LOCKHEED MARTIN

Y/ER-314

ENVIRONMENTAL RESTORATION PROGRAM

Quality Assurance Project Plan for the Removal Action at the Former YS-860 Firing Ranges, 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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ENTECH, Inc.

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

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Prepared by
ENTECH, Inc.
Oak Ridge, Tennessee
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Environmental Management Activities at
OAK RIDGE Y-12 PLANT
Oak Ridge, Tennessee 37831
managed by
LOCKHEED MARTIN ENERGY SYSTEMS, INC.
for the
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DISCLAIMER

APPROVALS

Quality Assurance Project Plan
for the Removal Action
at the Former YS-860 Firing Ranges,
Oak Ridge Y-12 Plant,
Oak Ridge, Tennessee
(Y/ER-314)

March 1998

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Victor Turner, LMES Project Manager — Date

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ABBREVIATIONS

ASO	Analytical Services Organization
EDD	electronic data deliverable
ESP	Environmental Surveillance Procedure
LMES	Lockheed Martin Energy Systems, Inc.
QA	quality assurance
QC	quality control
SMO	Sample Management Office

EXECUTIVE SUMMARY

This quality assurance project plan defines project organization and roles of responsibility, sampling and field procedures, sample documentation and chain-of-custody protocols, equipment calibration, analytical procedures, data reduction and validation, and internal quality control procedures for the former YS-860 Firing Ranges removal action at the Oak Ridge Y-12 Plant. The ENTECH Team will maintain the highest standards to ensure strict compliance with this plan. Implementation of this plan will include consideration of the technical, as well as administrative, aspects of activities affecting quality. Plan implementation is based on the premise that quality controls selected for each element of work are consistent with the risk, importance, and health and safety considerations of performing the work.

The purpose of this removal action is to address lead-contaminated soil and reduce a potential risk to human health and the environment. This site is an operable unit within the Upper East Fork Poplar Creek watershed. The removal action will contribute to early source actions within the watershed. The project will accomplish this through the removal of lead-contaminated soil in the target areas of two small arms firing ranges.

This plan covers the removal action at the former YS-860 Firing Ranges. These actions involve the excavation of lead-contaminated soils, the removal of the concrete trench and macadam (asphalt) paths, verification sampling, grading, and revegetation.

1. INTRODUCTION

1.1 PROJECT DESCRIPTION

The former YS-860 Firing Ranges are located at the eastern end of the Oak Ridge Y-12 Plant outside the primary facility fenceline and west of Scarboro Road within the Upper East Fork Popular Creek watershed in Oak Ridge, Tennessee. A decision has been made by the U.S. Department of Energy to conduct a removal action of lead-contaminated soils at this site as part of early source actions within the Upper East Fork Poplar Creek watershed, which are consistent with the Oak Ridge Reservation Environmental Restoration Program. The removal action will focus on the excavation of bullets and lead-contaminated soil from the shooting range berms, transportation of the material to a permitted treatment facility for disposal, demolition and landfilling of a concrete trench and asphalt pathways at the site, and grading and revegetating of the entire site. This quality assurance project plan establishes the requirements for the control and assurance of field and laboratory activities associated with this action.

These activities are being conducted in support of the Lockheed Martin Energy Systems, Inc. (LMES), Environmental Restoration Program. This plan defines the project's quality program for these field activities; identifies requirements and responsibilities for ensuring objectives are achieved as planned; and describes or references the controls, procedures, and guidelines to be followed during performance of project activities. General quality assurance (QA) procedures are described in ENTECH's Quality Assurance Manual, Quality Assurance Program Plan.

1.2 QA OBJECTIVES

The objective of the project described in this plan is to perform a removal of lead contamination above the action level at the site and to perform site restoration compatible with a recreational land use. The data should be of sufficient quantity and quality to document the field activities; verify and confirm removal action effectiveness; and demonstrate the proper transportation, treatment, and disposal of waste from the site.

2. PROJECT ORGANIZATION AND RESPONSIBILITY

2.1 ROLES AND RESPONSIBILITIES

The roles and responsibilities of key personnel responsible for managing and ensuring that the project achieves its quality objectives and requirements are as follows:

- LMES Project Manager has overall responsibility for ensuring that this project accomplishes its mission and objectives. This includes execution of the project within the cost, schedule, quality, technical, health, and safety criteria established in the contract. The Project Manager selects the project team, coordinates the project planning and implementation, and reporting.

The Project Manager reviews this plan and establishes a management assessment process to assure that quality requirements are implemented by all participants.

- ENTECH's Project Manager is responsible for integrating the various organization's technical efforts in support of project planning, execution and reporting. The Project Manager coordinates the planning and implementation and reporting of the excavation, treatment, and disposal of lead-contaminated soil; demolition and disposal of a concrete trench and asphalt pathways; verification and confirmatory sampling; and regrading and revegetation of the site.

- ENTECH's Program Manager and the LMES Business Manager will ensure the integrity, completeness, and timeliness of project cost accounting, funding/authorization control, and work control.

- ENTECH's Field Manager will be present on-site during the majority of field activities. The Field Manager will act as the Project Manager's representative in the field and will exercise all necessary authority to assure that field activities are conducted according to schedules and according to technical and administrative requirements as specified in the removal action work plan (DOE 1998). The Field Manager will direct the daily activities of ENTECH field personnel, document site activities, record events and labor usage, and coordinate and oversee subcontractor personnel.

- ENTECH's Sampling Team Leader will be responsible for directing and performing confirmatory sampling activities and interfacing with the LMES technical staff for field decision making. The Sampling Team Leader will also be responsible for verifying record keeping (e.g., logbooks, chain of custody) and overall interpretation of data. With the Field Manager, the Sampling Team Leader will serve to facilitate fieldwork as required.

- The subcontractor organization(s) responsible for waste hauling, treatment and disposal, on-site laboratory analysis, and fixed-base laboratory analysis shall ensure that the quality-related activities for their respective tasks are planned, implemented, controlled, verified, and documented in accordance with the removal action work plan. Processes and activities affecting quality will be identified and controlled.

- The LMES Site Health and Safety Officer is supported by various disciplines within the Y-12 Plant safety and health divisions and is responsible for project safety and health compliance. The Compliance Manager will assist in defining the safety and health requirements and will perform assessments to confirm that requirements included in plans are implemented and adequate to achieve the project's safety and health requirements.

- ENTECH's Site Health and Safety Officer, in consultation with the LMES Safety and Health Manager, will ensure that an adequate level of personal protection exists for anticipated potential hazards for all field personnel. The Site Health and Safety Officer's actions are not dictated by any program or project constraints (such as budget and schedule) other than the assurance of appropriate safeguards for staff conducting on-site activities. Day-to-day on-site health and safety while in the field will be the responsibility of the Field Engineer and the Site Health and Safety Officer, working in coordination with the Project Manager and the LMES Safety and Health Manager.

- LMES Sample Management Office (SMO) representative assists in the development and selection of the sample collection, analysis, validation, and reporting processes. The SMO also is the primary interface for assessing and selecting laboratories involved in analyzing environmental data. The Y-12 Plant Analytical Services Organization (ASO) Laboratory is to be the laboratory for this project.

- The LMES Environmental Manager is supported by various disciplines within the Y-12 Plant Environmental Management division and is responsible for project environmental compliance. The Environmental Manager assists in defining the environmental requirements and will perform assessments to confirm that requirements included in plans are implemented and adequate to achieve the project's environmental compliance requirements.

- The ENTECH Quality Engineer has the responsibility and authority to identify and ensure that the appropriate quality requirements are defined, implemented, and documented by the project. The Quality Engineer assists in the preparation and review of this plan, verifies that it is implemented, reports the results to management, and verifies that appropriate corrective actions are planned and implemented. The Quality Engineer reports functionally to the LMES Project Manager and administratively to the ENTECH Project Manager.

Each organization performing work on this project shall adhere to the appropriate requirements of this plan and shall prepare implementing procedures for approval as defined herein and in their contract with LMES. 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.

2.2 PERSONNEL TRAINING AND QUALIFICATION

The project-specific training and qualification needs for the project are shown in Table 1. Personnel shall receive the necessary indoctrination and performance-based training. Each LMES organization and all contractors participating in the project are responsible for ensuring that requirements are met and for maintaining training records as Quality Assurance Records for persons assigned to them.

Each organization/contractor shall, if requested, provide the Project Manager with a list of the required training course titles and module numbers, as well as the names of the personnel who have completed the training. At a minimum, personnel performing work for the project shall have documented evidence of the necessary training, education, experience, or certification requirements.

Table 1. Project-specific training requirements

Personnel	Training required
Field personnel	Training per health and safety plan
Samplers	Sample collection, chain of custody, preservation, packaging and shipping processes
Decontamination	Decontamination procedures
Laboratory analyst	Analysis for lead and other analytical processes presented in Sect. 1.7
Data validation	Data validation techniques
Auditors (assessment personnel)	Quality surveillance/auditing techniques

3. SAMPLING AND FIELD PROCEDURES

Documented and controlled procedures will be used to perform field activities affecting quality. The procedures listed in Table 2 (or approved equivalent) will be used during the field sampling activities. Unless otherwise indicated, the implementing organizations are responsible for verbatim compliance to the procedures. Copies of the project-specific procedures will be available to project personnel in a separate YS-860 Firing Ranges Removal Action Project-Specific Procedures manual.

Table 2. Project-specific procedures

Field procedure description	Document number or reference	Implementing organization
Field Quality Control	ESP-102, Rev. 1	ENTECH
Statistical Sampling Design	ESP-103, Rev. 0	ENTECH
Collection of Soil Samples	ESP-303-1, Rev. 1	ENTECH
Sample Chain-of-Custody	ESP-501, Rev. 2	ENTECH
Field Logbook and Field Forms	ESP-503, Rev. 0	ENTECH
Field Monitoring Equipment Calibration	ESP-504, Rev. 0	ENTECH
Decontamination	ESP-801, Rev. 0[a] ESP-802, Rev. 0 ESP-803, Rev. 0	ENTECH
Sample Packing and Shipping	ESP-505, Rev. 1	ENTECH
Waste Management	ESP-105, Rev. 0	ENTECH
Land Surveying		ENTECH

[a]ENTECH plans to use these procedures with modifications. Modifications are described in the following project-specific work aids described in Chap. 3.

3.1 PROJECT-SPECIFIC WORK AID FOR FIELD QUALITY CONTROL PROCEDURE ESP-102, REV. 1

Protocols provided in procedure number Environmental Surveillance Procedure (ESP) 102, Rev.1, will be followed for defining the field quality control sampling requirements for this project. Specific QA/quality control (QC) samples to be collected include field duplicates, field blanks, and equipment rinsates.

Field duplicate samples will be collected at a rate of 10% of soil samples by collecting two aliquots from a composited sample volume. The two aliquots will be collected simultaneously to minimize any bias in the composited sample volume. Field duplicate sample results will be used to evaluate the precision and accuracy of the sampling and analytical processes.

A single potable water source field blank will be collected during the first week of remediation field activities. The sample will be collected directly into appropriate prepreserved sample containers from the on-site water supply spigot or hydrant. This sample will be used to ensure that source waters used for decontamination and QA/QC sampling do not contain unacceptable levels of lead. If the designated potable water source does contain excess lead, the sampling equipment decontamination process will be revised to eliminate or minimize the affect of this finding.

Equipment rinsates will be collected from clean sampling equipment at a rate of one per week in which sampling is taking place. The equipment rinsate sample will be collected by pouring deionized water over and through decontaminated sampling equipment and decanting the rinsate directly into appropriate prepreserved sampling containers. The equipment rinsate samples will be used to demonstrate the effectiveness of the sampling equipment decontamination process.

Trip blanks will not be used during this project except for waste acceptance criteria sampling because volatile organic compounds are not suspected to be present at the site. Temperature blanks will be included in coolers shipped for fixed-base laboratory analysis.

3.2 PROJECT-SPECIFIC WORK AID FOR SAMPLING DESIGN PROCEDURE ESP-103, REV. 0

Protocols provided in procedure number ESP-103, Rev. 0 will be followed for the design and implementation of the verification and confirmatory sampling. The verification sampling is based on a nonrandom authoritative grid because the general location of the affected media is well established (the range end berms). As a result of the random nature of the distribution of lead within a shooting range end berm and the localization of the lead contamination (bullets) within the soil matrix, samples will be collected at each grid node. The grid spacing will be set to provide for a large number of sampling locations to improve representativeness.

Verification sampling will be conducted in conjunction with excavation activities to ensure that the removal of contaminated soil effectively reduces lead concentrations below the action level. The sampling grid as defined in the field sampling and analysis plan (ENTECH, Inc. 1998a) accomplishes removing lead concentrations below the action level through visual inspection and verification soil sampling. The results of verification soil sampling will be used to determine if any additional soil will be removed from the berm face. If additional soil is removed, a second round of verification sampling will be conducted in the area of the additional berm cut.

Confirmatory sampling is based on both nonrandom and random grid sampling. A grid will be established over the area of regraded soil, and shallow (2-in. bgs) samples will be collected at each grid node (nonrandom sampling). Additionally, eight grid nodes from the same grid will be selected by using a random number table to assign the grid coordinates. Surface soil samples will be collected by using a hand auger at the randomly selected nodes to a depth of 6-in. bgs.

3.3 PROJECT-SPECIFIC WORK AID FOR COLLECTION OF SOIL SAMPLES PROCEDURE ESP-303-1, REV. 1

Collection of shallow surface soil samples (2-in. bgs) will be accomplished by using a clean stainless-steel spade, scoop or spoon following ESP-303-1, Rev. 1. The sample will be collected from the cut or regraded surface to a depth of approximately 2-in. bgs. The sample excavation shall be symmetrical to the extent possible to avoid vertical bias of the sample volume. The soil aliquot will be collected directly into a clean stainless-steel bowl for compositing. The aliquot collected should be approximately 8-oz in volume, and care should be taken to ensure that all aliquots within a given composite sample are the same volume. The sampling device or a clean sample container can be used to measure the sample aliquot at each sampling location.

Collection of discrete surface soil samples (6-in. bgs) will be accomplished by using a clean hand-driven stainless steel bucket auger (preferably 2-in. inside diameter) in accordance with ESP-303-1. The auger will be advanced at the selected grid node to 6-in. bgs and the entire sample volume transferred directly to a sample container with a clean stainless-steel spoon or, if necessary because of the volume, to a clean bowl for homogenization and subsampling. Any excess sample volume will be replaced into the auger boring. The use of plastic sheeting will not be necessary because of the depth of sampling.

3.4 PROJECT-SPECIFIC WORK AID FOR SAMPLE PACKING AND SHIPPING PROCEDURES OF ESP-505, REV. 1

Protocols provided in ESP-505 will be followed. Samples will be transported to the Y-12 Plant ASO fixed-base laboratory for analysis.

3.5 PROJECT-SPECIFIC WORK AID FOR DECONTAMINATION PROCEDURES OF ESP-801, REV. 0; ESP-802, REV. 0; AND ESP-803, REV. 0

Decontamination of heavy equipment, tools, and vehicles is not expected to be required. Cleaning of heavy equipment, tools, and vehicles will be limited to washing soil from the equipment with potable water on-site. The use of detergents, pressure washing, or steam cleaning will only be performed if radiological screening performed by LMES or other chemical monitoring indicate that additional decontamination following ESP-802 and/or ESP-803 is necessary to clear the equipment for release.

Sampling equipment decontamination will be performed following ESP-801 (formerly ESP-900) procedures for stainless steel or metal sampling equipment with the exceptions indicated below. The cleaning will be performed in the field at a lined temporary decontamination pad erected at the site. Cleaning solutions used during equipment decontamination, with the exception of the

solvent rinsate, will be disposed of on-site. The solvent rinsate will be collected and containerized for off-site disposal. The revised cleaning procedure will consist of the following steps:

1. Thoroughly scrub and wash the equipment in a solution of potable water and an environmentally benign laboratory detergent (e.g., Liquinox).

2. Rinse the equipment with potable water.

3. Rinse the equipment with deionized water.

4. Rinse the equipment with laboratory-grade isopropyl alcohol.

5. Allow to air dry for as long as practical (a minimum of 15 min).

6. If the equipment is to be stored for more than 24 hours before use, it will be wrapped in foil or clean plastic.

3.6 PROJECT-SPECIFIC WORK AID FOR LAND SURVEYING

Land surveying will be performed to provide location information for verification and confirmatory sampling grid corner and/or end stakes. Other transect stake and grid node locations will be determined by direct measurement with a fiberglass tape by the ENTECH personnel and recorded in the field logbook with a unique station identifier keyed to the location. These measurements along with the land surveying coordinates will be used to produce scale sampling location maps in the Y-12 Plant Administrative Grid.

Surveying will be accomplished by the Y-12 Environmental Restoration Program personnel unless otherwise dictated.

4. SAMPLE DOCUMENTATION AND CUSTODY PROCEDURES

4.1 CHAIN-OF-CUSTODY

Sample custody shall be performed in accordance with procedure ESP-501, Rev. 2, "Sample Chain of Custody." Sample and project identifiers, sample media, type, preservative, date, time, and signature of sample custodians will be included on standard preprinted chain-of-custody forms. Laboratory chain-of-custody forms will be used for fixed-base laboratory samples. Following analysis, original or original carbon copies of the chain-of-custody forms will be returned to ENTECH.

4.2 SAMPLE CUSTODY SEALS

At the time of collection, the samples will have a seal placed across the container opening in accordance with ESP-501, Rev. 2. The sample seal ensures the integrity of the sample, protects the custody, and provides the following information:

- name or initials of person collecting the sample and
- date.

4.3 SAMPLE CONTAINER LABELS

Each sample container will be labeled with a self-adhesive label in accordance with ESP-501, Rev. 2, or have the equivalent information written in indelible ink directly on the container at the time of sample collection. Sampler team members will fill out the labels on each container before collection to minimize handling errors. Labels will be permanently attached to the sample container and discarded with the container when analysis is complete. Sample identification numbers will be derived as indicated in Sect. 5.1.1 of the removal action work plan. Label information will include the following information:

- name of collector,
- sample number (e.g, VW05C00-06), and
- sampling time and date (e.g., 1400, 01February1998).

4.4 FIELD NOTEBOOKS

Field activities will be recorded in field notebooks in accordance with ESP-503, Rev. 0. Field notebooks will be bound with consecutively numbered pages. All pertinent information necessary to interpret fixed-base laboratory analytical data will be recorded in field notebooks. The entries should also provide a chronological record of the team's activities, enabling reconstruction of the field activities at a later date. The following minimum entries are to be included:

- date and time of collection,
- name(s) of sample collector(s),
- number of samples taken,
- type of sample container,
- sample identifier,
- observations during sampling (unusual waste stream conditions: color, density, thickness, texture of sample),
- description of sampling equipment,
- sample location,
- site activities,
- volume of soil/debris removed, and
- bill of lading/waste container/shipping document identification numbers.

5. CALIBRATION PROCEDURES AND FREQUENCY

Instruments that affect the quality of the data and health and safety of the workers shall be calibrated using standards traceable to nationally recognized standards organizations. Unless otherwise indicated, instruments shall be calibrated at least once per day before being used as, shown in Table 3. Calibration procedures and the results of calibration checks shall be documented.

Organizations responsible for equipment calibration shall have and implement a system for controlling the calibration of equipment.

Table 3. Field instrument calibration frequency

Instrument	Calibration frequency
Chemical monitoring (e.g., photo ionization detector)	Daily before use
Radiological monitoring (Geiger-Muller counter, alpha scintillation)	Daily before use

Historical site data and current well monitoring data indicate that there is limited potential for exposure or contamination of site personnel within the scope of this project; therefore, a photo ionization detector is not proposed to be used for this project. The primary potential for contamination would be from lead in the soil to be removed. Although no radiological exposure is anticipated during planned site activities, project team members should conduct radiological screening of their hands and equipment periodically. A Y-12 Plant Health Physics technician will periodically monitor site operations and site equipment for radiological contamination.

Before shipment of any samples, the SMO may review the calibration protocol and acceptance criteria of the fixed-base analytical laboratory through an on-site audit. The Y-12 Plant ASO laboratory standard calibration protocol has been SMO approved. Minimum calibration requirements for laboratory instruments are specified in the corresponding analytical methods. Laboratory instrument calibration and operation will be recorded on hard-copy records.

6. ANALYTICAL PROCEDURES

The analytical support for the YS-860 Firing Ranges Removal Action project will consist of the LMES SMO-approved fixed-base Y-12 Plant ASO analytical laboratory. A total of 699 shallow surface soil samples will be collected and composited for a total of 75 samples submitted for fixed-base laboratory analysis. This total includes verification and confirmatory composite samples. In addition to the composite samples, a total of eight discrete surface soil samples will be collected and submitted for fixed-base laboratory analysis. QA/QC samples include eight soil duplicates to be submitted for fixed-base laboratory analysis, one water source field blank, and three equipment rinsates for fixed-base laboratory analysis.

Analytical methods and sample loads associated with this project are summarized in Tables 4, 5, and 6.

Table 4. Analytical requirements for verification sampling by fixed-base laboratory

Analyte	Protocol	Procedure	Number of samples	Rinsate blanks	Field blanks	Field duplicates	Total samples
Lead	SW-846	EPA-7421	58	2	1	6	67

Table 5. Analytical requirements for fixed-base laboratory

Analyte	Protocol	Procedure	Number of samples[a]	Rinsate blanks	Duplicates	Total samples
Lead	SW-846	EPA-7421	25	1	2	28

[a]Includes fixed-base laboratory confirmation and discrete samples

Table 6. Analytical requirements for waste acceptance criteria sampling by fixed-base laboratory[a]

Waste acceptance criteria	Protocol	Procedure	Number of samples
Total organic compound	SW846	9060	1
Inductively coupled plasma metals	SW846	3050/6010	1
Cyanide	SW846	9010	1
TCLP NV Extraction	SW846	1311	1
TCLP Metals	SW846	6010	1
TCLP Mercury	SW846	7040	1
TCLP Selenium	SW846	7740	1
Soil pH	SW846	9045	1
Soil particle size distribution	ASTM	D421-85	1
Volatile organic compounds	SW846	8260	1
Semivolatile organic compounds	SW846	8270	1
PCBs/pesticides	SW846	8081	1
Herbicides	SW846	8150	1
Bulk density	ASTM	D5057	1
Gross alpha beta	EPA	900.0	1
Percent moisture	ASTM	D2216-90	1

TCLP = toxicity characteristic leaching procedure; ASTM = American Society for Testing and Materials; EPA = U.S. Environmental Protection Agency.

[a]Waste acceptance criteria analyses will be performed before initiating other removal and sampling activities.

7. DATA REDUCTION, VALIDATION AND REPORTING

7.1 LABORATORY DATA REDUCTION AND VERIFICATION

The fixed-base analytical laboratory will reduce and review analytical data for correctness in accordance with the specific procedures and the internal QA programs of the contract laboratory. The practices of the fixed-base analytical laboratory is evaluated as part of the SMO qualification requirements to receive samples. All data generated for controls and samples shall be maintained on an Oak Ridge Environmental Information System–compatible database/system.

7.2 LABORATORY REPORTING

When analytical work has been completed and reviewed, the laboratory will prepare a case narrative that describes the analytical results, quality control results, review, and other relevant information. NOTE: Because key decisions will be weighted on matrix spike recovery information, **ANY** failure to meet recovery criteria given in the applicable method must be presented and explained in the case narrative. Any specified recourse given in the method, such as use of method of standard additions if recovery is not within the acceptance limits, must also be followed.

The fixed-base analytical laboratory must report hard-copy data in a format consistent with the requirements prescribed in the SMO Analytical Master Specifications section of the fiscal year 1997 LMES Analytical Support Agreement Terms and Conditions. The SMO will review the forms before work begins to ensure all reporting requirements specified will be met. Complete data packages are to be supplied. These are to include the analytical and quality control sample results on forms as well as all associated raw data, including instrument printouts and copies of applicable standards and sample preparation logbook pages. These complete data packages are defined in applicable SMO Analytical Master Specifications.

In addition to the hard-copy deliverables specified, the fixed-base analytical laboratory is also to supply results for samples and quality control in electronic format. The preferred electronic format is PEMS and will be attached to the analytical laboratory statement of work.

7.3 CONTRACT VERIFICATION/ELECTRONIC DATA DELIVERABLE SCREENING

Contract verification is performed to ensure completeness and consistency with the deliverable requirements in the SMO Analytical Master Specifications. When contractual requirements are not satisfied, the SMO will contact the laboratory to resolve the problem. A report detailing the results of contract verification will be generated by the SMO and will be forwarded to the project for each data package. The guidelines for the contract verification associated with this project are defined in Oak Ridge Reservation SMO procedure LMES-ASO-AP-206.

Electronic data deliverable (EDD) screening will be performed to ensure consistency of format and screening for inconsistencies between electronic and hard-copy laboratory deliverables. The EDD screening report and the EDD will be performed by ENTECH and documented in the project file. The guidelines for the EDD screening are defined in Oak Ridge Reservation SMO procedure LMES-ASO-AP-206.

7.4 DATA VALIDATION

Data validation is performed to evaluate the sufficiency of data for intended use and shall be performed to an extent consistent with the objectives of the project. Reviews will entail evaluation of data reported on standardized forms and may include a detailed review of raw data. Validation of fixed-base laboratory data will be performed consistently with requirements in the LMES procedure for Metals Data Verification and Validation. Discrepancies in the fixed-base laboratory analytical data packages will be resolved to the extent possible with the contract laboratory. These discrepancies and their resolution will be reported to the SMO by ENTECH.

8. INTERNAL QUALITY CONTROL CHECKS

8.1 FIELD QUALITY CONTROL

Field QC checks will be implemented through all phases of the field investigation. The QC features, requirements, and method of checking are presented in Table 7.

Table 7. Field internal quality control

Feature controlled	Requirement	QC check
Outside Sources of Contamination	Use of new or precleaned sample containers	Sample container materials will be certified lead-free
	Ensure potable water source does not contain lead	Collect and analyze field blank of potable water source
Cross-Contamination	Chemical decontamination of all sampling equipment between samples	Inspect equipment for visual cleanliness
		Collect and analyze equipment rinsate samples
Sampling Collection Technique Variability	Collect field duplicates of samples	Collect and analyze 10% of total samples as field duplicates
Completeness and Accuracy of Data.	Verification and validation of the data	Review completed field data records for completeness and accuracy before submittal to validator

8.2 LABORATORY INTERNAL QUALITY CONTROL

The QC program will consist of an internal program for the fixed-base analytical laboratory QC requirements.

Before the submission of any samples to the contract fixed-base laboratory, the SMO will have reviewed the QC program within that laboratory. The Y-12 Plant ASO Laboratory is an SMO-approved laboratory. The SMO will review the documentation of the QC program as well as its implementation within the laboratory. To receive and analyze samples, the laboratory must demonstrate to the SMO that it has developed and implemented a documented and auditable QC program. The goal of the laboratory QC program is to monitor the activities within the laboratory and to ensure that all data generated are reliable.

The laboratory will analyze the submitted samples in batches so that a spike sample, and a duplicate or spike duplicate, can be prepared from the sample matrix. A laboratory control sample must also be analyzed with the batch if the analytical protocol in use can accommodate such samples. Measurements from these extra samples will serve as tools to evaluate the quality of data being furnished by the laboratory. Procedures for utilizing surrogates, spikes, laboratory control

samples, blanks, and control charts will be reviewed during the SMO audit. At a minimum, the quality control program of the laboratory must meet the criteria specified within the required SW-846 methods and SW-846 Chapter One, *Quality Control.*

9. PERFORMANCE AND SYSTEM AUDITS

An assessment (e.g., audit) schedule shall be developed and maintained to identify and schedule the areas that will be reviewed. All assessment and surveillance activities shall be planned, conducted, and documented in accordance with project, site-specific, or LMES guidance.

9.1 MANAGEMENT ASSESSMENT

The project assessment activities are comprised of a readiness review and ongoing management assessments. Readiness (to begin work) review will be conducted before the initiation of on-site activities (mobilization, excavation, or sampling) to ensure all necessary preparations have been completed. Management assessments will be conducted periodically by the LMES Project Manager or designee and by the ENTECH Project Manager. These assessments should consider LMES *and* contractor safety, health, quality, and environmental performance as well as cost and schedule performance. Deficiencies will be corrected and the assessment results reported to the LMES and ENTECH Project Managers.

9.2 INDEPENDENT ASSESSMENT

Independent assessments will be performed to determine whether there is objective evidence that activities comply with procedures, instructions, drawings, and other documented requirements. These assessment activities will evaluate if the project objectives are clearly defined and effectively implemented per the project documentation.

Scheduled independent assessments may be performed by the LMES Project Quality Engineer. Other independent assessments may be scheduled and performed at the discretion of the LMES Project Manager and the ENTECH Project Manager. Results will be documented and reported to the Project Managers and other appropriate LMES organizations. Independent assessments shall be included in the project assessment scheduled mentioned above.

10. PREVENTATIVE MAINTENANCE

There are no special preventative maintenance or spare part requirements for the project. However, each organization should consider the affect on the schedule if preventative maintenance is not conducted or spare parts or equipment are not immediately available. A 24-hour repair or replacement requirement is included in the various subcontractor statements of work for all key equipment (e.g., trackhoes, loaders) to minimize the affect of any unanticipated breakdowns.

Preventive maintenance of analytical instruments used in this project will be performed according to the procedures and schedules set forth in manufacturers' maintenance manuals and as described in appropriate parts of standards methods. Documentation of maintenance must be maintained. Critical spare parts must be on hand or readily accessible. The preventive maintenance program of the laboratory will be verified through the SMO audit program.

11. SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

11.1 PRECISION, ACCURACY, REPRESENTATIVENESS, COMPLETENESS AND COMPARABILITY OBJECTIVES

The data generated during this project will be evaluated in term of precision, accuracy, representativeness, completeness, and comparability. A summary of the acceptance criteria for precision, accuracy, and completeness is given in Table 8.

Table 8. Acceptance criteria for precision, accuracy and completeness

Parameter	Sample type	Precision	Accuracy	Completeness
Lead	Total	25%	50-150%	95%

11.1.1 Precision

The following definition defines the QA objective for precision: A measure of mutual agreement among individual measurements of the same property usually under "prescribed similar conditions." Precision can be expressed in terms of relative percent difference for two replicate measurements, say X_1 and X_2.

Percent Relative Difference = $[X_1 X_2 / 0.5 \times (X_1 X_2)] \times 100\%$

Various measures of precision exist, depending on the prescribed similar conditions.

11.1.2 Accuracy

Accuracy is defined as the degree of agreement between a measurement (or an average of measurements of the same parameter) X, with an accepted reference or true value T. Accuracy can be expressed as the difference between the two values, X - T, or the percent relative difference to the reference or true value, 100% (X - T)/T, and is sometimes expressed as the percent recovery by the ratio, 100% (X/T). Accuracy is a measure of the bias in a system. Accuracy values presented in Table 9 and are expressed as percent recovery of the true or known value. Several means of assessing accuracy are indicated in the analytical methods and the QC chapter of SW-846. The accuracy objective for this project is based on results of laboratory control sample analysis.

Table 9. Methods for assessing field precision, accuracy and completeness

	Method for assessing		
Data source	**Precision**	**Accuracy**	**Completeness**
Monitoring equipment	Calibration checks	Calibration checks	Records review, project assessments
Sampling process	Field duplicate and equipment rinsate analysis; Use of controlled procedures and trained personnel	Field duplicate analysis; Use of controlled procedures and trained personnel	Records review, data verification and validation, project assessments
Sample accountability (chain of custody)	Not Applicable	Not Applicable	Records review, data verification and validation, project assessments

11.1.3 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount expected to be collected under normal conditions. To achieve the 90% confidence level, the goal for completeness is 100%. However, an acceptance criteria of 70% completeness has been established because of the possibility of iterative sampling and the potential for changes in the grid size for the confirmatory sampling.

11.1.4 Representativeness and Comparability

Representativeness and comparability objectives are not quantifiable. Representativeness is defined as the degree to which data accurately and precisely represent a characteristic of a population, process condition, or an environmental condition. Comparability is defined as the confidence with which one data set can be compared with another. The proper use of standard and approved sampling methods (including subsampling in the laboratory) will optimize representativeness. Using standardized and approved methodology and reporting the results in common units will ensure comparability.

11.2 FIELD ACTIVITIES

The precision, accuracy, and completeness of field monitoring and measurement data shall be assessed on a routine basis. The methods used to assess these parameters are presented in Table 9.

11.3 LABORATORY ACTIVITIES

The precision, accuracy, and completeness of laboratory analytical data is dependent on proper implementation of internal QA/QC requirements to minimize the affect of inherent sample variability. Assessment of laboratory data quality shall be performed on an ongoing basis. Setting

of laboratory detection limits provides a basis for measuring laboratory data quality. Detection limit goals are based on the overall project objectives.

11.3.1 Laboratory Detection Limits

The analytical methods selected have been chosen for their reliability, implementability, and proven performance on similar projects in similar matrices. A method detection limit chosen for fixed-base laboratory analysis of lead in soil by the U.S. Environmental Protection Agency Method 7421 is approximately 50 μg/g. Mechanical factors that influence detection limits include instrument condition, tuning, operation, and lack of contamination in the analytical system. Laboratory QA/QC protocols are designed to minimize these factors.

11.3.2 Laboratory Data Quality

Laboratory data collected during this project include on-site field screening and fixed-base analysis of lead and waste acceptance criteria. Each type of data is associated with a quality level or parameter reflecting the utility of the measurement for a given purpose. Each type of measurement is made to achieve a specific project objective that ranges from quantifying the extent and magnitude of the contamination to data sufficient for risk-based decision making. Each objective has as an associated level of data quality necessary to achieve the objective. The types of data collected during this project have been designed to meet the specific project objectives presented in the removal action work plan. The laboratory deliverable categories have been designed in accordance with these objectives.

It must be emphasized that the level of data quality implies the degree of confidence in the data, not necessarily in the accuracy of the data. For example, field pH measurements may be more accurate or representative of the actual pH than laboratory measurements but have a lower degree of confidence.

Laboratory precision is based on the calculated percent relative difference for duplicate analyses. Laboratory precision criteria will be verified during the on-site audit conducted by the SMO.

Laboratory accuracy is determined from the percent recovery based on the recovery of spike analytes or on the recovery of surrogate spikes where utilized. Laboratory recovery criteria will be verified during the on-site audit conducted by the SMO.

Analytical procedures conducted by the fixed-base laboratory reflect the highest data quality levels for the activities covered by the removal action work plan.

12. PERFORMANCE, SYSTEM AUDITS, CORRECTIVE ACTIONS, AND QA REPORTS

12.1 PERFORMANCE/SYSTEM AUDITS

All analytical support laboratories participating in the SMO are prequalified by means of an on-site annual audit. The audit evaluates the capabilities and established quality programs of all

support laboratories. As a part of the SMO Analytical Support Agreement, established lines of inquiry have been developed for the assessment of the technical and quality systems of the support laboratories.

Project-specific lines of inquiry will be developed to address the requirements defined for this project. The lines of inquiry will be completed based on the results of the previous qualification audits and the monthly progress reports submitted by the selected laboratory. On the basis of the results of the project-specific lines of inquiry and the requirements of the project, a project-specific audit of the fixed-base laboratory may be conducted by the SMO or ENTECH. The SMO has reviewed the Y-12 Plant ASO laboratory procedure for sample receipt, required analytical methodologies, and reporting requirements.

12.2 CORRECTIVE ACTIONS/QA REPORTS

When the need for corrective actions has been identified, holding times missed, or suspect data generated, the person within the laboratory designated to address QA is responsible for reporting any related nonconformance and associated corrective action to the SMO and ENTECH. Nonconformance and corrective actions will be recorded by written reports, noted in the case narrative, and will become part of the records of the laboratory taking such actions. Fixed-base laboratory policy for corrective actions and QA reports will be reviewed by the SMO.

12.3 CORRECTIVE ACTION (QUALITY IMPROVEMENT)

Quality improvement objectives include prevention and early detection of quality problems along with continuous process improvement. The Project Managers and assigned personnel shall monitor project performance to identify areas for quality, cost, and schedule improvements. Performance data, failure costs, prevention costs, and other quality-related information will be analyzed to identify trends that could adversely affect quality and thereby indicate items or areas for potential improvements to the process. Items and processes that do not meet established requirements and goals or that do not result in the anticipated quality are to be identified, documented, analyzed, and resolved or dispositioned in accordance with project-specific, site-level, or LMES guidance.

The Project Managers will use the following techniques to detect, minimize, or prevent quality problems:

- conduct regularly scheduled project team meetings;
- develop written instructions, procedures, and drawings;
- conduct design and document reviews;
- identify training needs;
- ensure training is completed and documented;
- conduct assessments, readiness reviews, and surveillances in accordance with site-level and LMES guidance; and

- ensure that health and safety pre-entry briefings are conducted, when required, as identified in the project-specific health and safety plan (ENTECH, Inc. 1998b).

All nonconforming items and services that are to be dispositioned as "use as is or repair" shall be submitted to the LMES and ENTECH Project Manager for approval before use or implementation.

12.4 QA REPORTS TO MANAGEMENT

The following quality reports shall be provided to the Project Managers as soon as possible after production:

- assessment reports,
- nonconformance reports, and
- quality deficiencies and recommended solutions.

13. DOCUMENTS AND RECORDS

The LMES and ENTECH Project Managers shall ensure a document control system is established and maintained throughout the life of the project. The system for controlled documents shall ensure that documents are reviewed for adequacy, approved for release by authorizing personnel, and distributed to and used at the location where the prescribed activity is performed. The LMES Project Manager will identify a list of required reviewers for documents affecting the project and coordinate timely review, comment and resolution of issues by the designated reviewers. This plan and implementing procedures, as well as other applicable LMES procedures, shall be used to assure and control the quality of project documents and related activities.

Record copy materials generated by the project shall be routinely submitted to the Environmental Management and Enrichment Facilities Document Management Center for retention. Records shall be maintained in accordance with appropriate site-level or LMES guidance. Revisions of controlled documents should be reviewed and approved by the same organizations that provided the original review and approval, unless otherwise specified by the LMES Project Manager. The LMES Project Manager shall also ensure that Quality Assurance Records and Controlled Documents are transmitted to and maintained in the Document Management Center.

14. REFERENCES

DOE (U.S. Department of Energy) 1998. *Removal Action Work Plan for the YS-860 Firing Ranges, Oak Ridge Y-12 plant, Oak Ridge, Tennessee*, DOE/OR/01-1709&D1, Lockheed Martin Energy Systems, Inc., Oak Ridge, Tenn.

ENTECH, Inc. 1998a. *Field Sampling and Analysis Plan for the YS-860 Firing Range Removal Action, Oak Ridge, Tennessee*, Y/ER-313, Lockheed Martin Energy Systems, Inc., Oak Ridge, Tenn

ENTECH, Inc. 1998b. *Health and Safety Plan for the YS-860 Firing Range Removal Action, Oak Ridge, Tennessee*, Y/ER-313, Lockheed Martin Energy Systems, Inc., Oak Ridge, Tenn.

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