2)	PPE (level D) nitrile gloves for handling potentially contaminated materials Administrative controls Medical clearance for HAZWOPER work	Site inspection by SHSO or FOM	Very low
Animal hazards (bees, wasps, snakes)	PPE (boots, work clothes) Insect repellant as needed	Visual survey	Low
Temperature extremes	If ambient temperature >77°F, routine breaks, chilled liquids readily available If ambient temperature <30°, dry clothing available, warm break area available (see temperature extremes section)	Temperature monitoring, heart rate monitoring as appropriate	Varies by season
Radiation	Compliance with RWPs Decontamination (as appropriate) PPE as appropriate for area	Survey for radioactivity, dosimetry	Low
	Equipment decontamination (hot water washing, soap and water washing, isopropanol washing)		
General equipment decontamination hazards (slips, falls, equipment handling)	PPE (level D) minimum for task is: hard hat (as appropriate), safety glasses, nitrile or PVC gloves, safety boots, field work clothes, face shield (when operating spray washer)		
Noise (spray washer)	Hearing protection	Site inspection by SHSO or FOM	Low to moderate
Release of contaminants to the environment during cleaning	Containment system dependent on contaminant levels		Low

Table 3 (continued)

Safety and health hazards	Controls	Monitoring	Probability
Fire/explosion (isopropyl alcohol)	Open quantities limited to single day's use Firefighting equipment suitable to hazards Use in ventilated area	None	Low
Exposure to chemicals (see Table 10.2)	PPE (nitrile gloves for handling potentially contaminated materials Medical clearance for HAZWOPER work	None	Very low
Animal hazards (bees, wasps, snakes)	PPE (boots, work clothes) Insect repellant as needed	Visual survey	Very low
Temperature extremes	If ambient temperature >77°F, routine breaks, chilled liquids readily available If ambient temperature <30°F, dry clothing available, warm break area available (see temperature extremes section)	Temperature monitoring, heart rate monitoring as appropriate	Varies by season
	Waste management (waste collection, waste packaging, waste labeling)		
General waste management hazards (slips, falls, abrasions, heavy lifting)	PPE (level D) minimum for task is: hard hat (as appropriate), safety glasses, safety boots, field work clothes, sturdy gloves		
Fire/explosion	Exclude ignition sources from flammables storage areas Firefighting equipment suitable to hazards Outside storage of flammable wastes	Site inspection by SHSO or FOM	Low
Exposure to chemicals (see Table 10.2)	PPE (level D) Nitrile or similar gloves to handle potentially contaminated material Administrative controls	None	Low
Temperature extremes	If ambient temperature >77°F, routine breaks, chilled liquids readily available If ambient temperature <30°F, dry clothing available, warm break area available (see temperature extremes section)	Heart rate monitoring as appropriate, WBGT measurements as appropriate	Varies by season

Table 3 (continued)

Safety and health hazards	Controls	Monitoring	Probability
Drum/container handling	PPE: gloves, safety boots, teamwork for heavy lifts	Visual for physical hazards	Moderate
Radiation	Establish work area boundaries PPE as required for area Decontamination (as appropriate)	Survey for radioactivity, dosimetry, and air sampling	Low
	Test pit sampling into the disposal area		
General hazards (moving machinery, suspended loads, moving equipment, slips, falls)	PPE (level D) minimum for task is: hard hat (as appropriate), safety glasses, safety boots, field work clothes, HAZWOPER training, exclusion zone around backhoe, buddy system, no personnel in excavation Excavation kept as small as possible	Site inspection by SHSO or FOM	Moderate
Noise	None	None	Low
Fire/explosion	Fuels stored in closed safety cans No opening of intact containers Do not bring intact containers to surface SHSO or FOM present continuously during excavation Fire extinguisher(s) rated for 10 lb capacity and approved for fuels and flammable metals Evacuation and appropriate notifications if reactions are observed	CGI	Low
Exposure to chemicals; see Table 10.2)	PPE (level D) plus nitrile or similar gloves when handling potentially contaminated material Upgrade to level D^+ if extensive contact appears likely Medical clearance for HAZWOPER work	HNu or equivalent and other sampling as appropriate Visual for airborne dust	Moderate

Table 3 (continued)

Safety and health hazards	Controls	Monitoring	Probability
Temperature extremes	If ambient temperature >77°F, routine breaks, chilled liquids readily available If ambient temperature <30°F, dry clothing available, warm break area available (see temperature extremes section)	Temperature monitoring, heart rate monitoring as appropriate	Varies by season
Electric shock	Identification and clearance of overhead and underground utilities, penetration permit (see general hazard controls)	Visual of all work areas	High
Radiation	Rad Worker 2 training Compliance with RWPs PPE as required for area Decontamination (as required) Minimize contact	Survey for radioactivity, dosimetry	High

FOM = Field Operations Manager.
HAZWOPER = Hazardous Waste Operations.
PFD = personal flotation device.
PVC = Polyvinyl chloride.
RWP = Radiolgoical Work Plan.
WBGT = Wet bulb globe temperature.

- Copies of MSDSs for all hazardous chemicals (chemicals brought on site) will be maintained in the work area. MSDSs will be available to all employees for review during each work shift.

- All containers received on site will be inspected to ensure the following:
  — clear labeling as to the contents;
  — the appropriate hazard warning; and
  — the name and address of the manufacturer.

- All secondary containers will be labeled with either an extra copy of the original manufacturer's label or with generic labels that have a block for identity and the hazard warning.

3.3.1 Animal Hazards

Field conditions may present a variety of animal hazards such as bees, ticks, poisonous snakes, etc. Employees will avoid heavy cover. If heavy cover cannot be avoided, employees may wear snake protective leggings during warmer months. Insect repellant may be applied to the lower body to prevent tick attachment. Employees will not handle or otherwise disturb wildlife.

3.3.2 Illumination

Outside operations will commence no earlier than 15 min after sunrise and conclude no later than 15 min prior to sunset. Since most activities will be conducted during daylight hours, field illumination measurements will normally not be required. However, if activities require outside work to be done at night, a minimum of 5 ft-c will be required. Office areas will be illuminated at 10 ft-c or more.

3.3.3 Ergonomics

Potential hazards related to the interaction of personnel with their working environment may be present at this site. The primary ergonomic hazards that may exist may be lifting heavy loads, equipment vibrations, body positioning, and physical obstacles associated with traversing ditches and brush. Personnel should always position themselves properly and lift from the legs when attempting to lift equipment. Personnel should rely on their buddy to assist in lifting loads that are too heavy for one person to properly lift and carry. Back strain, the most common ergonomic hazard in the field, may be easily avoided, provided the on-site workers always ask for assistance when they need it.

A certain degree of vibration may be encountered by drilling personnel when operating the drill rig. If any ergonomic symptoms are encountered in the field, the SHSO must be notified immediately.

3.3.4 Electrical Hazards

Utilities

Prior to placing the sampling equipment at a borehole location, the Field Operations Manager or his designee will verify that the sampling equipment will not be placed where any part of the drill rig mast enters within a minimal radial distance of 10 ft from electrical transmission lines or as

specified in Table 4. Excavation/penetration permits will also be obtained prior to sampling to assure that sampling locations are selected to avoid subsurface hazards.

Drilling Operations

All drilling equipment must be in good condition and must pass a safety inspection. Prior to the start of site work, the drilling subcontractor will inspect all drilling equipment in the presence of the Field Operations Manager. The inspection will be documented in the field records. If field operations last longer than 1 week, the drilling equipment inspection must be repeated on a weekly basis.

The location of all underground utilities must be ascertained and confirmed prior to the start of subsurface drilling operations. Excavation/penetration permits will be in the possession of the Field Operations Manager (or his designee) prior to commencement of the intrusive investigation at that point of the site.

Table 4. Safe working distances from electrical transmission lines for equipment

Normal voltage, phase-to-phase (kV)	Minimum required clearance (ft)
When operating near high-voltage power lines	
0 to 50	10
51 to 200	17
201 to 350	22
351 to 500	27
501 to 750	35
751 to 1000	44
While in transit with mast, boom, shovel, etc., lowered and secured	
All voltages	10

Source: 20 *CFR* 1910.180j(1).

General Drilling Practices

- Drill rigs will be equipped with functional kill switches.
- Drill-mounted fire fighting equipment will not be tampered with and will not be removed for other than the intended fire-fighting purposes or for servicing.
- If lubrication fittings are not accessible with guards in place, machinery will be stopped and disabled (locked out) for oiling and greasing.
- The area around the derrick ladder will be kept clear to provide unimpeded access to the ladder.
- Work areas and walkways will not be obstructed.

Hoisting Operations

- The derrick must not be raised unless the area is free of overhead obstructions and far enough from power lines.
- The derrick must not be raised until the rig has been blocked, leveled, and chocked.
- Rigging equipment for material handling will be checked prior to use on each shift and as often as necessary to ensure it is safe. Defective rigging will be removed from service.
- Workers will never stand near the well bore whenever any wire line device is being run.
- Hoisting control stations will be kept clean and controls labeled as to their functions.

Cat Line Operations

- Only experienced workers will be allowed to operate the cat head controls. The kill switch must be clearly labeled and operational prior to operation of the cat line.
- The cat head area must be kept free of obstructions and entanglements.
- Personnel will not stand near, step over, or go under a cable or cat line which is under tension.

4. TRAINING

4.1 GENERAL TRAINING REQUIREMENTS

Personnel who perform field work as part of this project are subject to the following training requirements. This section contains Table 5 which presents the requirements in condensed format and a brief discussion of each training course. Documentation of the required training will be maintained in the on-site project files.

The following paragraphs present brief summaries of the training requirements. These summaries include a course description and guidance on who must take each course.

General Employee Training is required for all employees and any site visitor who visits to perform work for more than 10 working days per year. This training addresses general site features and hazards, alarm signals, and evacuation.

Radiation Worker training (Rad Worker II) is required for unescorted entry into radiological contamination areas. This training is designed to enable attendees to work safely within a radiological control zone.

The SARA/OSHA 40-h Hazardous Waste Site Worker course is required for hands-on workers in the exclusion (contamination) or contamination reduction (buffer) zone, and anyone who will spend extended periods in the exclusion (contamination) or contamination reduction (buffer) zone.

Table 5. Training requirements

Training	Worker	Supervisor	Site visitor (unescorted)	Site visitor (escorted)
General Employee Training	√	√	√	√
Radiation Worker (radiological contamination areas)	√	√	√	×
SARA/OSHA (40 h, 3 day OJT)	√	√	×	×
SARA/OSHA (24 h, 8 h OJT)	×	×	√	×
SARA/OSHA Annual Refresher (8 h)	√	√	√	×
SARA/OSHA Supervisors Training (8 h)	×	√	×	×
General Hazard Communication Training (contained in 40 or 24 h)	√	√	√	×
Respiratory Protection (required only if respirators are worn; contained in 40 h)	√	√	√	√
Respirator Issue (required for respirator issuers)	√	√	√	×
Hearing Conservation (for workers in hearing conservation program)	√	√	√	×
Site Access Briefing	√	√	√	√
Site Specific Hazard Communication	√	√	√	√
Safety Briefing (daily and whenever conditions or tasks change)	√	√	×	×

√ = Required
× = Not required

This course is mandated by the Hazardous Waste Operations and Emergency Response Standard (29 *CFR* 1910.120). It is designed to enable employees to operate safely on an uncontrolled hazardous waste site. Three days of relevant field experience is required in conjunction with this training.

The SARA/OSHA 24-h Hazardous Waste Site course is required for occasional visitors to the exclusion (contamination) or contamination reduction (buffer) zones. This course is mandated by the Hazardous Waste Operations and Emergency Response Standard (29 *CFR* 1910.120). It is designed to enable employees to safely visit a hazardous waste site or work at a RCRA Treatment Storage or Disposal Facility. Eight hours of relevant field experience is required in conjunction with this course.

The SARA/OSHA 8-h Annual Refresher course is required to maintain currency in the 40-h and 24-h courses. It must be repeated annually by anyone who is required to have either of these courses. This course is mandated by the Hazardous Waste Operations and Emergency Response Standard (29 *CFR* 1910.120).

The SARA/OSHA Supervisors training is required for all personnel who directly supervise hands-on workers. This is an 8-h course that must be taken once. No refresher is required. Note that the SARA/OSHA 40-h course is a prerequisite.

General Hazard Communication training is required for all site workers. This training must communicate the risks and protective measures for chemicals that employees may encounter. This requirement is met by taking GET, 40 or 24-h SARA/OSHA, and the appropriate access briefing. This training must be refreshed as needed to maintain currency with the chemical hazards present on the job site.

Waste Generation training is required for personnel who are responsible for the generation and satellite storage of hazardous waste. This training addresses the legal and operational requirements for the proper storage and labeling of hazardous waste.

Respiratory Protection Training is required for all individuals who wear respirators. It includes the basic procedures for proper respirator use. This training must be refreshed on an annual basis. Respirator users must also have medical clearance to wear respirators and must have passed a quantitative respirator fit test with the size and type of respirator to be used.

Respirator Issue training is required for any individual who issues respiratory protective devices. This training includes the information in Respiratory Protection Training as well as the requirements for proper storage, issuance criteria, and use limitations.

Hearing Conservation Training is required on an annual basis by 29 *CFR* 1910.95 for all employees enrolled in a hearing conservation program. This will include all employees exposed to occupational noise in excess of 85 dBA on a time weighted average.

Personnel in the exclusion (contamination) or contamination reduction (buffer) zone must have received the site access briefing. Two versions of this briefing will be used. The site worker version will contain full information on site hazards, hazard controls, and emergency procedures. A shortened version will be used for visitors who will be on site for short times and who will not do hands-on work. This shortened version will contain the hazard information that is directly relevant to the purpose of the visit. Signatures of those attending and the type of briefing must be entered in the field logbook before site access will be granted. Note that casual visitors (package deliverers,

observers, etc.) to the support zone will not be required to have the access briefing. The site worker access briefing will include the following site-specific information:

- names of site health and safety personnel and alternates;
- contents of the HSP;
- hazards and symptoms of contaminant exposure (chemical, radiological);
- hazards and symptoms of chemicals present in the workplace;
- physical hazards in the workplace;
- location and availability of written hazard communication program;
- site and task PPE (including donning, doffing, proper use);
- safe work practices to minimize risks;
- safe use of engineering controls and equipment;
- medical surveillance requirements;
- site control measures;
- personnel decontamination procedures;
- contingency plans (communications, phone numbers, emergency exits, assembly point, etc.);
- spill containment procedures (reporting, clean up methods, etc.); and
- emergency equipment (fire extinguishers, spill kits, etc.).

Site-Specific Hazard Communication training is required for all personnel assigned to the project. This training is included in the site access briefing. It includes the identity of potential chemical exposures, the symptoms of exposure, and appropriate protective measures.

Safety Briefings will be held when conditions or tasks change and at least daily. These briefings will be conducted by the SHSO and/or operations manager and will be attended by all site workers and supervisors. These briefings will address site-specific safety issues and will be used as an opportunity to refresh workers on specific procedures and to address new hazards and controls.

4.2 SITE VISITOR TRAINING

Site visitors who enter the exclusion (contamination) or contamination reduction (buffer) zone on an infrequent basis and have a limited potential for exposure to chemical, physical, radiological hazards are subject to different training requirements than site workers. Visitors who will not be escorted or who will perform some type of hands-on work but will not wear respiratory protection are required to complete General Employee Training, Rad Worker, SARA/OSHA 24-h, SARA/OSHA Annual Refresher (as appropriate), General Hazard Communication training, and the Site Access Briefing.

5. PERSONAL PROTECTIVE EQUIPMENT

PPE for site tasks is based on potential site-specific physical, chemical, and radiological hazards. In cases where multiple hazards are present, a combination of protective equipment will be selected so that adequate protection is provided for each hazard. When a conflict exists with the PPE requirements, the more restrictive shall apply. This section emphasizes the programmatic requirements for PPE. For task-specific equipment see Chap. 3.

5.1 PPE SELECTION

The protective equipment selected for a particular task is based on the following:

- potential for exposure because of work being done;
- route of exposure;
- measured or anticipated concentration in the medium of concern;
- toxicity, reactivity, or other measure of adverse effect; and
- physical hazards such as falling objects, flying projectiles, etc.

In situations where the type of contaminant, concentration, and probability of contact are not known, the appropriate level of protection must be selected based on professional experience and judgment until the hazards are further evaluated.

The SHSO may raise or lower the level of PPE worn by the teams, depending upon the site-specific hazards encountered in the field. Prior to lowering the level of PPE, the EMEF Health and Safety Manager and the SAIC Health and Safety Manager will be contacted for approval. If site conditions are such that the level of PPE is insufficient or work must be stopped, the SHSO will take appropriate action immediately and the appropriate personnel (see above) will be contacted afterwards. Whenever a conflict exists with the PPE requirements, the more restrictive will apply. Criteria indicating a possible need for reassessment of the PPE selection include the following:

- commencement of an unplanned (hazard not previously assessed) work phase,
- working in unplanned temperature extremes,
- encountering new hazards,
- exceeding the action limits of chemical/radiological hazards, or
- changing the work scope so that the degree of contact with contaminants changes.

5.2 LEVELS OF PROTECTION

Levels of protection that may be used to protect against chemical and physical hazards at this site include:

- Level C Protective Equipment
  - — half- or full-face respirator and air purifying cartridges capable of filtering out organic vapors, radionuclides, and other airborne hazards as appropriate;
  - — safety glasses (if half-face respirators used);
  - — hooded chemical-resistant clothing (Polyethylene-coated Tyvek®) with all seams and openings taped;
  - — two pair chemical-resistant gloves (appropriate for chemical and task);
  - — safety boots;
  - — shoe covers;
  - — hard hat (if overhead hazards are present);

- Level D+ Protective Equipment
  - — coated Tyvek® coveralls;
  - — chemical-resistant disposable gloves;
  - — safety boots;
  - — hard hat (if overhead hazards are present);
  - — safety glasses;

- Level D Protective Equipment
  - coveralls/field clothes;
  - safety boots;
  - safety glasses;
  - hard hat (if overhead hazards are present).

The outer protective garment for Levels C and D+ will be made of a chemical-resistant material (coated Tyvek® or equivalent) that forms a protective barrier against the chemical(s) of concern for a period of time at least equal to the period of time the clothing will be worn.

Levels of protection that may be used to protect against radiological hazards include:

- Contamination Area
  Hands-on work: Modesty garment
  - One pair of anti-C coveralls (cloth, Tyvek®, or coated Tyvek®);
  - One pair of booties taped to the anti-C coverall, unless Tyvek® coveralls have attached shoe covers;
  - One pair of anti-C shoe covers;
  - Single anti-C gloves over surgeon's gloves, anti-C gloves taped to coveralls; and
  - Skull Cap.

  Nonhands-on work: Coveralls/field clothes/personal clothing
  - Yellow lab coat;
  - One pair of anti-C shoe covers;
  - Single anti-C gloves; and
  - Skull Cap.

- High Contamination Area
  Hands-on work: Modesty garment
  - Two pair of anti-C coveralls (outer pair with a hood; inner pair taped to one pair of booties, unless Tyvek® coveralls have attached shoe covers);
  - Two pair of anti-C shoe covers over company shoes;
  - Two pair of anti-C gloves over surgeons gloves, inner pair of anti-C gloves taped to coveralls; and
  - Skull Cap.

  Nonhands-on work: Modesty garment
  - One pair of anti-C coveralls;
  - Two pair of anti-C shoe covers over company shoes;
  - Two pair of anti-C gloves; and
  - Skull Cap.

6. TEMPERATURE EXTREMES

Field activities conducted during the summer or winter pose a hazard because of temperature extremes. Physical demands placed upon investigative personnel may be compounded through the

use of protective clothing/equipment, moderate to heavy workloads, ambient air temperatures, relative humidity, and exposure to nonionizing radiation. The guidance contained in the American Conference of Governmental Industrial Hygienists (ACGIH) handbook *1997 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices* (ACGIH 1997) will be used to control these hazards.

Two important factors will help personnel function in hot environments: acclimatization and consumption of fluids. Acclimatization of workers to hot environmental conditions may require up to a week. During this period especially, workers should concentrate on maintaining a balanced diet, consuming plenty of fluids (while outside contaminated areas) throughout the day, and remaining aware of signs of heat-related illness. Headaches, dizziness, high body temperature, and increased heart rate are all early warning signals of heat stress. It is imperative that the SHSO be informed if a worker experiences these signs. All activities that take place at the investigative site require the use of a buddy system, and as field activities continue, all personnel should be apprised of their buddy's condition with respect to heat stress. As a minimum, for work in ambient temperatures greater than 77°F, employees will be provided with ready access to cooled water or electrolyte replacement fluids and will be allowed to take routine breaks in a cool area.

If necessary, in the judgment of the SHSO, a work/rest regimen based on the ACGIH guidelines will be instituted to help in combating heat-related disorders. If a work/rest regimen becomes necessary, physiological monitoring, based on the recommendation in the NIOSH document *Recommendations for an Occupational Standard for Workers Exposed to Hot Environments* (1997), may also be instituted. This monitoring will consist of monitoring employees' pulse rates at the beginning of each break. Work cycles must ensure that the pulse rate during the first .5 to 1 minute of rest is no more than 110 beats per minute.

Critical factors in preventing cold stress disorders are adequate clothing and staying dry. The greatest cold stress hazard posed by this project is the potential for getting wet while water sampling. Cold water conducts body heat more readily than air and can induce hypothermia in a very short time. The SHSO and Field Operations Manager will ensure the capability to quickly move individuals who become wet to a sheltered, warm area.

7. MEDICAL SURVEILLANCE

All employees performing field work as part of this project will be enrolled in a medical surveillance program incorporating annual medical examinations. This medical surveillance will be in compliance with the requirements of 29 *CFR* 1910.120 (Hazardous Waste) and 29 *CFR* 1910.134 (Respiratory Protection). Each employee must have a current medical clearance for hazardous waste work filed on site prior to performing on-site work.

8. EXPOSURE MONITORING AND AIR SAMPLING

Assessment of airborne chemical concentrations, airborne radiological concentrations, and surficial radiological contamination levels will be performed, as appropriate, to ensure that exposures do not exceed acceptable levels. Action levels, with appropriate actions, have been

established for this monitoring. In addition to the specified monitoring, the SHSO may perform, or require, additional monitoring such as organic vapor monitoring in the equipment decontamination area, personnel exposure sampling for specific chemicals, etc. The deployment of monitoring equipment will depend on the activities being conducted and the potential exposures. The minimum monitoring requirements and action levels are presented in Table 6.

Air monitoring for volatile organic compounds will be conducted using a PID or FID. Although not all volatile organic chemicals can be detected in this fashion, many of the site contaminants, such as TCE and acetone, can be detected and will serve as indicators of contamination. The action levels for organic vapor measurements have been set conservatively to compensate for the inability of the instrument to detect some of the site contaminants. Because these action levels are based on the potential to exceed time weighted average exposure limits, their use requires the application of professional judgement on the part of the SHSO. For example, a breathing zone measurement of 5 ppm for 1 to 2 min that does not recur will not be sufficient reason to require the use of respiratory protection. If breathing zone concentrations remain at 2 to 5 ppm, the activity will be stopped or respiratory protection will be used. The SHSO will also initiate attempts to identify the airborne chemical(s). If breathing zone readings decrease to less than the action level, the activity will be resumed or respiratory protection use will be discontinued. The instrument will be calibrated each day it is used.

Air monitoring for combustible gasses will be conducted using a combination combustible gas indicator. This instrument will be calibrated each day it is used.

Monitoring for radiological hazards will be conducted. The following types of routine monitoring will be required for radiological contamination areas.

- All personnel will monitor or be monitored for radioactive contamination prior to entering the support zone from the contamination reduction zone if radiological contamination is known or suspected.

- All personnel entering the site will participate in the Site Dosimetry Program. Thermoluminescent dosimeters shall be worn at all times while on site.

- All personnel participating in hands-on work in radiological contamination areas will participate in the Y-12 24-h Urinalysis Program when directed by the Radiological Control Organization.

- All equipment and samples will be monitored for radiological contamination before being moved into the support zone from the contamination reduction zone if radiological contamination is known or suspected.

Table 6 lists site monitoring action limits. Table 7 contains a summary of contamination values.

9. SITE CONTROL

The SHSO will be responsible for establishing the site control zones, as necessary, around areas that present physical, chemical, and/or radiological hazards.

Table 6. Site monitoring action limits

Hazard or measured parameter	Area	Interval	Limit	Action	Tasks
Beta/Gamma radiation (Beta/Gamma survey)	Area other than posted radiation area	Continuous dosimetry; surveys prior to site work, and at appropriate intervals	2 × ambient background	Notify HP area supervisor, project manager, H&S manager	Applicable to all tasks
	Area other than posted radiation area		>0.5 mrem/h	Stop work; notify HP area supervisor, project manager, H&S manager; do not re-enter without HP authorization	Applicable to all tasks
	Area other than posted radiation area		>5 mrem/h	Post as radiation area or control/reduce source	Applicable to all tasks
	Posted radiation area		>100 mrem/h	Stop work; notify HP area supervisor, project manager, H&S manager; do not re-enter without HP authorization; post as high radiation area	Applicable to all tasks
Personnel radiological contamination	Area other than posted surface radioactivity area	As determined by HP	Detectable above background	Notify HP area supervisor, project manager, H&S manager; monitor all personnel; survey area for surface radioactivity	Applicable to all tasks

Table 6 (continued)

Hazard or measured parameter	Area	Interval	Limit	Action	Tasks
	Area other than posted surface radioactivity area	As determined by HP	Table 10.7 values	Stop all work; notify HP area supervisor, project manager, H&S manager; monitor all personnel; control the area; survey for surface radioactivity; pursue isotope analyses and/or decontamination	Applicable to all tasks
	Posted surface radioactivity area, airborne radioactivity area, or respirator area	Upon exit from contamination reduction zone	Table 10.7 values	Notify HP area supervisor, project manager, H&S manager, project manager, H&S manager	Applicable to tasks in rad control areas
Surface radiological contamination	Area other than posted surface radioactivity area	As determined by HP	Table 10.7 values	Stop work; monitor personnel; notify HP area supervisor, project manager, H&S manager; do not re-enter until authorized by HP	Applicable to all tasks
	—Soil disturbance in or near underground radiological areas	Prior to handling newly exposed soils	>Table 10.7 values	Stop work; monitor personnel; notify HP area supervisor, project manager, H&S manager; do not re-enter until authorized by HP	Applicable to all tasks
	—Portable toilets (LAW, spot alpha and beta gamma)	Weekly	>Table 10.7 values		

Table 6 (continued)

Hazard or measured parameter	Area	Interval	Limit	Action	Tasks
	—Samples (Smear, frisk for alpha and beta/gamma)	Prior to placing in coolers	>Table 10.7 values		
	—Sample coolers (Smear and frisk for alpha and beta/gamma)	Prior to release from the site	>Table 10.7 values		
	—Office trailers, Break area (LAW, spot alpha and beta/gamma frisk)	Before use and weekly	Same except maximum for breakrooms is 2500 dpm/100 cm^2 fixed, 250 dpm/100 cm^2 removable per SPP 803		
	—Equipment (smear and spot alpha and beta/gamma frisk)	At least daily (when used)	>Table 10.7 values		
	—Vehicles	Prior to exit from a contamination area and as determined by HP	>Table 10.7 values		
	—Decontamination pad (smear and spot alpha and beta/gamma)	Weekly	>Table 10.7 values		
	—Waste staging area	Weekly	>Table 10.7 values		
	Posted contamination area	As determined by HP	>100× Table 10.7 values	Stop work; monitor personnel; notify HP area supervisor; do not re-enter until authorized by HP	All tasks in rad control areas

Table 6 (continued)

Hazard or measured parameter	Area	Interval	Limit	Action	Tasks
Airborne radioactivity	Area other than posted airborne radioactivity or respirator area	≥10 times Table 10.7 values and tasks have potential to generate airborne contaminants	0.1 DAC averaged over 8 hours	Stop work; notify HP area supervisor; post as airborne radioactivity or respirator area; do not re-enter until authorized by HP	TBD
	Posted airborne radioactivity area	At least once per shift	0,5 DAC averaged over 8 hours	Notify HP area supervisor and post as respirator area if ≥1.0 DAC; investigate further actions	TBD
Reactions or liquid chemicals	Any intrusive work	Continuously	Visible reactions or liquid chemicals	Stop work, evacuate immediate area. Contact project manager and H&S manager.	Intrusive tasks
Airborne chemical concentrations (detector tubes)	Breathing zone	If PID ≥5 ppm	PEL or TLV	Variable, may include engineering, administrative, or personal protective measures	TBD
Airborne organics with PID	Breathing zone (14 in. in front of employee's shoulder)	Continuously during elevated readings	<5 ppm	Level D	Intrusive tasks
			≥5 ppm	Withdraw and evaluate —Identify contaminants —Notify SAIC Health and Safety manager	
Dust	All	Continuously during intrusive work	Visible dust emission	Stop work Evaluate controls Notify SAIC Health and Safety Manager	Intrusive tasks

Table 6 (continued)

Hazard or measured parameter	Area	Interval	Limit	Action	Tasks
Flammability with combustible gas indicator	In confined spaces and any area where flammable gasses are suspected at potential source	Continuously during intrusive work	<5% LEL	Continue	Intrusive tasks
			5-10% LEL	Evaluate source	
			>10% LEL	Withdraw	

DAC = Derived air concentration
HP = Health Physics
LEL = Lower explosive limit
PEL = Permissible exposure limit
SOP = Standard Operating Procedure
TBD = To be determined
TLV = Threshold limit value

Table 7. Surface radioactivity values [1]

Nuclide	Removable [2,4] (dpm/100 cm^2)	Total (Fixed + Removable)[2,3] (dpm/100 cm^2)
U-nat, U-235, U-238, and associated decay products	1,000	5,000
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	20	500
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	200	1,000
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.[5]	1,000	5,000
Tritium Organic Compounds; surfaces contaminated by HT, HTO, and metal tritide aerosols.	[Reserved]	[Reserved]

[1] The values in this appendix apply to radioactive contamination deposited on, but not incorporated into the interior of, the contaminated item. Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.

[2] As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[3] The levels may be averaged over one square meter provided the maximum surface activity in any area of 100 cm^2 is less than three times the value specified. For purposes of averaging, any square meter of surface shall be considered to be above the activity guide G if: (1) from measurements of a representative number n of sections it is determined that $1/n \, \Sigma_n \, S_i \geq G$, where S_i is the dpm/100 cm^2 determined from measurement of section i; or (2) it is determined that the sum of the activity of all isolated spots or particles in any 100 cm^2 area exceeds 3G.

[4] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by swiping the area with dry filter or soft absorbent paper, applying moderate pressure, and then assessing the amount of radioactive material on the swipe with an appropriate instrument of known efficiency. (Note - The use of dry material may not be appropriate for tritium.) When removable contamination on objects of surface area less than 100 cm^2 is determined, the activity per unit area should be based on the actual area and the entire surface should be wiped. Except for transuranics and Ra-228, Ac-227, Th-228, Th-230, Pa-231 and alpha emitters, it is not necessary to use swiping techniques to measure removable contamination levels if direct scan surveys indicate that the total residual surface contamination levels are within the limits for removable contamination.

[5] This category of radionuclides includes mixed fission products, including the Sr-90 which is present in them. It does not apply to Sr-90 which has been separated from the other fission products or mixtures where the Sr-90 has been enriched.

Source: 10 CFR 835, Appendix D

The SHSO will monitor the implementation of the required site control work rules and will report any deviations from prescribed practice to the Field Operations Manager or stop work, as appropriate. Site control zones will be established in a number of locations over the site. The exact locations will vary depending on the final selection of sampling points; therefore, it is not possible to illustrate the exact locations or extent of site control zones. The following sections describe the situations that will require the establishment of site control zones. Site control zones will be established where contamination or physical hazards require the exclusion of unauthorized personnel. As a minimum, site control will be established around drill rigs and other heavy equipment. Site control will generally not be established around tasks such as surface water sampling and surface soil sampling.

9.1 ZONE 1: EXCLUSION ZONE

The exclusion (contamination) zone is the area where the greatest potential exists for exposure to contamination or physical hazards. The periphery of the exclusion zone will be identified by barricade tape or rope suspended above the ground. This rope or tape will be red for chemical contamination and yellow and magenta for radiological contamination. An entry and exit checkpoint will be visually defined to regulate the flow of personnel and equipment. The entry and exit checkpoint will be delineated with barricade tape/rope and signs. Signs will include "Contamination Reduction Zone," "Construction Area," "High Noise Area," and/or "Radiological Contamination Area," as appropriate. The number of people and equipment in the exclusion zone will be minimized to control physical hazards and the spread of contamination.

The following standard rules will apply to all entry into the exclusion zone.

- The SHSO or Field Operations Manager must approve (and log) entry into the exclusion zone.
- All personnel entering the exclusion zone will wear the prescribed level of protective clothing.
- All items and related paraphernalia intended to be placed on the face or in the mouth (cigarettes, lighters, matches, chewing tobacco, food, cosmetics, etc.) are prohibited in the exclusion zone.

Exclusion zones will be established around drilling sites, areas of heavy equipment use, equipment decontamination stations, radiological contamination areas, and all activities where chemical/radiological contamination is a potential hazard. As a minimum, the exclusion zone will be large enough so that no part of an overturned drill rig will fall outside the zone. A larger exclusion zone will be used, as necessary, to protect bystanders and the public from chemical or other hazards. Exclusion zones for other activities will be appropriate to the hazard and surroundings.

9.2 ZONE 2: CONTAMINATION REDUCTION ZONE

A contamination reduction (buffer) zone will be established, as necessary, outside the exclusion zone to provide a transition from and a buffer between the exclusion zone and the support zone. A contamination reduction zone will be established if respiratory protection is used, the exclusion zone is a radiological contamination zone, or significant surface chemical contamination is present or suspected. An entry and exit checkpoint will be visually defined at the periphery of the zone to regulate the flow of personnel and equipment. The entry and exit checkpoint and the perimeter of the zone will be delineated with the use of ropes/barricade tape and signs.

All personnel entering the contamination reduction zone will wear the prescribed level of protective clothing required for that zone. Entry into the buffer zone is prohibited without the

approval of the operations manager or SHSO. All items intended to be placed on the face or in the mouth (e.g., cigarettes, chewing tobacco, food, cosmetics, etc.) are prohibited in the contamination reduction zone. Doffing of protective clothing and personnel decontamination will occur at the boundary between the exclusion and contamination reduction zones. For more information see Chap. 10, Decontamination Procedures.

9.3 ZONE 3: SUPPORT ZONE

The support zone is the clean and relatively safe area surrounding the exclusion and contamination reduction zones. Primary functions of the support zone are:

- staging area for clean equipment and supplies; and
- location for support services [e.g., office trailers, laboratory trailers, eating area(s), toilet facilities, parking, visitor area(s), etc.].

9.4 SITE VISITORS

Visitors to SAIC-controlled areas of the site shall abide by the following:

- Visitors shall be instructed to stay outside the exclusion and contamination reduction zones and remain within the support zone during the extent of their stay, unless entry has been approved by the SHSO.
- Visitors requesting to enter the exclusion or contamination reduction zones must wear all appropriate PPE for entry into the zone and abide by the appropriate work rules. If respiratory protective devices are necessary, visitors must produce evidence that they have medical approval for respirator use, respirator training, and have been fit tested for the type and size respirator to be used, within the past 12 months. See Chap. 4, Training , for visitor training requirements (Sect. 4.2).
- Visitor inspection of the contaminated area shall be at the discretion of the Field Operations Manager.

10. DECONTAMINATION PROCEDURES

10.1 DECONTAMINATION PROCEDURES

A system of procedures will be used to control the spread of contamination from the exclusion (contamination) zone and to ensure that workers are sufficiently free of contamination to preclude adverse health effects. PPE doffing and personnel decontamination are part of this system. Routine procedures will include "frisking" upon departure from radiological contamination zones to verify acceptable levels of surface contamination.

The following procedures present basic requirements for personnel decontamination and, dependent upon site conditions, may be modified by the SHSO if improvements are needed. Potential modifications include adding an additional scrub/wash station for re-usable PPE, allowing

some disposable PPE to be worn out of an exclusion zone if the exposure hazard is a highly volatile chemical with no residual exposure potential, etc.

The following procedures present basic requirements for exit from the exclusion zones around activities such as drilling, equipment decontamination, sediment sampling, etc. The steps of PPE doffing/routine decontamination will begin at the boundary between the exclusion zone and the contamination reduction zone and be completed prior to leaving the contamination reduction zone. As a minimum, personnel will wash their hands prior to eating or drinking.

Level D protection will be used when the potential for personnel contamination is very low, and decontamination consists of showering after work. Decontamination procedures for C and D+ levels of protective equipment are included.

10.1.1 Level D Protection Decontamination

Station 1: Disposable glove and boot cover removal

Deposit disposable gloves and boot covers in a designated container. Note that this step is necessary only if gloves and boot covers are in use.

Station 2: Frisking

Personnel will be frisked (a radiological screening) prior to leaving the buffer (contamination reduction) zone. Note that this requirement applies only if the exclusion zone is known or suspected to be a radiological contamination area.

10.1.2 Level D+ Protection Decontamination

Station 1: Tape removal

Remove all tape (if used) from outer clothing and place in appropriate waste container.

Station 2: Boot covers, outer disposable garment, and gloves removal.

Carefully remove boot covers, outer contamination-resistant garment, and gloves.

Station 3: Frisking

Personnel will be frisked (a radiological screening) prior to leaving the contamination reduction zone for the support zone to ensure that no radiological contamination is transferred to the support zone. Note that this requirement applies only if the exclusion zone is known or suspected to be a radiological contamination area.

Station 5: Field wash

Wash hands and face prior to eating, drinking, smoking, etc. This step may be accomplished with soap and water or disposable disinfectant wipes.

10.1.3 Level C Protection Decontamination

Station 1: Segregated equipment drop

Deposit equipment used on site (tools, sampling devices, containers, monitoring instruments, clipboards, etc.) on plastic sheets or in different containers with plastic liners. Segregation of the equipment at the drop site reduces the possibility of cross-contamination.

Station 2: Outer garment, boots, and gloves scrubbing and rinsing

Scrub outer garment, boots, and gloves with laboratory-grade detergent and water and rinse with potable water. All wash water and rinsing solutions will be disposed of in accordance with the WMP (Chap. 11) of this report. *Note: This station is not necessary when disposable PPE is used.*

Station 3: Outer boot and glove removal

Remove tape from outer boots and outer gloves. Remove outer boot covers and outer gloves. Deposit gloves and boot covers in plastic trash bags.

Station 4: Cartridge change

If a worker has left the exclusion zone for the sole purpose of changing a canister/cartridge of the respirator, this is the last step of the decontamination procedure. Once the worker's canister/cartridge has been replaced, the outer boots and gloves will be replaced and retaped so that all potential pathways to the skin are sealed. The used canister/cartridge will be placed in the plastic bag and will be disposed of in accordance with the WMP.

Station 5: Disposable outer garment removal

Remove disposable outer garment, deposit in a plastic trash bag, and dispose in accordance with the WMP.

Station 6: Respiratory protection and disposable inner glove removal

The respirator is the next-to-last item for removal. The cartridges/canisters are placed in a plastic trash bag and disposed of in accordance with the WMP. The respirator is placed in a plastic bag dedicated for used respirators only. Remove disposable inner gloves last and deposit them in a plastic trash bag, in accordance with the WMP.

Station 7: Frisking

Personnel will be frisked (a radiological screening) prior to leaving the contamination reduction zone for the support zone to ensure that no radiological contamination is transferred to the support zone. Note that this requirement applies only if the exclusion zone is known or suspected to be a radiological contamination area.

Station 8: Field wash

Wash hands and face prior to eating, drinking, smoking, etc. This step may be accomplished with soap and water or disposable disinfectant wipes.

10.2 EQUIPMENT DECONTAMINATION

The equipment decontamination station will be enclosed to prevent the spread of contamination. Enclosure requirements depend upon the degree of contamination and will be evaluated on a case-by-case basis. The equipment decontamination station will be constructed so that liquids generated during decontamination and any rainwater that falls in the decontamination station will be contained.

Sampling and related equipment will be decontaminated to a level sufficient to prevent cross-contamination of subsequent samples. This stringent requirement assures that decontaminated sampling equipment is sufficiently clean from a personnel contact perspective. Larger pieces of equipment, such as drill rigs, will be decontaminated with pressurized hot water/steam and will be surveyed for radioactive contamination prior to leaving the site.

Steps will be taken to assure that the transporting of sampling equipment does not spread contamination to previously uncontaminated areas. Sampling and related equipment will be screened for radiological and chemical contamination prior to being transported to the decontamination station. Any equipment that is deemed to be heavily contaminated, in the judgement of the site Radiological Control or SHSO, will be decontaminated in the immediate area of the sample collection, or will be wrapped in plastic during transit.

11. EMERGENCY RESPONSE/CONTINGENCY PLAN

The Field Operations Manager will remain in charge of all project personnel during emergency activities. All personnel working on site will be trained to recognize and report emergencies to the SHSO or Field Operations Manager. The SHSO or Field Operations Manager will notify the Y-12 site emergency response organization. The Y-12 site emergency response organization will be contacted for emergency response to all fires, personnel injuries, chemical spills that cannot be controlled by the on-site personnel, or other significant emergencies.

11.1 EMERGENCY PHONE NUMBERS

Listed below are emergency groups and their telephone numbers. A cellular phone may be present in the field and available for use when workers are not in close proximity to a plant phone or radio. *If an emergency occurs, contact the Site Shift Superintendent first. The Site Shift Superintendent is the trained site emergency response director.* Note that 911 will not access the Site Shift Superintendent from a cellular phone.

SHIFT SUPERINTENDENT

Plant Phone: (Site telephone number)	**911**
Cellular Telephone Number:	**574-7172**

11.2 REPORTING AN EMERGENCY

Telephone

- If a plant telephone is accessible, dial **911**. With a cellular phone, dial **574-7172**.
- Describe the type of emergency.
- Identify the location of the emergency.
- Identify who is calling.
- Identify the number on the phone being used.
- ***Tell whether an ambulance is needed.***
- Listen to and follow any instructions that are given.
- Do not hang up until ***after*** the Emergency Control Center has hung up.

Fire Alarm Pull Boxes

Pulling a fire alarm box automatically transmits the location of the emergency to the Fire Department and the Emergency Control Center. The person pulling the alarm should remain at the alarm box and supply any needed information to the emergency responders.

11.3 EVACUATION PROCEDURES

- The SHSO or Field Operations Manager will designate the evacuation routes.
- Familiarize yourself with the evacuation routes that are designated by the SHSO or Field Operations Manager.
- In the event of an evacuation, proceed to the predetermined assembly station and wait for further instructions.
- The SHSO or Field Operations Manager and crew will follow instructions given by the assembly station director and/or the Emergency Response Team upon its arrival.

11.4 EMERGENCY EQUIPMENT

Several items of emergency equipment will be maintained at the work site. These include:

- first aid kit suitable to treat minor injuries such as cuts and abrasions;
- whistle or compressed gas horns;
- pressurized eye wash to meet ANSI standard;
- fire extinguisher(s); and
- basic spill kit suitable to handle small spills of decontamination fluids, hydraulic fluid, or fuels.

12. EMERGENCY ACTION PLAN

Not applicable to this project.

13. SPILL CONTAINMENT

The project spill containment program addresses the potential spills associated with this project. In general, the potential for spills resulting in significant environmental impact or personnel injury is very limited. The quantities of substances that might be spilled during the project are will be relatively small. Specific potentially spillable materials include: gasoline, diesel fuel, hydraulic fluid, sample preservatives, isopropyl alcohol, and groundwater.

The following general steps will be followed to prevent and minimize the impact of spills.

- Only sound containers will be used.
- Containers will be kept closed when not in use.
- Vehicles will be inspected for fluid leaks and will not be used on site if leaking.
- Plastic sheeting will be placed under drill rigs during drilling.
- A spill kit containing appropriate sorbents will be maintained on site.

If a spill occurs the following general steps will be followed.

- The Field Operations Manager and SHSO will be notified.
- The site Shift Superintendent will be notified.
- The EMEF and SAIC health and safety managers will be notified.
- The field crew will take immediate steps (under the direction of Field Operations Manager and SHSO) to safely control the release and minimize spread to other areas.

APPENDIX D

WASTE MANAGEMENT PLAN

WASTE MANAGEMENT PLAN APPROVAL

Angela Fleming
Angela Fleming, Waste Management

3/17/98
Date

Greg Schank for
Duncan Moss, SAIC, Project Manager

3/17/98
Date

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1. INTRODUCTION

This waste management plan (WMP) addresses limited waste management requirements for waste generated during the accelerated remedial action project activities at the Boneyard/Burnyard (BYBY) site at the Oak Ridge Y-12 Plant. This WMP identifies the types of various wastes that may be generated during the field activities. The approach to managing waste outlined in this WMP emphasizes the following:

- management of the waste generated in a manner that is protective of human health and the environment;
- minimization of waste generation, thereby reducing unnecessary costs and usage of limited permitted storage and disposal capacities; and
- compliance with federal, state, and site requirements.

1.1 SITE LOCATION

The Y-12 Plant is currently under a Federal Facilities Agreement to define soil and groundwater contamination and develop remedies to protect human health and the environment. The BYBY is located at the west end of the Y-12 Plant complex, outside the Y-12 Plant fence line near Bear Creek and Bear Creek Road.

1.2 SITE DESCRIPTION

The BYBY, located east of the Oil Landfarm, consists of three sites: Boneyard, Burnyard, and Hazardous Chemical Disposal Area (HCDA). Information concerning operations at this site is sparse.

The Boneyard, which consisted of a series of unlined earthen trenches, was an active waste disposal site from the mid-1940s to the mid-1970s. Site wastes have been characterized as ranging from ignitable and radioactive to inert. They are known to have included organics, metals, debris, acids, and beryllium, but the total quantity of material is unknown. The primary waste that went to the Boneyard in the late 1950s to the late 1960s was depleted uranium metal chips. These were placed into an open pit and were burned without being covered. Some waste oil or waste paper was used to start the burning, which was usually done once a week.

Magnesium chips were disposed of in the southwest corner of the Boneyard, south of the gravel road. The metal chips were placed in burn pans in unlined earthen trenches, and ignitable waste solvents were used to initiate the burn. The residue remaining in the trenches was covered with soil and compacted until the trenches were filled, after which they were covered with topsoil and seeded with grass. The remaining land in the Boneyard was used to dispose of construction spoil material such as concrete and rebar.

The Burnyard consisted of two trenches ~90 m (300 ft) long and 12 m (40 ft) wide. The site is no longer visible because the HCDA was built on top of it and subsequently capped. An active waste site from 1943 to 1968, the Burnyard is estimated to have received ~90 m^3 (350 yd^3) per month

[1000 m^3 (4000 yd^3) per year] of sanitary refuse, including solids, liquids, and sludges from plant operations. The waste materials, which may have contained empty pesticide containers, metal shavings, solvents, oils, and laboratory chemicals, were placed in unlined earthen trenches and burned. Oils and other flammable liquids, possibly transformer oils containing PCBs, were used to start and sustain combustion. Dioxin/furan contamination could have resulted from this burning of PCBs at relatively low temperatures. After the trenches became filled, they were covered with soil. No collection or treatment systems, other than burning, are known to have been used on this site.

The HCDA is located on top of the former Burnyard site. The site is estimated to have received less than 3.8 m^3 (5 yd^3) of solid, liquid, and gaseous waste materials a year from 1975 to 1981. The material was broadly characterized as ignitable, reactive, corrosive, toxic, highly flammable, or in some instances, inert.

2. OBJECTIVES

The objectives of the BYBY study are to determine what material at the BYBY is acting as a source for uranium contamination to groundwater and surface water, what is the volume of this source material, what is the areal extent and approximate volume of uranium-contaminated material that does not constitute a source, and what are the physical and chemical characteristics of the source material.

3. REMEDIAL ACTION ACTIVITIES

The characterization activities for the BYBY Remedial Action project will include the following:

- Direct Push Borings
  - — Installing 40 direct push borings on and around the BYBY. Subsurface soil samples will be taken and a groundwater sample will be collected from each borehole.
  - — Packaging and delivering samples to the Y-12 Plant Analytical Services Organization Laboratory.

- Test Pits
  - — Opening up to six test pits in known contamination areas. Soil samples will be collected at 2-ft intervals.
  - — Backfilling of pits with excavated material.
  - — Packaging and delivering samples to the Y-12 Plant Analytical Services Organization Laboratory or packaging and shipping samples to a Sample Management Organization laboratory.

4. WASTE MANAGEMENT PLAN CHECKLIST

The strategies and methodologies to be used in the management of wastes generated during project activities are documented in the Environmental Management and Enrichment Facilities (EMEF) Program Waste Management Plan checklist for the Y-12 Plant, given in Attachment 1. The WMP checklist provides guidance and recommendations to be used for ensuring the protection of the worker, the environment, and the public.

4.1 KEY PROJECT PERSONNEL

Individuals involved in the management of waste generated by this project include the project manager, EMEF Generator Interface, facility manager, waste coordinator, site safety and health officer, and the EMEF Waste Management Coordinator. The names, addresses, and telephone numbers of these individuals are given in Sect. 1.0 of the checklist. The waste management responsibilities for these roles are described in the EO-710, ES-WM-10, and procedures identified in the WMP checklist.

4.2 WASTE GENERATION ACTIVITIES

Activities associated with the BYBY Remedial Action project will result in the generation of limited volumes of solid and liquid wastes at the site. These activities are listed in Sect 3.0 of the WMP checklist and are briefly discussed below.

Direct Push Borings. Subsurface soil samples will be collected in each of the direct push borings. One sample from each boring will be sent to the laboratory for analysis. The remainder of the soil samples will be considered waste. A groundwater sample will be collected from each boring. A small amount of water will be purged from each boring before sampling.

Test Pits. Six test pits will be opened during this study. The pits will be excavated in 2-ft increments with soil and waste segregated by interval on plastic. The pits will be backfilled so that the removed soil will be put back from the same depth from which it was removed. It is anticipated that no soil waste will be generated.

Decontamination. Decontamination of the drilling, sampling, and digging equipment will produce limited volumes of isopropyl alcohol and decon water fluids that will be segregated.

Miscellaneous Waste. Miscellaneous waste, such as paper, trash, and PPE, will be generated. Any of this type of waste that comes in contact with any suspected radiological contaminated material will be scanned with radiological meters. Any waste determined to be radiologically contaminated will be segregated and put into rad bags for disposal. Waste that is not determined contaminated will be considered sanitary waste.

4.3 WASTE TREATMENT, STORAGE, AND DISPOSAL

The soil and water waste generated from the drilling, test pit, and decontamination activities will be left on-site. Soil will be spread around the borehole area from which it came, and water will be put on the ground and allowed to percolate back into the subsurface. Any radiological contaminated waste and sanitary waste will be transferred to the Waste Management Organization for disposal. Before transfer of waste to the Waste Management Organization, the appropriate waste management forms, if necessary, will be completed and signed. The waste certifier and the waste coordinator are responsible for completing and signing the forms.

4.4 WASTE TRANSPORTATION

Waste transportation will be coordinated with the Waste Management Organization. Expected routes of transportation are identified in Sect. 8.0 of the WMP checklist. Waste generated will be transported in accordance with all applicable federal and state regulations, U.S. Department of Energy (DOE) orders, and Lockheed Martin Energy Systems, Inc. (Energy Systems) policies and procedures.

5. HEALTH AND SAFETY

A project health and safety plan (HSP) has been developed using Energy Systems standard practices when applicable. This plan describes all of the requirements to conduct project activities at the Y-12 Plant. It is the responsibility of the project managers, field managers, and site safety and health officers to ensure that this work is done safely. These personnel will verify that the HSP is sufficiently protective. If it is determined that the requirements of the HSP are not sufficiently protective, a field change order (FCO) will be prepared. FCOs will include a completed job hazard analysis or similar worksheet to ensure complete hazard assessment. FCOs must be approved by the program manager, health and safety manager, subcontractor project or field manager, and subcontractor health and safety representative. As a minimum, FCOs will be prepared if additional tasks will be performed.

ATTACHMENT 1

EMEF PROGRAM WASTE MANAGEMENT PLAN CHECKLIST

Original Issue Date:	
Revision Date:	
WMO # (if applicable):	

ENVIRONMENTAL RESTORATION PROJECT WASTE MANAGEMENT PLAN CHECKLIST

PROJECT NAME	CHECKLIST NUMBER[1]
Boneyard/Burnyard Accelerated Action Project	

Project Manager	Date
John Vanderlan John A. Vanderlan	3/19/98

Waste Management Coordinator	Date 3-19-98
Angela Fleming Angela Fleming	

Waste Certification Official	Date 3-19-98
Angela Fleming Angela Fleming	

Waste Management Operations	Date
Mary Wiginton Mary Wiginton	3/19/98

[1] Assigned by the Environmental Restoration Document Management Center.

PROJECT WASTE MANAGEMENT PLAN

Project Name:	Boneyard/Burnyard Accelerated Remedial Action Project	Start Date:	
Project Location:	Y-12 Plant	End Date:	
Charge Number:		ER WM Plan Checklist #:	

1.0 KEY PROJECT PERSONNEL

Project Manager:	John Vanderlan	Waste Certifier:	Angela Fleming
Address:	Bldg 8734, MS-8130	Address:	Bldg 9983-AH, MS-827
Phone:	576-2745	Phone:	574-9551

Facility Manager:	John Vanderlan	Waste Generator:	Angela Fleming
Address:	Bldg 8734, MS-8130	Address:	Bldg 9983-AH, MS-827
Phone:	576-2745	Phone:	574-9551

Waste Packer:	SAIC - Victor Harness	Site Safety Officer:	SAIC - Greg Schank
Address:	PO Box 2502 Oak Ridge, TN 37831	Address:	PO Box 2502 Oak Ridge, TN 37831
Phone:	481-8735	Phone:	481-8760

ER WM Coordinator:	Angela Fleming	Construction Engineer:	N/A
Address:	Bldg 9983-AH, MS-8247	Address:	
Phone:	574-9551	Phone:	

2.0 INTRODUCTION

2.1 Project Description

The Boneyard/Burnyard project will consist of the installation of 40 direct push boreholes and the digging of 6 test pits to determine the volume, types of waste, and levels of contamination. Soil samples will be collected from the direct push borings and test pits. Groundwater samples will be collected from the direct push borings.

2.2 Brief Site History

The Boneyard consisted of a series of unlined earthen trenches and as an active waste disposal site from the mid-1940s to the mid-1970s. Types of waste included organics, metals, debris, acids and beryllium. The total quantity of material disposed of is unknown. The Burnyard consisted of two unlined earthen trenches that were an active waste site from 1943 to 1968. The types of waste included solids, liquids, and sludges from plant operations. Waste materials may have contained empty pesticide containers, metal shavings, solvents, oils, and laboratory chemicals.

2.3 Reference Documents

Environmental Restoration Integrated Water Quality Program Plan, Oak Ridge, Tennessee, ES/ERTM-205; Procedure ER/C-P2101, *Preparation of Environmental Task/Project-specific Waste Management Plans;* Procedure EMEF/EM-P2109, *Environmental Restoration and Waste Management Organization Waste Certification.*

3.0 WASTE GENERATION ACTIVITIES

	Coring	X	PPE		Geophysical Survey		Remedial Actions
X	Drilling	X	Excavating		D&D Activities		UST Activity
X	Decontaminating		Renovation		Well Installation		ISV
X	Water Sampling	X	Soil Sampling		Scoping Surveys		Other

Explain Other

3.1 Waste Generating Area[s]

Location or Building Number[s]

Boneyard/Burnyard - west end of Y-12 Plant, along Bear Creek Road

4.0 Waste Characterization

4.1 Wastes Types and Volume

Category[1]	Sanitary Waste						
Type[2]	solid						
Description of Waste stream/ source[3]	PPE, paper						
RAD - contact or remote handled							
Suspected contaminants (radiological and chemical)[4]							
Estimated Contaminant Concentrations (pCi/g)							
Characterization of contaminant by sampling and analysis (Yes/No)							
Characterization of contaminant determined by process knowledge[5] (Yes/No)							
Solids[6] (ft^3)	10 cu ft						
Liquids (gallons)							
Volume that WMO may receive (solids and liquids)	10 cu ft						
Investigation Derived Waste (IDW) volume (solids and liquids)							
IDW Type[2]							

Category[1]	Sanitary Waste						
Destination[7]	WMO						

1 RCRA, TSCA, LLW, TRU, LLW/RCRA, LLW/TSCA, TRU/RCRA, TRU/TSCA, TRU/RCRA/TSCA, LLW/RCRA/TSCA, RCRA/TSCA, sanitary waste/industrial waste, liquid waste to be treated at K-25 site, liquid waste to be treated at ORNL, liquid waste to be treated at Y-12 plant.

2 Liquid, sludge, solid, gas (compressed), etc.

3 Floor tiles, duct work, concrete, metal, plastic, soil, glass, cylinders, etc.

4 This is not to include trace or naturally occurring chemicals or radionuclides found in nature.

5 Documents that defend process knowledge should be listed in Sect. 2.

6 See Methodology for Generating Waste Volumes Estimates (ES/ER/TM-18). It is imperative that waste volumes be given the appropriate units. (i.e., solids in cubic feet, liquids in gallons, etc.)

7 Energy Systems Waste Management Organization (ESWMO), Environmental Restoration (ER), Plant and Equipment Organization (P&E), etc..

What Methodology was used to estimate waste volumes?

Calculations based on acticipated PPE

4.2 Waste Characterization Plan

Waste has been characterized to pose a marginal risk. Waste will be scanned wtih rad meters prior to packaging.

Has the organization or person responsible for obtaining samples been designated?

	Yes		No	x	NA

List Name _____ Date _____

Has the organization responsible for analyzing samples been identified?

	Yes		No	x	NA

List Name _____ Date _____

Can the Solid Radioactive Waste Group accept the volumes of radiological waste to be generated?

x	Yes		No		NA

List Name Angela Fleming Date _____

Can the Liquid Gaseous Waste Group accept the volumes of liquid waste to be generated?

x	Yes		No		NA

List Name Angela Fleming Date _____

Will TRU or TRU/mixed waste be generated?

	Yes	x	No		NA

List Name _____ Date _____

Will any of the waste generated be handled as IDW?

x	Yes		No		NA

List Name SAIC Date _____

List any specific requirements as requested by any of the above organizatons or compliance.

Who will be responsible for completing the [weekly] Waste Generated Waste form?

List Name Angela Fleming Date: _____

5.0 HANDLING AND STORAGE REQUIREMENTS

5.1 List Special Handling Procedures For Waste or Waste Containers

5.2 List What Will Be Used To Protect The Integrity Of Waste Containers From Environmental Elements. (Examples: Lid Tops, Plastic Covering, Epoxy, Storage Shelter)

5.3 Applicable Waste Storage Area(s)

	Waste Staging Area		Satellite Accumulation Area		Waste Consolidation Area
	90-d Storage Facility	x	Area of Contamination		Other [specify]

Describe location of above areas (attach sketch)

Liquid and soil waste will be returned to the AOC (Boneyard/Burnyard)

5.4 Explain how waste will be managed to assure that personal safety and the environment will be protected.

SAIC will perform work in accordance with approved plans.

Waste Storage Area Supervisor _____

Does Supervisor/staff have the appropriate required training?

x	Yes		No		NA

List Training Requirements

GET, Rad Worker

Will a spill control kit be required on-site?

x	Yes		No		NA

List spill control kit contents.

Absorbent materials, plastic sheeting, tyvek, gloves, absorbent pads or pillows

6.0 WASTE MINIMIZATION

6.1 Waste Minimization Techniques To Be Implemented

x	Segregation		IDW Concept
x	Decontamination		Material Recycle (Solvents, Decon Waters)
	Compaction		Cutting Fluids Recovery
	Solvent Substitution		Selection of Equipment
	Sludge Dewatering		Solidification
x	Selection of PPE	x	Other

Identify other waste minimization techniques not listed above

All liquid and soil waste will be returned to the AOC

7.0 TREATMENT, STORAGE, AND DISPOSAL OPTIONS

7.1 Potential Treatment, Storage, and Disposal Options
[if applicable]

Option[s]	TSD Capacity	Organization
Disposal	PPE, Sanitary Waste	

7.2 Special Requirements of the Waste Acceptance Criteria To Meet

None

7.3 Applicable Waste Management Forms

	UCN-2822		UCN-1457		UCN-2109		UCN-20299
	UCN-16114		UCN-20116		TX-5352A		UCN-20300
	UCN-16114A		UCN-19611		UCN-20118		Other

Personnel that will be responsible for completing and signing Waste Management form[s].

Name	Phone Numbers	Organization
Angela Fleming	574-9551	LMES

8.0 TRANSPORTATION

8.1 Transportation Requirements

A. Who or what organization will transport waste to waste consolidation or staging area[s]?

Waste Management Organization

B. List specific issues for transporting waste and their resolutions.

WMO will provide transportation to the waste staging area. All applicable federal and state regulations, DOE orders, and LMER/LMES policies and procedures will be adhered to when transporting waste.

9.0 ENVIRONMENT, SAFETY, AND HEALTH

9.1 Identify Health and Safety Plan and other Environmental Management documents associated with this project.

Document Title	Date
Health and Safety Plan for the BYBY Remedial Action Project	
Sampling and Analysis Plan for the BYBY Remedial Action Project	

10.0 ADDITIONAL INFORMATION

APPENDIX E

DATA MANAGEMENT IMPLEMENTATION PLAN

DATA MANAGEMENT IMPLEMENTATION PLAN APPROVAL

Virginia Forsberg, LMES Data Management — Date: 3/17/98

Duncan Moss, SAIC, Project Manager — Date: 3/17/98

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1. INTRODUCTION

This appendix presents the data management implementation plan (DMIP) for project activities to be performed by Science Applications International Corporation (SAIC) for the Bear Creek Valley Boneyard/Burnyard Accelerated Action Project. This plan describes the data management process to be implemented for this project. The DMIP presents the process used for the planning, collection, tracking, verification, validation, analysis, presentation, and storage of site characterization data. The plan identifies required data documentation materials and procedures, as well as project file requirements. The plan also provides the reporting requirements for presenting the raw data and conclusions of the investigation. These procedures are consistent with and satisfy the requirements of the Lockheed Martin Energy Systems (LMES) Data Management Procedures.

Project activities will generate data, including sample locations, measurements of field parameters, and results of sample analyses and data reviews. Important records regarding the collection and analysis of the samples and data will also be generated. The data management process requires the proper flow of data from field collection and processing by the analytical laboratory to those involved in the project evaluation and decision making. Figure 1 illustrates the flow of information for the project. This DMIP will ensure the validity and accessibility of data to support environmental data analysis and the evaluation of corrective measures.

2. INVESTIGATION DATA

2.1 DATA TYPES

Sampling activities proposed for the project will result in the collection of multiple data types from multiple sources. Data collection activities will include acquisition of historical data as appropriate, entry of sample collection data and field measurements from logbooks, loading of analytical data from laboratory electronic data deliverables, loading of civil survey results, and entry of data validation result qualifiers. In addition, critical project records, such as chain-of-custody forms, laboratory data packages, and validation results, will be maintained in the project file.

2.2 KEY IDENTIFIERS

The key identifiers for project sampling data will be the sample location/station and a unique sample identification number. All samples will be assigned an area and station to identify the specific point where the field measurements or samples were collected. Descriptions, geographic coordinates, and elevations will be obtained for these sampling stations.

Unique sample numbers are derived from the location, sampling station within the location, sample medium, and sample type, plus a sequential number. Field duplicates represent a separate sample type, and distinct depths receive different sequential numbers so no duplication of sample numbers will occur. The sample identification will appear on the sample collection log sheet, sample label, chain-of-custody form, and on any correspondence related to the sample. Additional information regarding sample identification is presented in the sampling and analysis plan.

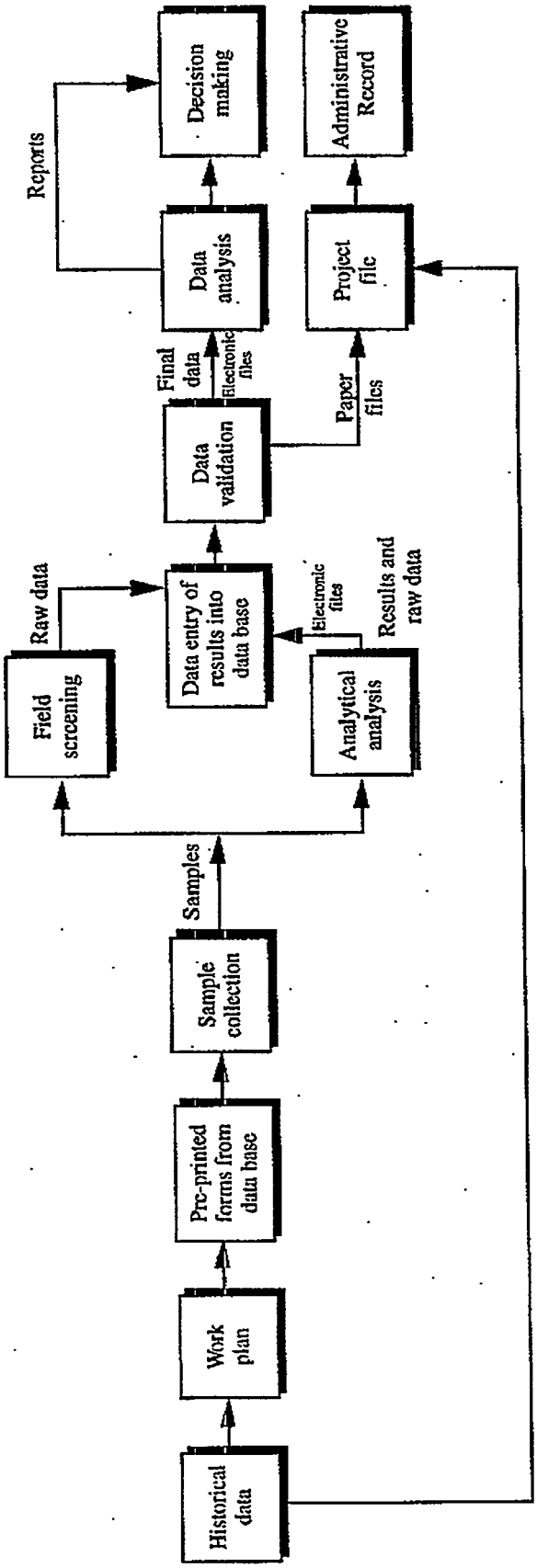

Fig. 1. Project information flow diagram for the Bear Creek Valley Boneyard/Burnyard Accelerated Action Project.

3. DATA MANAGEMENT SYSTEM

The data management system facilitates the information flow by providing a means of tracking, organizing, reporting, and archiving data and information. The system has four primary components:

1. A multi-disciplinary team of data management professionals.

2. A process model that integrates activities relevant to ensuring that data are complete, consistent, and fully qualified and minimizes the uncertainties associated with the data, data products, or interpretations of results.

3. Guidance provided in the SAIC *Quality Assurance Technical Procedures Volume I: Data Management.*

4. A standardized database structure to support the collection, management, analysis, and presentation of site characterization data.

4. DATA MANAGEMENT AND TRACKING PROCESS

To meet the regulatory requirements for the acquisition of technically sound and legally admissible data, a traceable audit trail will be established from the development of the project work plan through the archiving of information and data. Each step or variation of the sampling and analytical process will be documented. Standardized formats for electronic transfer and reporting will be used. To meet this requirement, the following data management process will be followed throughout the collection, management, storage, analysis, and presentation of the site environmental characterization data.

4.1 SAMPLING AND ANALYSIS PLANNING

Plans for the collection of field and laboratory quality control samples are detailed in the sampling and analysis plan and the quality assurance project plan (Appendix B). These two plans together specify all applicable sampling and analytical data that will be entered into the database.

The interface with the analytical laboratory is crucial in achieving the goal of generating technically sound data. On the basis of the laboratory data quality objectives presented in the quality assurance project plan, the laboratory statement of work details analytical methods, validation criteria, deliverables, and deliverable formats required of the analytical laboratory. The analytical laboratories that have been contracted with for chemical and geotechnical testing are identified in the quality assurance project plan.

Before initiating field work, the project database will be populated with sample locations, sample numbers, analytical parameters and detection limits, and associated sampling and laboratory information based on the requirements of the sampling and analysis plan. A report of all planned samples will be generated for review by the SAIC Field Manager. After approval of the presampling database, the data coordinator will generate field sampling forms including preprinted sample

information, bind and number the logbooks, and print and organize the required sample labels. This process will increase the accuracy of the final database and minimize the amount of information samplers must record in the field.

4.2 FIELD SAMPLE COLLECTION AND MEASUREMENT

Before beginning field sampling, field personnel will be trained as necessary and participate in a project-specific readiness review. These activities ensure that standard procedures will be followed in sample collection and in completing field logbooks, chain-of-custody forms, labels, and custody seals. Documentation of training and readiness is submitted to the project file.

The master field investigation document will be the site field logbooks. The primary purpose of these documents is to record each day's field activities; personnel on each sampling team; and any administrative occurrences, conditions, or activities that may have affected the field work or data quality of any environmental samples for any given day.

Each field sampling team will have a field logbook in which it will record data collected in the field. To the extent possible, preprinted field logbook sheets will be generated from the data management system. If preprinted logbook sheets are not used for a given sample, required information will be recorded manually. As samples are collected in the field, the field sampling team members will complete the logbooks with sample collection data and required field measurements as specified in the sampling and analysis plan and the quality assurance project plan. Standardized reporting formats will be used to document this information.

The field logbooks will be signed and dated by the data recorder and will specify whether field methods and procedures were followed. Entries will be verified by a sampling team member other than the recorder, or by the SAIC Field Manager, who will perform a quality assurance review and sign and date the logbook to document the review.

Backup photocopies of the field logbooks will be made and submitted to the project file. Sample collection and measurement information from the logbooks and data forms will be manually entered into the database and checked for accuracy. Entries will be verified through the use of double entry and comparing protocols. As necessary, the actual forms used will be modified to include the appropriate information codes to facilitate data entry. Completed logbooks and appropriate field forms will be submitted to the project file upon completion of the project.

At any point in the process of sample collection or data or document review, a Nonconformance Report (NCR) may be initiated if nonconformances are identified, and data entered into the database may be flagged accordingly. Additional information regarding NCRs is presented in the sampling and analysis plan.

4.3 CHAIN-OF-CUSTODY DOCUMENTATION

Sample containers will be tracked from the field collection activities to the analytical laboratory following proper chain-of-custody protocols and using standardized chain-of-custody forms.

When the samples are received at the laboratory, the laboratory receiving staff will check and document the condition of the samples upon arrival, check that the sample identification numbers

on containers and chain-of-custody forms match, and assign laboratory sample identification numbers traceable back to the field identification numbers. Within 24 hours of receipt of the sample containers, the laboratory will send a letter of receipt to the Oak Ridge Operation Office Sample Management Organization and the SAIC Laboratory Coordinator or his designee. This letter will provide the following information:

- sample receipt date,
- problems noted at the time of receipt,
- list of sample identification numbers and corresponding laboratory identification numbers for all samples received,
- analyses requested for each sample received, and
- completed cooler receipt checklists for each cooler received.

The letter of receipt will be accompanied by the completed and signed chain-of-custody form(s) for the samples, and both documents will be submitted to the project file. Sample information recorded on the chain-of-custody form and in the letter of receipt will be entered into the sample tracking database. This database will allow for tracking of the status of samples from the time of collection through analysis and validation. The database tracking program will produce reports that will inform the project team of potential delays or problems related to sample analysis and validation.

4.4 ANALYTICAL LABORATORY DOCUMENT AND DATA SUBMISSION

Before release of a data package, the analytical laboratory supervisor will review the data package for precision, accuracy, and completeness and will attest that it meets all data analysis and reporting requirements for the specific method used. The supervisor will then sign the hard-copy forms certifying that the data package and any electronic format deliverables were reviewed and are approved for release.

Analytical results will be submitted to the Oak Ridge Operations Office Sample Management Organization and the SAIC Laboratory Coordinator or his designee on standardized forms in data packages in accordance with the subcontract scope of work for analytical services. These forms will contain results and required quality assurance/quality control information applicable to the analytical laboratory method used for analysis. In addition, as required by the scope of work, results of analyses will also be provided in electronic format on diskettes. The data coordinator receiving laboratory deliverables will make a copy of each data package and/or diskette and submit the originals to the project file. Results will be transferred to the database either electronically by diskette or manually from the hard copy into appropriate data tables within the database.

4.5 DATA VERIFICATION AND VALIDATION

All data packages received from the analytical laboratory will be reviewed, verified, and validated by data management personnel. Details regarding the data verification and validation processes are presented in the project quality assurance project plan.

With regard to data reduction, any replicate measurements associated with a single sample will be averaged before further data reduction. Correction of extreme (outlier) values will be attempted if the cause for the outlier value can be documented. This type of data will be corrected if the outliers are caused by incorrect transcription and the correct values can be obtained and documented from valid records. If the values can be documented as resulting from a catastrophic event or a problem in methodology, the values will be appropriately qualified. Documentation and validation of the cause of outliers will accompany any attempt to correct or delete these data values. Outlier values will not be omitted from the raw data reported to the project, however, only valid values will be included in data summary tables. Analytical values determined to be at or below the detection limit will be reported numerically (e.g., </= 0.1 mg/L). The data presentation procedures will cite analytical methods used including appropriate detection limits.

4.6 DATA CENTRALIZATION AND STORAGE

Once the data for a given sample or group of samples are complete and entered into the database, the data coordinator will check that logbooks, other field records, and all analytical data are complete and properly stored, including both the electronic form and associated data packages. Each piece of information will be documented as to its source, and hard-copy information will be appropriately indexed and filed.

Procedure-based routines for establishing data security, backup, archival, and maintaining proper database changes are also used to maintain database integrity. Classes of users will be defined with access levels approved and controlled by the SAIC Data Manager. Once loaded, the database will be secured from physical corruption (i.e., hardware or software failure) or from unauthorized access and illegal updating. Physical security requires recovery procedures, time-stamping, and other related standard operating processes and controls. Any changes made to the completed database will be documented on standardized forms, which will be placed into the project file.

4.7 DATA SUMMARIZATION AND REPORTING

When field sampling has been completed and the analytical data have been received, validated, and transferred into the project database, the project report and data quality assessment will be generated.

Project data will be screened for potential data errors, compared with site-specific background values and applicable regulatory limits, summarized in both tabular and graphical form to facilitate data interpretation. Data reduction and summation will be accomplished using quality-controlled and documentable reporting programs. Data summaries will be generally produced using predefined report formats available within the data management system. Statistical summaries will be generated by transferring data to a SAS data set and adapting exiting data analysis programs to include project-specific aggregation or screening criteria. Any new programs developed under this project will be tested, reviewed, and documented as error-free following SAIC quality assurance technical procedures. Data presented on maps, figures, or tables will be transferred electronically as far as possible to avoid introducing typographical errors.

4.8 RECORDS MANAGEMENT AND DOCUMENT CONTROL

Hard copies of all original site and field logbooks, chain-of-custody forms, data packages with analytical results and associated quality assurance/quality control information, data verification and validation forms, and other project-related information will be indexed, catalogued into appropriate file groups and series, and archived.

The SAIC Data Manager will archive the project data to the appropriate electronic media. A data archive information package will be prepared that describes the data system, file format, and method of archival. Sufficient documentation will accompany the archived data to fully describe the source, contents, and structure of the data to ensure future usability. Computer programs used to manipulate or report the archived data will also be included in the data archive information package to further enhance the data's future usability.

Project electronic deliverables will be delivered to the Oak Ridge Environmental Information System database as directed by the project management. Project files accumulated by SAIC will be delivered to Environmental Management and Enrichment Facilities Document Management Center as directed by the project management.

APPENDIX F

BEST MANAGEMENT PRACTICES PLAN

BEST MANAGEMENT PRACTICES PLAN APPROVAL

Mick Wiest

Mick Wiest, LMES

3-17-98

Date

John Vanderlan

3/18/98

Date

Greg Schank for

Duncan Moss, SAIC, Project Manager

5/18/98

Date

PREFACE

The Boneyard/Burnyard Accelerated Remediation Project Best Management Plan was prepared under the Environmental Restoration Program to support the sampling of the Boneyard/Burnyard for determination of waste quantity and characteristics. This plan will be used to protect the environment during the site pit excavation and shallow soil sampling activities.

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1. INTRODUCTION

1.1 SITE LOCATION

The Oak Ridge Y-12 Plant is currently under a Federal Facility Agreement to define soil and groundwater contamination and develop remedies to protect human health and the environment. The Boneyard/Burnyard (BYBY) is located at the west end of the Y-12 Plant Complex, outside the Y-12 Plant fence line near Bear Creek and Bear Creek Road.

1.2 SITE DESCRIPTION

The BYBY, located east of the Oil Landfarm, consists of three sites: Boneyard, Burnyard, and Hazardous Chemical Disposal Area (HCDA). Information concerning operations at this site is sparse.

The Boneyard, which consisted of a series of unlined earthen trenches, was an active waste disposal site from the mid-1940s to the mid-1970s. Site wastes have been characterized as ranging from ignitable and radioactive to inert. They are known to have included organics, metals, debris, acids, and beryllium, but the total quantity of material is unknown. The primary waste that went to the Boneyard in the late 1950s to the late 1960s was depleted uranium metal chips. These were placed into an open pit and were burned without being covered. Some waste oil or waste paper was used to start the burning, which was usually done once a week.

Magnesium chips were disposed of in the southwest corner of the Boneyard, south of the gravel road. The metal chips were placed in burn pans in unlined earthen trenches, and ignitable waste solvents were used to initiate the burn. The residue remaining in the trenches was covered with soil and compacted until the trenches were filled, after which they were covered with topsoil and seeded with grass. The remaining land in the Boneyard was used to dispose of construction spoil material such as concrete and rebar.

The Burnyard consisted of two trenches ~ 90 m (300 ft) long and 12 m (40 ft) wide. The site is no longer visible because the HCDA was built on top of it and subsequently capped. An active waste site from 1943 to 1968, the Burnyard is estimated to have received ~ 90 m^3 (350 yd^3) per month [1000 m^3 (4000 yd^3) per year] of sanitary refuse, including solids, liquids, and sludges, from plant operations. The waste materials, which may have contained empty pesticide containers, metal shavings, solvents, oils, and laboratory chemicals, were placed in unlined earthen trenches and burned. Oils and other flammable liquids, possibly transformer oils containing PCBs, were used to start and sustain combustion. Dioxin/furan contamination could have resulted from this burning of PCBs at relatively low temperatures. After the trenches became filled, they were covered with soil. No collection or treatment systems, other than burning, are known to have been used on this site.

The HCDA is located on top of the former Burnyard site. The site is estimated to have received less than 3.8 m^3 (5 yd^3) of solid, liquid, and gaseous waste materials a year from 1975 to 1981. The material was broadly characterized as ignitable, reactive, corrosive, toxic, highly flammable, or in some instances, inert.

2. OBJECTIVES

The objectives of the BYBY study are to determine what material at the BYBY is acting as a source for uranium contamination to groundwater and surface water, what is the volume of this source material, what is the areal extent and approximate volume of uranium-contaminated material that does not constitute a source, and what are the physical and chemical characteristics of the source material.

3. CHARACTERIZATION ACTIVITIES

The characterization activities for the BYBY Remedial Action project will include the following:

- Direct Push Borings
  - — Forty direct push borings will be installed on and around the BYBY. Subsurface soil samples will be taken and a groundwater sample will be collected from each borehole.
  - — Samples will be packaged and delivered to the Y-12 Plant Analytical Services Organization Laboratory.

- Test Pits
  - — Up to six test pits will be opened in known contamination areas. Soil samples will be collected at 2-ft intervals.
  - — Pits will be backfilled with excavated material.
  - — Samples will be packaged and delivered to the Y-12 Plant Analytical Services Organization Laboratory or packaged and shipped to a Sample Management Organization laboratory.

4. HEALTH AND SAFETY

A project health and safety plan (HSP) has been developed using Lockheed Martin Energy Systems, Inc. (LMES), standard practices, when applicable. This plan describes all of the requirements to conduct project activities at the Y-12 Plant. It is the responsibility of the project managers, field managers, and site safety and health officers to ensure that this work is done safely. These personnel will verify that the HSP is sufficiently protective. If it is determined that the requirements of the HSP are not sufficiently protective, a field change order (FCO) will be prepared. FCOs will include a completed job hazard analysis or similar worksheet to ensure complete hazard assessment. FCOs must be approved by the program manager, health and safety manager, subcontractor project or field manager, and subcontractor health and safety representative. As a minimum, FCOs will be prepared if additional tasks will be performed.

5. SAMPLING AND ANALYSIS

A sampling and analysis plan has been developed for work planned during field activities. This plan includes tabulated sample descriptions, methods, quality assurance, and data management plans.

6. WASTE MANAGEMENT

A waste management plan has been developed for work planned during field activities. This plan includes a list of waste types and volumes.

7. ENVIRONMENTAL COMPLIANCE

The Tennessee Department of Environment and Conservation has been informed of the described project activity, including the intention to follow a best management practices plan. Compliance requirements will be maintained throughout all testing and sampling activity.

8. SEDIMENT AND EROSION CONTROL

It is not anticipated that sediment and erosion control will be necessary. Test pits will be opened and closed in the same day, and no soil will be stockpiled. Excavated soil will be put back into the test pit upon completion of sampling. In the unlikely event that a test pit must remain open overnight, a silt fence will be installed in accordance with LMES Engineering Standard ES-7.16-1 in locations necessary to control potential soil loss.

9. PROJECT TEAM

The project team is listed in Table 1. The key individuals and communication information are shown. This team will be informed of all progress and project changes for the duration of activity.

Table 1. Boneyard/Burnyard project team roster

Responsibility	Name	Phone No.
LMES Project Manager	John Vanderlan	576-2745
LMES Program Manager	Steve Haase	576-5790
LMES Data Manager	Virginia Forsberg	574-7000
LMES Sample Manager	Jim Davis	241-5066
LMES Compliance	Mick Wiest	574-3390
LMES Waste Management	Angela Fleming	574-9551
SAIC Project Manager	Duncan Moss	481-4752
SAIC Quality Assurance and Data Manager	Nile Luedtke	481-8751
SAIC Health and Safety Manager	Steve Davis	481-4755
SAIC Field Team Leader	Greg Schank	481-8760

SAIC = Science Applications International Corporation.

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