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FINAL

SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN

UNNAMED TRIBUTARY OF PATROON CREEK, PATROON CREEK, AND THREE MILE RESERVOIR

OCTOBER 2003

U.S. ARMY CORPS OF ENGINEERS
NEW YORK DISTRICT OFFICE

FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM

OCL 2003.10.042

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LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS

%R	percent recovery
µg/g	micrograms per gram
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
AOC	Area of Concern
ARAR	*applicable or relevant and appropriate requirement*
CCV	Continuing Calibration Verification
CFR	Code of Federal Regulations
COC	Chain-of-Custody
CVAA	cold vapor atomic absorption
DQO	data quality objective
ECD	electron capture detector
EDi	Environmental Dimensions, Inc.
FAR	Federal Acquisition Requirement
FID	flame ionization detector
FSP	Field Sampling Plan
FUSRAP	Formerly Utilized Sites Remedial Action Program
GC/ECD	gas chromatography with an electron capture detector
GC/MS	Gas Chromatograph/Mass Spectrometer
GPC	Gel Permeation Chromatography
Ha	Alternative Hypothesis
HASP	Health and Safety Plan
HAZWOPER	*Hazardous Waste Operations and Response*
HCN	hydrocyanic acid
Hg	mercury
H0	Null Hypothesis
ICP	inductively coupled plasma emission spectroscopy
IDL	instrument detection limit
IDM	investigation-derived materials
KC	Kansas City
LCS	laboratory control sample
MDA	minimum detectable activity
MDC	minimum detectable concentration
MDL	method detection limit
MeV	mega electron volt
mg/L	milligrams per liter
MRL	method reporting limit
MS	matrix spike
MSD	matrix spike duplicate
NCP	*National Contingency Plan*
nm	nanometers
NRC	National Research Council
NYSDEC	New York State Department of Environmental Conservation
OSHA	Occupational Safety and Health Administration
pCi/g	picocuries per gram
PGM	Pancake Geiger-Mueller
PID	photoionization detector
PPE	personal protective equipment
ppm	parts per million
PQL	practical quantitation limit
PRAC	Pre-Placed Remedial Action Contract
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Project Plan

QC	Quality Control
QIP	quality improvement process
RER	relative error ratio
RPD	relative percent difference
SAP	Sampling and Analysis Plan
Shaw	Shaw Environmental, Inc.
SI	Site Investigation
SOP	Standard Operating Procedure
SOW	Statement of Work
SSHO	Site Safety and Health Officer
SV	screening value
SVOC	semi-volatile organic compound
TAT	turnaround time
TCLP	Toxicity Characteristic Leaching Procedure
Th-232	Thorium-232
TPU	Total Propagated Uncertainty
U-238	Uranium-238
USACE	U.S. Army Corps of Engineers
USDOE	U.S. Department of Energy
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound

1.0 INTRODUCTION

Shaw Environmental, Inc. (Shaw) has been contracted by the U.S. Army Corps of Engineers (USACE) to perform a Site Investigation (SI) for sediment within the unnamed tributary of Patroon Creek, Patroon Creek, and the Three Mile Reservoir. These three Areas of Concern (AOCs) are located downstream of the Colonie Formerly Utilized Sites Remedial Action Program (FUSRAP) Site, and the SI is being conducted to evaluate if radiological contamination resulting from historical site operations conducted at the Colonie FUSRAP Site has impacted the sediment at the three AOCs.

The Colonie FUSRAP Site is located in the Town of Colonie, Albany County, New York (**Exhibit 1-1**). The three AOCs for this Sampling and Analysis Plan (SAP) are as follows: the unnamed tributary from where it leaves the Colonie FUSRAP Site to where it intersects to Patroon Creek; Patroon Creek from the confluence of the unnamed tributary to Three Mile Reservoir; and, Three Mile Reservoir. **Exhibit 1-2** shows the locations of the three AOCs discussed in this SAP. This work is being performed for USACE under the Kansas City (KC) District Pre-placed Remedial Action Contract (PRAC) DACW41-01-D-0031 Delivery Order DA02.

This SAP contains a Field Sampling Plan (FSP) and a Quality Assurance Project Plan (QAPP). It outlines the data quality objectives (DQOs) and details the specific sampling procedures and the relevant sampling and analytical protocols to ensure that the data collected are of sufficient quality to support remedial decisions.

This plan details the general procedures to be followed for sampling activities and analytical requirements for both off-site and on-site laboratories. It has been prepared in general accordance with applicable requirements of USACE EM-200-1-3 guidelines (USACE, 2001a). This plan is complementary to and supports the following documents associated with the removal action work at the Colonie FUSRAP Site:

- Operations Work Plan;
- Health and Safety and Emergency Response Plan;
- Contractor Quality Control Plan;
- Final Status Survey Plan;
- Groundwater Treatment Plant Operations and Maintenance Manual; and,
- Soil Stabilization System Operations and Maintenance Manual.

The above documents are incorporated by reference into this document and should be consulted as necessary for background information and details on the particulars of each individual document.

1.1 SITE LOCATION, DESCRIPTION AND BACKGROUND

Please refer to Section 2.0 of the Patroon Creek Site Investigation work plan (USACE, 2003a) for a detailed discussion of the project, including the following information:

- Site description and current status;
- Relevant background information; and,
- Previous investigations.

1.2 SCOPE OF WORK

The project-specific objectives are to determine the absence/presence of radioactive contamination within the three AOCs as a result of historic industrial operations conducted at the Colonie FUSRAP site. This will be accomplished by screening for absence/presence of radiological constituents on-site by direct gamma scans of the cores using a Pancake Geiger-Mueller (PGM) instrument. In addition, a select percentage of off-site gamma/alpha spectroscopy confirmation samples will be collected and analyzed. If radiological contamination is detected at a level greater than 1.5 times instrument background (recorded for each measurement), the level of non-radiological contamination will also be determined to aid in evaluations of waste acceptance criteria requirements. This will be accomplished by screening for radiological constituents using a PGM instrument; determining if concentrations exist; and determining if waste disposal actions are required in radiological contaminated areas by sampling for metals parameters. Sample collection will be performed in accordance with established Standard Operating Procedures (SOPs) (**Appendices A & B**) designed to ensure the collection of representative samples. Southwest Laboratories of Oklahoma, the current Colonie FUSRAP Site subcontractor laboratory is approved by USACE will perform sample analysis. The laboratory's QA plan may be found in **Appendix C**. Laboratory analytical methods will be performed in accordance with U.S. Environmental Protection Agency (USEPA) protocols and methods. Data generated may be part of an investigation used in a future risk assessment. Shaw will validate the data to meet the requirements for a risk assessment following USEPA Region II validation SOPs. These SOPs meets all of the validation elements suitable for a risk assessment. Criteria requirements of the QAPP, USACE Shell (USACE, 2001b) document, the analytical method, and laboratory SOP will be evaluated during the validation process. Data qualifiers will be consistent with USEPA Region II guidelines.

This field effort includes the collection and analysis of sediment sample cores for radiation using a PGM instrument from the following locations (Refer to **Exhibit 1-3**):

- Along Patroon Creek Upstream of Colonie: One sample (CSD-US1) will be collected upstream of the Colonie FUSRAP Site.
- Unnamed Tributary of Patroon Creek: A total of seven samples (CSD-UT1 through 7) are to be collected from locations along the unnamed tributary that crosses the Colonie FUSRAP Site. Two sets of three transects (samples CSD-UT1/2/3 and CSD-UT5/6/7) will be collected to represent a cross-section of the creek to account for various flow/sedimentation conditions.
- Patroon Creek: A total of four samples (CSD-PC1 through 4 on **Exhibit 1-3**) are to be collected from locations along Patroon Creek. One sample will be collected at the point where the Unnamed Tributary meets Patroon Creek. One sample is to be collected at a point between the convergence of the Unnamed Tributary meets Patroon Creek and before the sedimentation pool. One sample is to be collected from the sedimentation pool before Central Avenue and one sample is to be collected between Central Avenue and Three Mile Reservoir).
- Three Mile Reservoir: Samples will be collected from a total of fifteen sample locations (CSD-3MR1 through 15). Transect locations have been selected near the dam as that is where the previous core sample showed contamination and at the beginning of the transition section between Patroon Creek and Three Mile Reservoir where the old sedimentation basin was located and where the wetlands begin. In addition, two transects (CSD-3MR5/6/7 and CSD-3MR9/10/11) were selected as midpoints between the other two transects. Single sampling points (CSD-3MR4, CSD-3MR8 and CSD-3MR12) were located between transects along the path of the main flow. It is anticipated that the transects and individual points should provide information to determine the absence/presence of radiological contamination.
- Downstream of Three Mile Reservoir: A total of two samples (CSD-DS1 and CSD-DS2) will be collected from locations downstream of the dam at the Three Mile Reservoir. The sample locations will be selected in areas of sedimentation to determine if the material has moved downstream of Three Mile Reservoir.

At any sample location where on-site radiological contamination is present, a sample will be sent to the off-site laboratory and analyzed for Toxicity Characteristic Leaching Procedure (TCLP) metals for waste characterization. The waste characterization samples are to be collected from the same sample that is screened using a PGM instrument. Ten percent of these samples will also be analyzed for full TCLP, ignitability, corrosivity as pH, and reactivity as confirmation. Due to the history of the area, TCLP metals and radiologicals are target analyses. However, to ensure that the IDM generated has been fully characterized, the full waste characterization suite will be being performed on 10% of the IDM collected. Please refer to the Patroon Creek SI Work Plan (USACE, 2003a) for detailed information and discussions on the scope of work.

1.2.1 Safety and Logistics

Field activities will be conducted in accordance with the Health and Safety Plan (HASP) for the Unnamed Tributary to Patroon Creek, Patroon Creek, and Three Mile Reservoir (USACE, 2003b). On-site monitoring, personal protective equipment (PPE), site control, and decontamination measures described in the HASP will be utilized to minimize all potential hazards during field activities. Prior to commencing field activities, all permits (if any) needed to complete the scope of work will be obtained by Shaw. Examples of applicable permits may include rights of entry; drilling and/or excavation permits; utility clearances (DigSafe); and state and/or local permits as applicable.

1.2.2 Field Schedule

Field activities are scheduled tentatively to commence at the unnamed tributary, Patroon Creek, and Three Mile Reservoir in October 2003. The project schedule is presented as **Exhibit 1-4**. It displays the sequence and duration of each task for the project. The project schedule may be amended based upon work plan approvals, permits, rights of way, weather, existing field conditions and/or sample results.

1.3 TARGET CONTAMINANTS

The target contaminants at the unnamed tributary, Patroon Creek, and Three Mile Reservoir have been categorized into radiological and chemical constituents. The radiological constituents consist of Uranium-238 (U-238) and Thorium-232 (Th-232). The chemical constituents are those associated with waste disposal classification and health and safety issues and consist of TCLP metals. Confirmation waste samples will also be collected and analyzed for full TCLP, ignitability, corrosivity, and reactivity. Full TCLP includes TCLP VOCs, TCLP semi-volatile organic compounds (SVOCs), TCLP metals, TCLP herbicides, and TCLP pesticides.

2.0 FIELD SAMPLING PLAN

This section outlines the procedures that are used for field screening activities and in the collection of sediment samples as well as the parameters for which the samples are analyzed. A summary of the samples to be collected and the required analyses and necessary field quality assurance/quality control (QA/QC) samples is provided in **Exhibit 2-1**.

2.1 FIELD SCREENING ACTIVITIES

2.1.1 Radiological Sampling of Sediment Samples

Radiological sediment sampling will be conducted in accordance with Shaw E&I SOP S.5 found in **Appendix B** and Edi SOP 4A.2 found in **Appendix A**. Sediment samples will be collected using Vibracore Technology at Three Mile Reservoir, and Slam Bar Technique at all other areas. Radiological screening will be performed for each core sampled following Environmental Dimensions, Inc. (Edi) SOP 5A.2 found in **Appendix A**. The radiological surveys will be conducted utilizing a Pancake Geiger-Mueller (PGM) detector to detect the presence of gamma radiation in the sediment cores in 6 inch sections. The PGMs utilize a G-M tube with a thin window protected by a sturdy wire screen that allows detection of beta particles with energies greater than 40 KeV. Each of the cores collected will be measured for radiological contamination and documented in the field as to contamination depth, type, sampling location and quantity. Further details as to gamma radiation logging may be found in EDi SOP 3B.5 in **Appendix A**. Measurements found greater than 1.5 time instrument background will be considered detections. The instrument background is based upon ambient air and will be measured at each location the PGM instrument is used and samples measured. Samples will be screened for radiological contamination over the entire core collected at 6-inch intervals. If detected, samples for off-site radiological confirmatory analysis will be composited over the 6-inch area of the core detected with the highest radiological contamination. Samples for waste characterization will also be collected from the interval exhibiting the highest radiological contamination. However, if sufficient sample volume cannot be collected from that interval, the adjacent intervals may be composited to obtain the required volume such that the sample will be representative of media that may be encountered during future potential removal actions. The radiological confirmation samples will be collected first, followed by the waste characterization samples. If a sediment sample comes back with less than 70% recovery, the sample location will be moved over roughly one foot and a replacement sample taken, unless there is a definite detectable radioactive signature on the first core. Operation and calibration of these instruments are performed in accordance with Edi SOPs 5A.2 and 5E.1. **Exhibit 2-2** describes the type of instrumentation typically used for this survey. These screening results will be utilized to determine whether additional off-site analysis TCLP sampling is required for waste characterization.

2.1.2 Organic Vapor Screening of Sediments

Although volatile organic compound (VOC)-contaminated sediments are not anticipated during the SI efforts, the sampling area will be routinely screened for organic vapors with a photoionization detector (PID) and/or flame ionization detector (FID) meter (**Exhibit 2-2**). If organic vapors are detected above the threshold limits 1 parts per million (ppm) at the ground surface or in the breathing zone, the SSHO will be notified of the presence of organic vapors in the workspace and further precautionary steps taken (i.e. colorimetric tube analysis) as to worker safety as noted in the SI HASP (USACE, 2003b).

2.1.3 Survey of Personnel and Equipment

Personnel performing sampling are screened for radiological contamination ("frisked out") after sampling is completed each day. Equipment (*e.g.*, slam bar, Vibracore) is also surveyed. Surveys are performed as described in EDi SOPs 2B.2 and 2C.1. Survey instruments are calibrated twice daily and are operated according to EDi SOPs 5A.2, 5B.14 and 5B.16. Surveys are performed to monitor worker's exposure to radioactivity. These procedures are performed as outlined in the Colonie FUSRAP Site Radiation Safety Manual and the Health and Safety and Emergency Response Plan (USACE, 2003c). **Exhibit 2-2** describes the type of instrumentation typically used for this survey.

2.2 FIELD SAMPLING ACTIVITIES

2.2.1 Sediment Sampling

A total of 29 sampling locations have been selected along the three AOCs **(Exhibit 1-3)**. Sediment samples will be collected for characterization and profiling purposes. Detailed procedures for collecting sediment samples are presented in SOP S.5 located in **Appendix B** and Edi SOP 4A.2 located in **Appendix A**.

To minimize the potential for cross contamination during sampling, sample CSD-US1, located upstream of the Colonie FUSRAP Site, will be collected first. The sampling sequence will than proceed from the downgradient-most location (sample CSD-DS2) incrementally upstream towards the site.

Sediment samples from the upgradient locations, unnamed tributary, Patroon Creek, downgradient of Three Mile Reservoir will be acquired from each location using a decontaminated slam bar. Specific slam bar sampling protocols are contained in SOP S5. For the Three Mile Reservoir, the sediment samples will be collected using a Vibracore sampler. Specific Vibracore sampling protocols are contained in SOP S5. Capping and sealing of the core will be completed on the boat used for sample collection.

Sampling depths in the upgradient locations, unnamed tributary, Patroon Creek, and downgradient of the Three Mile Reservoir will be a minimum of 6-12" below top organic layer to ensure the collection of a representable sample. Samples will be obtained with a slam bar and will be taken until the depth of refusal or to maximum depth of 3 feet, whichever occurs first.

For sampling in Three Mile Reservoir, the sampling depth will be to a maximum of 9 feet and a minimum of 6.6 feet (2 meters). A continuous core through the layer of interest will be collected. Sediment borings in Three Mile Reservoir will be advanced to the desired sampling depth using Vibracore methods to assess potential contaminant migration.

Sediment samples will be collected for radiological analysis as indicated on **Exhibit 2-1**. Samples will be placed in the containers specified on **Exhibit 2-3**. Parameters with the same preservation requirements may be combined at the laboratory's discretion. Samples from all AOCs will be logged for stratigraphic characterization and all samples will be analyzed on-site for radiation using a PGM instrument. Sediment cores for each AOC will be screened in 6-inch intervals. If off-site analysis is to be performed the core section based on the highest radiological readings within all of the 6-inch sample intervals will be used. Details on the performing on-site gamma screening are presented in the QAPP. In addition, 20 percent of the overall number of samples, or a 5 sample minimum, will be shipped to the off-site laboratory for confirmation sampling. The off-site laboratory will analyze the samples for gamma spectroscopy and alpha spectroscopy. The sample size and method tolerances will be considered during comparison between the alpha and gamma spectroscopy analysis.

For all sample locations where there is at radiological contamination is present above 1.5 times instrument background, a sample will be sent to the off-site laboratory and analyzed for TCLP metals. The waste characterization samples are to be collected from the same sample that is screened using a PGM instrument. Samples for waste characterization will be collected from the interval exhibiting the highest radiological contamination. However, if sufficient sample volume cannot be collected from that interval, the adjacent intervals may be composited to obtain the required volume such that the sample will be representative of media that may be encountered during future potential removal actions. Ten percent of the samples will be analyzed for full TCLP, ignitability, corrosivity as pH, and reactivity as confirmation.

2.2.1.1 Field Quality Control Sampling Procedures

Replicate sediment samples are collected at a minimum frequency of one replicate for every 10 samples analyzed onsite and shipped for off-site analysis. Replicates are not required for TCLP analysis. The replicate samples are analyzed for the same analyses as the original sample. When collecting replicate samples, two splits are collected from the same material. Further details as to the replicates may be found in **Exhibit 2-1** and **Exhibit 3-8**.

Rinse blanks may be collected at a frequency of one sample per twenty samples. Rinse blanks are obtained once any non-dedicated sampling equipment is decontaminated and are physically obtained by pouring laboratory-supplied analyte-free distilled water over the sampling equipment into a stainless steel mixing bowl and collecting the rinsate in the appropriate sample containers. A minimum of one rinse blank will be collected from the slam bar and one rinse blank from the vibracore sampler. If collected, rinse blanks are analyzed for the same parameters as the original sample. Further details as to the rinse blanks may be found in **Exhibit 2-1** and **Exhibit 3-8**.

2.2.1.2 Decontamination Procedures

Reusable sampling equipment is decontaminated by scraping off loose material, washing with an Alconox solution, and rinsing with distilled water in the field. Sampling equipment used to collect for metals and radioactive contaminants will be rinsed with a dilute nitric acid solution prior to the distilled water rinse. Decontamination rinse water is released to the ground surface in the general vicinity of the decontamination operations. On-site laboratory decontamination rinse water and other *de minimus* quantities of aqueous waste are collected, returned to the Colonie FUSRAP site, and processed in the water treatment plant.

3.0 QUALITY ASSURANCE PROJECT PLAN

Shaw has been contracted by the USACE to perform an SI for sediment within the unnamed tributary of Patroon Creek, Patroon Creek, and the Three Mile Reservoir. These three AOCs are located downstream of the Colonie FUSRAP Site, and the SI is being conducted to evaluate if radiological contamination resulting from historical site operations conducted at the Colonie FUSRAP Site has impacted the sediment at the three AOCs.

This QAPP establishes function-specific responsibilities and authorities for data quality and defines procedures that will ensure that SI activities will result in the generation of reliable data. Inherent in the QA program is the implementation of QC measures. These measures provide assurance that the monitoring of quality-related events has occurred, and that the data gathered in support of the project are complete, accurate, and precise. Implementation of this QAPP will help ensure the validity of the data collected and will establish a firm foundation for decisions regarding the SI. This document was developed in accordance with specifications contained in USACE, EM 200-1-3, *Requirements for the Preparation of Sampling and Analysis Plans*, (USACE, 2001a), USEPA *Data Quality Objectives Process for Hazardous Waste Site Investigations* EPA QA/G-4HW (USEPA, 2000), and the USACE *Shell for Analytical Chemistry Requirements, EM 200-1-3, Appendix I* (USACE, 2001b).

3.1 PROJECT OBJECTIVES

The objectives to be accomplished through this SI are described in this section.

3.1.1 Radioactive Contamination Absence/Presence

The project objective is to determine the absence/presence of radioactive contamination within the three AOCs as a result of historic operations conducted at the Colonie FUSRAP site. If radiological contamination is detected, the level of non-radiological metals contamination will be determined to aid in evaluations of waste acceptance criteria. This will be accomplished by screening for absence/presence of radiological constituents by direct gamma scans of the cores using an on-site PGM instrument, with off-site gamma/alpha spectroscopy confirmations; determine if concentrations exist; and if so determine the metals concentrations for waste characterization disposal in the radiological contaminated areas. Sample collection will be performed in accordance with established SOPs (**Appendix B**) designed to ensure the collection of representative samples. A subcontractor laboratory that is approved by USACE will perform sample analysis. Laboratory analytical methods will be performed in accordance with USEPA protocols and methods. Shaw will have the laboratory data validated according to the requirements of the QAPP, USACE *Shell document (Ref. USACE 2001b), the analytical method, and laboratory SOP. Data qualifiers* will be consistent with USEPA Region II guidelines.

This field effort includes the collection and analysis of sediment samples for gamma screening from the following locations (Refer to **Exhibit 1-3**):

- Along Patroon Creek Upstream of the Colonie FUSRAP Site;
- Unnamed tributary after it exits the Colonie FUSRAP Site;
- Patroon Creek from the unnamed tributary to Three Mile Reservoir;
- Three Mile Reservoir; and,
- Downstream of Three Mile Reservoir.

3.1.2 Metals Waste Characterization and Confirmation

For waste acceptance criteria, determine the level of metals contamination in the radioactive *contaminated sediment areas. This data will be used for order-of-magnitude estimation of metals in the* sediment samples taken for waste acceptance characterization. Ten percent of these samples will be fully characterized for waste acceptance criteria as confirmation.

3.1.3 Health and Safety Requirements

The health and safety requirements may be found in the SI HASP (USACE, 2003c). The objective of the HASP is to provide site-specific safety and health controls that will prevent and minimize personal injury, illness, and physical damage to equipment and property. The evaluation of hazards, level of protection (LOP), and procedures specified, are the minimum safety and health requirements to be observed by all Shaw personnel. Unforeseen site conditions or personal preferences may warrant the use of a higher LOP. It is recognized that site conditions may change; therefore, it is imperative that the personnel protective measures be thoroughly assessed by the Site Safety and Health Officer (SSHO), prior to and during planned activities.

3.1.4 Public Concern

The AOCs will be evaluated for the absence/presence of radiological contamination in response to public concerns of recreation/trespasser use of Patroon Creek and Three Mile Reservoir. This includes the possible use of surface water and sediments downstream of Three Mile Reservoir. This is per agreed objectives noted in the TPP Meeting of July 16, 2003 (**Appendix C** of Work Plan). The waste characterization analysis was added to the scope for disposal purposes and possible future removal actions.

3.2 PROJECT ORGANIZATION AND RESPONSIBILITIES

Quality assurance goals for the development and execution of the collection of data for this scope of work will be achieved through proper planning, organization, review, communication of objectives, auditing, reporting, and corrective action. Personnel knowledgeable in QA theory and practice will carry out the QA program. Facilities, equipment, and services that affect data quality or integrity will be routinely inspected and maintained, as required by SOPs.

Implementation of this QAPP requires that the project staff maintain an awareness of contractual procedures and goals. It is the policy of Shaw to provide a QA program that ensures information produced by its employees and subcontractors is valid and of known quality. These requirements include statements of completeness, comparability, representativeness, precision, and accuracy, where applicable.

Field and analytical methods and procedures used in measurement and monitoring efforts will conform to USEPA and USACE specifications, as applicable. Field team members will possess the appropriate qualifications and training prior to collecting environmental samples. Measurement methods will be fully documented and include QC procedures.

3.2.1 Project Organization

Exhibit 3-1 presents the Project Organizational Chart for the unnamed tributary, Patroon Creek, and Three Mile Reservoir SI. Responsibilities for the implementation of the project QA program in accordance with QA/QC contractual obligation lies principally with the Shaw project staff and subcontractors. The QC Manager has the responsibility to ensure the reliability and the validity of project activities and deliverables in compliance with the project QA program. Project organization for subcontractors is also listed.

Project Manager, **Anthony Sheeran, P.E.** is responsible for ensuring that all activities are conducted in accordance with contractual specifications, the Statement of Work (SOW), and approved work plans. The Project Manager will also provide technical coordination with the USACE Project Officer. The Project Manager is responsible for management of all operations conducted for this project. He will ensure that all personnel assigned to this project, including subcontractors, review the technical plans before any task associated with the project is initiated. The Project Manager will monitor the project budget and schedule and ensure availability of necessary personnel, equipment, subcontractors, and services. He will participate in the development of the field program, evaluation of data, development of conclusions and recommendations, and reporting.

Shaw Field Operations Leader (FOL), David Stahl, P.E. provides management of the field activities. He is responsible for ensuring that technical matters pertaining to the field program are addressed. He will participate extensively in data interpretation, report writing, and preparation of deliverables, and will ensure that work is being conducted as specified in the technical plans. Before field activities are initiated, he will conduct a field staff orientation and briefing to acquaint project personnel with the site, and assign field responsibilities.

Project QC Manager, Heide-Marie Dudek, P.E. is responsible for ensuring that the QC procedures and objectives in the project-specific work plans are met, reviewing selected field and analytical data to ensure adherence to Quality Assurance/Quality Control (QA/QC) procedures, and approving the quality of data before they are included in the SI report. The Project QC Manager is also responsible for day-to-day compliance monitoring of the approved QC plans including records filing, archiving and reporting project activities.

Site Safety and Health Officer (SSHO), Joseph Hurley, is responsible for day-to-day compliance with the approved HASP. This plan specifies site-specific personnel training; maintenance of the medical monitoring program; management of personal protective equipment (PPE), decontamination operations, and operations support to the on-site field staff. The SSHO will ensure that all field staff maintain Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Response (HAZWOPER) certifications and are current under medical monitoring programs meeting 29 Code of Federal Regulations (CFR) 1910.120.

Project Chemist/Data Validation Manager, Eric Malarek, will ensure that the work performed is in accordance with the QAPP, Standard Operating Procedures (SOPs), and other pertinent analytical procedures. He will also be responsible for sample tracking, data management, laboratory coordination, data interpretation, and report writing. He will be responsible for the review, evaluation, and validation of all analytical data for the project and will participate in interpreting and presenting the analytical data. This includes reviewing selected field and analytical data to ensure adherence to QA/QC procedures, and approving the quality of data before they are included in the SI report. The Project Chemist/Data Validation Manager will be responsible for the validation of the analytical data from the contract laboratory according to the QAPP, USACE Shell requirements (USACE, 2001), USEPA analytical methods performed, and laboratory SOPs. Data qualifiers will be consistent with the USEPA Region II standards. The Data Validation Manager is also responsible for the production of a final validation report for the project with a justification for qualifiers applied (if any), while maintaining strict adherence to project schedules.

Project Engineer, Mohammad Iqbal, P.E.: The Project Engineer is responsible for project planning, documentation, and technical support. This position will also coordinate work plan development and preparation of the SI Report. Mr. Iqbal will report directly to the Project Manager, Mr. Anthony Sheeran.

Shaw Project Team *(persons to be determined)* implement field activities, field QA/QC, and health and safety operations as required in the Work Plan, Quality Assurance Plan and Site Health and Safety Plan. The project team will get additional specific guidance for field modifications from the field operations leader and the SHSO.

Subcontractors: Subcontractor support services will be procured through competitive bidding in accordance with USACE and U.S. Government Federal Acquisition Requirements (FARs). Subcontractors will be selected based upon demonstrated experience; technical approach; staff experience; cost and schedule commitments; and business classification. Shaw will utilize several subcontractors for major work elements during this field effort. Professional service subcontractors anticipated for this field effort include: licensed land/civil surveying, and analytical laboratory services.

> **Analytical Laboratory Project Manager, Southwest Laboratories of Oklahoma,** is responsible for the technical quality of the laboratory, adherence to the laboratory Quality Assurance (QA) Manual, laboratory personnel management, cost control, and strict adherence to project schedules concerning the analysis for the parameters of interest. The laboratory Project Manager (Mr. Kert Surface) will ensure the satisfactory analysis of all samples and completeness of data documentation according to the analytical statement of work and QAPP. Shaw E&I will monitor the laboratory activities.
>
> **Licensed Land/Civil Surveying Subcontractor, CT Male Associates, L.S.:** Surveying will be conducted as part of this field effort. CT Male Associates, L.S. is the surveying subcontractor for the Colonie FUSRAP Site and, as such, is familiar with the scope of work and the Project Team.

3.3 QUALIFICATIONS OF CHEMICAL QUALITY MANAGEMENT PERSONNEL

The laboratory QC officer will have a baccalaureate in chemistry or any related scientific/engineering discipline and three years of laboratory experience in environmental sample preparation, testing, and analysis. The Gas Chromatograph/Mass Spectrometer (GC/MS) Special Interpretation Expert will have at least three years experience, and the GC Analytical Expert will have at least two years experience. Technicians will have a minimum of high school chemistry and will work under the supervision of a chemist. These qualifications were assessed during the laboratory selection process. The laboratory QA plan may be found in **Appendix C**.

3.4 LINES OF AUTHORITY

Exhibit 3-2 is a diagram modeling the lines of technical direction and communication within the Shaw project staff. Technical direction is communicated down the organizational structure. QA/QC requirements are communicated to staff through an independent quality organization. Communication of project objectives is typically provided to project staff through meetings, reporting, and reviews. Contact information for key points of contact for Shaw and major subcontractors is presented in **Exhibit 3-3**.

3.5 QUALITY ASSURANCE OBJECTIVES

Quality assurance is defined as the overall system of activities for assuring the reliability of data produced. The system integrates the quality planning, assessment, and corrective actions of various groups in the organization to provide the independent QA program necessary to establish and maintain an effective system for collection and analysis of environmental samples and related activities. The program encompasses the generation of complete data with its subsequent review, validation, and documentation.

3.5.1 Data Quality Objectives

The overall QA objective is to develop and implement procedures for sample and data collection, evaluation, and reporting that will allow reviewers to determine whether the field and laboratory procedures meet the criteria and endpoints established in the DQOs. DQOs are qualitative and quantitative statements that outline the decision-making process and specify the data required to support corrective actions. DQOs specify the level of uncertainty that will be accepted in results derived from environmental data.

The DQO process used for developing data quality criteria and performance specifications for decision making is consistent with the *Data Quality Objectives Process for Hazardous Waste Site Investigations*, EPA QA/G-4HW (USEPA, 2000). The DQO process consists of the seven steps below. A phased focus approach has been adopted for this investigation to optimize resource utilization and minimize decision errors. Each phase is broken out in the following DQO elements. DQO elements common to all investigative areas are included in italics following each process step. The components of project-specific DQOs are defined on **Exhibit 3-4**. Project-specific DQOs may be found on **Exhibit 3-5** for the SI.

1. **State the Problem:** Define the problem to focus the study. Specific activities conducted during this process step include (1) the identification of the planning team, (2) primary decision-maker, (3) statement of the problem, and (4) available resources and relevant deadlines.

   (1) The planning team consists of the representatives from the New York State Department of Environmental Conservation (NYSDEC), USACE, Shaw E&I, and State University of New York-Albany.
   (2) USACE is the primary decision-maker.
   *(3) Refer to **Exhibit 3-5**.*
   (4) Resource specifications are contained in the Unnamed Tributary, Patroon Creek, and Three Mile Reservoir Work Plan. The period of performance for this project is approximately ten months.

2. **Identify the Decision:** Define the decision statement that the study will attempt to resolve. Activities conducted during this step of the process involve (1) identification of the principal study question and (2) definition of resultant alternative actions.

(1) *Does radioactive contamination in sediments at unnamed tributary, Patroon Creek, and Three Mile Reservoir exist, and if present, does investigation-derived materials (IDM) metal concentrations within the samples taken indicate a hazardous level for disposal?*
(2) *Resultant alternative actions include:*
  (2a) *Additional data at unnamed tributary, Patroon Creek, and Three Mile Reservoir for radiological contamination are required and further study is warranted.*
  (2b) *There is no sediment impact at unnamed tributary, Patroon Creek, and Three Mile Reservoir for radiological contamination and no further study is warranted.*

3. **Identify Inputs to the Decision:** Identify information inputs required to resolve the decision statement and which inputs require environmental measurements. This step of the process includes (1) identification of the data that will be required to make the decision, (2) information source determination, (3) identification of data required for study action levels, and (4) confirmation of appropriate field sampling and analytical methods.

(1) *Refer to* ***Exhibit 3-5****.*
(2) *Samples will be analyzed using U.S. Department of Energy (USDOE) HASL-300, 28th Edition EML Procedures Manual (USDOE, 1997), USEPA Prescribed Procedures for Measurement for Radioactivity in Drinking Water Methodology (USEPA, 1980), and USEPA SW-846 Update III (USEPA, 1996). Refer to* ***Section 3.8****.*
(3) *The SI scope is to determine a presence/absence of radiological parameters to a sensitivity of 1 picocuries per gram (pCi/g). Disposal limits for TCLP metals will be evaluated against state of New York guidance, disposal facility permit levels, and/or USEPA disposal criteria (40 CFR 261.24 and USEPA SW-846 Chapter 7) for the IDM generated.*
(4) *Field sampling will be performed in accordance with the Unnamed Tributary, Patroon Creek, and Three Mile Reservoir Work Plan.*

4. **Define the Boundaries:** Define decision statement spatial and temporal boundaries. This step specifies (1) the spatial boundary, (2) population characteristics, applicable geographic areas and associated homogeneous characteristics, and (3) constraints on sample collection.

(1, 2, 3) *Refer to* ***Exhibit 3-5****.*

5. **Develop a Decision Rule:** Define the (1) parameters of interest, (2) action levels, and (3) develop a decision rule.

(1) *Parameters of interest are listed in the decision inputs. Refer to* ***Exhibit 3-5****.*
(2) *The SI scope is to determine a presence/absence of radiological parameters to a sensitivity of 1 pCi/g. Disposal limits for metals will be evaluated against state of New York guidance, disposal facility permit levels, and/or USEPA disposal criteria (40 CFR 261.24 and USEPA SW-846 Chapter 7) for the IDM generated.*
(3) *These will be developed in the final SI report.*

6. **Specify Acceptable Limits on Decision Errors:** Specify the decision maker's tolerable limits on decision errors. This step of the process includes (1) parameter range of interest, (2) decision errors, (3) potential parameter values, and (4) the probability tolerance for decision errors are identified during this phase.

(1) *Parameter ranges are not defined at this time.*
(2) *Decision errors include:*
  (2a) *Deciding that sediments are impacted with radiological contamination and indicate a hazardous level for disposal when they do not and (II) deciding that sediments are not impacted with radiological contamination and do not indicate a hazardous level for disposal when they actually do. The consequences of deciding that the sediments are impacted with radiological contamination and indicate a hazardous level for disposal*

when they do not will result in unnecessary investigative actions. The consequences of deciding that the sediments are not impacted with radiological contamination and do not indicate a hazardous level for disposal when they do will result in liabilities associated with future damages and environmental clean-up costs. Additionally, public opinion will be compromised.

(2b) The true state when the most severe decision error occurs (sediments are not impacted and do indicate a hazardous level for disposal, when they actually do) is that sediments are impacted with radiological contamination and do indicate a hazardous level for disposal. The true state when the less severe decision error occurs (sediments are impacted and do indicate a hazardous level for disposal, when they actually do not) is that sediments are not impacted with radiological contamination, and do not indicate a hazardous level for disposal. .

(2c) The null hypothesis (H0) is: sediments at Unnamed Tributary, Patroon Creek, and Three Mile Reservoir are impacted with radiological contamination and indicate a hazardous level for disposal. The alternative hypothesis (Ha) is: sediments at Unnamed Tributary, Patroon Creek, and Three Mile Reservoir are not impacted with radiological contamination (below 1.5 times instrument background levels for ambient air), and do not indicate a hazardous level for disposal. .

(2d) The false positive decision error occurs when H0 is erroneously rejected corresponding to decision error I. The false negative decision error occurs when Ha is erroneously accepted corresponding to decision error II. Project-specific Type I and Type II error rates are 0.05 and 0.2, respectively.

(3, 4) The consequence of decision errors and acceptable probability will be determined as part of the final SI report.

7. **Optimize Data Design:** Identify data collection activities commensurate with data quality specifications. This final step in the process consists of (1) reviewing DQO outputs and existing environmental data, (2) developing data collection design alternatives, (3) formulating mathematical expressions to resolve design problems for each alternative, (4) selecting cost-effective data design capable of achieving DQOs, and (5) documentation of operational details and theoretical assumptions.

(1) This SAP contains the proposed SI sampling design program. A phased focus approach has been adopted for this investigation to optimize resource utilization and minimize decision errors. DQO refinement will be an iterative process throughout the project life cycle.

(2) The development of the data collection alternatives was performed with Shaw, USACE, USEPA, and NYSDEC during the project planning session. Systematic sampling will be performed to collect additional data needed to complete the site investigation and waste characterization. Select sampling locations (number of points) have been determined along Patroon Creek upstream of the Colonie FUSRAP Site (1 point), within the unnamed tributary that crosses the Colonie FUSRAP Site (7 points: transects 1/2/3 and 5/6/7 and point 4), within Patroon Creek from the unnamed tributary to the Three Mile Reservoir (4 points), within the Three Mile Reservoir (15 points), and immediately downstream of the Three Mile Reservoir (2 points). For each sediment sample, gamma screening will be conducted at 6 inch intervals to determine the highest presence of radiological contamination greater than 1.5 times instrument background, and if present, metals waste characterization will be performed. In addition, off-site confirmatory samples will be taken for gamma radiation and depleted uranium, as well as for full waste characterization at a frequency described in Exhibit 2-1. The 6 inch interval indicating the highest level of radiological contamination will be taken for the off-site radiological analysis. Samples for waste characterization will also be collected from the interval exhibiting the highest radiological contamination. However, if sufficient sample volume cannot be collected from that interval, the adjacent intervals may be composited to obtain the required volume such that the sample will be representative of media that may be encountered during future potential removal actions.

(3) Qualitative assessments will be established during the refinement process.

(4) This SAP contains the proposed SI sampling design program based on cost and project DQOs.

(5) Refer to the Unnamed Tributary, Patroon Creek, and Three Mile Reservoir Work Plan.

The overall QA objective is to develop and implement procedures for sample and data collection, sample shipment, and reporting that will allow QA reviewers to determine whether the field and laboratory data collected during the SI at the unnamed tributary, Patroon Creek, and Three Mile Reservoir meet the criteria and endpoints established in the DQOs. The QA objective will be achieved through the implementation of specific procedures for sampling, field data collection, Chain-of-Custody (COC), calibration, internal QC, audits, preventive maintenance, and corrective actions as described in this document.

3.5.2 Accuracy, Precision, Representativeness, Completeness, Comparability, and Sensitivity

The DQO process will be used to ensure chemical data will be of known defensible quality appropriate to achieving project objectives. Project data needs will be defined in terms of a qualitative assessment of requirements expressed as accuracy, precision, representativeness, completeness, comparability, and sensitivity.

3.5.2.1 Precision

Precision refers to the level of agreement among repeated measurements of the same parameter. It is usually stated in terms of standard deviation, relative standard deviation, relative error ratio, relative percent difference (RPD), range, or relative range. The overall precision of data is a mixture of sampling and analytical factors. The analytical precision is easier to control and quantify because the laboratory is a controlled, and therefore, measurable environment. Sampling precision is unique to each area, making it harder to control and quantify. The goals for each factor are addressed below.

For radiological data, sampling precision will be evaluated by obtaining one duplicate sample for every 10 samples collected for each type of media (10% frequency). Precision control criterion was established at 1.5 acceptable relative error ratio (RER) equivalency for the sediment samples. The RER is calculated as:

$\mathrm{RER} = |R_1 - R_2| / (\mathrm{SQRT}\ [(\mathrm{TPU}_1^2)+(\mathrm{TPU}_2^2)])$
R_1 = original sample result
R_2 = duplicate sample result
TPU_1 = total propagated uncertainty of the original sample result (1σ)
TPU_2 = total propagated uncertainty of the duplicate sample result (1σ)
Criteria = $\mathrm{RER} \leq 1.5$

The RER will be calculated for both the field duplicates and laboratory duplicates for each analytical parameter that was detected in both samples. It is expected that the field and laboratory duplicates for solid matrices will have a RER less than 1.5 for radiological parameters. If these criteria are not met for the field duplicates, a careful examination of the sampling techniques, sample media, and analytical procedure will be conducted to identify the cause of the high RER and the usefulness of the data. If the precision criteria are not met for laboratory duplicates, an examination of the data will be conducted to determine the cause of the variability and usefulness of the data.

For laboratory generated chemical data, precision is evaluated by calculating the RPD as follows:

$$\mathrm{RPD}\ (\%) = \frac{/(XA - XB)/}{XM} * 100$$

Where:
XA and XB are the concentration in the sample and its duplicate, and
XM is the mean value of the concentrations in the sample and its duplicate, (XA + XB)/2

The RPD will be calculated for laboratory duplicates for each analytical parameter that was detected in both samples. It is expected that the laboratory duplicates for solid matrices will have an RPD within the tolerance of the analytical method performed which is around 25% for inorganics and 50% for organics. If the precision criteria are not met for laboratory duplicates, an examination of the data will be conducted to determine the cause of the variability and usefulness of the data. Laboratory analytical precision may also be performed by the analysis of matrix spikes (MSs) and matrix spike duplicates (MSDs).

3.5.2.2 Accuracy

Accuracy is a measure of system bias and is defined quantitatively as the degree of agreement of a measurement (or an average of measurements of the same parameter), X, with an accepted reference or true value, T. The accuracy of sampling activities will be qualitatively controlled through the use of SOPs that have been developed to standardize the collection of measurements and samples. For radiological data, accuracy of the preparation and analysis procedures will be checked quantitatively through the use of matrix spikes, laboratory control samples (LCSs), and blanks. The accuracy is calculated based on the percent recovery of the spiked samples of target analytes.

Laboratory control samples will be analyzed to assess general method performance by the ability of the laboratory to successfully recover the target analytes from a control matrix. The LCS is similar in composition to the method blank. For aqueous analyses, spiked analyte-free reagent water will be used. For sediment analyses, a purified solid matrix (e.g., sand, sodium sulfate, or other purified solid) will be used. The LCS is spiked with single-component target analytes before it is carried through the preparation, cleanup, and determinative procedures. LCSs are performed at a rate of one per preparation batch per matrix. When samples are not subjected to a separate preparatory procedure [i.e., purge and trap VOC analyses, or aqueous mercury (Hg) analysis], the Continuing Calibration Verification (CCV) may be used as the LCS, provided the CCV acceptance limits are used for evaluation. The results of the LCS will be evaluated, in conjunction with other QC information during the data validation process to ascertain the acceptability of the data generated for that batch of samples.

Matrix spikes are used to assess the performance of the method as applied to a particular project matrix. An MS is an environmental sample to which known concentrations of certain target analytes have been added before sample manipulation from the preparation, cleanup, and determinative procedures have been implemented. The original field sample is mixed or shaken to ensure homogeneous fractions when allowed by the method. Matrix spikes are performed at a rate of one per preparation batch or 5% whichever was more frequent per matrix. The results of the MS are evaluated, in conjunction with other QC information during the validation process to assess the effect of the matrix on the bias of the analysis.

Documentation protocols for field sampling and measurements are outlined in SOPs in the **Appendix B** and the Colonie FUSRAP Site SAP (USACE, 2002) **Appendices A and G**. Field inspection performed by the Shaw QA/QC Manager will be used to identify deviations and execute corrective actions. Consistent and proper calibration of equipment throughout the field exercises, as described in this QAPP, will ensure measurement accuracy. The accuracy of the results will be measured by percent recovery (%R) as applicable. For un-spiked solutions, the following equation should be used:

$$\boxed{\%\,R = \frac{\text{test value}}{\text{true value}} * 100}$$

For spiked samples, the following equation should be used:

$$\boxed{\%\,R = \frac{\text{Spiked test value} - \text{Unspiked value}}{\text{true value}} * 100}$$

3.5.2.3 Representativeness

Representativeness is a measure of the degree to which the measured results accurately reflect the medium being sampled. It is a qualitative parameter that is addressed through the proper design of the sampling program in terms of sample location, number of samples, and actual material collected as a "sample" of the whole.

Sampling protocols have been developed to assure that samples collected are representative of the media. Field handling protocols (e.g., storage, handling in the field, and shipping) have also been designed to protect the representativeness of the collected samples. Proper field documentation and QC inspections will be used to establish that protocols have been followed and that sample identification and integrity have been maintained.

3.5.2.4 Completeness

Completeness is a measure of the amount of information that must be collected during the field investigation to allow for successful achievement of the objectives. An adequate amount and type of data must be collected for conclusions to be useable. Missing data may reduce the precision of estimates or introduce bias, thus lowering the confidence level of the conclusions. While completeness has been historically presented as a percentage of the data that is considered useable, this does not take into account critical sample locations or critical analytical parameters.

The amount and type of data that may be lost due to sampling or analytical error cannot be predicted or evaluated in advance. The importance of any lost or suspect data will be evaluated in terms of the sample location, analytical parameter, nature of the problem, decision to be made, and the consequence of an erroneous decision. Critical locations or parameters for which data is determined to be inadequate will either be re-sampled and reanalyzed or the data will be appropriately qualified based on the decision of the Project Officer. The completeness goal percentage of useable data is set at 90% for Colonie.

Completeness will be inferred from records review and data validation. Sampling completeness is assessed through evaluation of the total number of samples proposed for collection versus the actual number of samples collected and analyzed. Analytical completeness is assessed by comparing the number of useable data points collected to the total number of data points generated. For the purposes of this report, un-useable data will be defined to include rejected data points ("R" qualifier). The analytical completeness will also be calculated on a parameter basis as well as an overall basis to pinpoint any usability issues based upon the resulting data validation. Completeness is calculated using the following equations:

$$\boxed{\%\ \text{Sampling Completeness} = \frac{\text{Number of Actual Samples Collected}}{\text{Number of Proposed Samples}}}$$

$$\boxed{\%\ \text{Analytical Completeness} = \frac{\text{Number of Useable Data}}{\text{Number of Requested Analyses}}}$$

3.5.2.5 Comparability

Comparability is the confidence with which one data set can be compared to another. Comparability will be controlled through the use of SOPs that have been developed to standardize the collection of measurements and samples and approved analytical technique with defined QC criteria. Consistent and proper calibration of equipment throughout the field exercises, as described in this QAPP, will assist in the comparability of measurements. Field documentation will be used during this project to establish that protocols for sampling and measurement follow appropriate SOPs (**Appendix B**).

3.5.2.6 Sensitivity

Sensitivity requirements are expressed differently for various methods and/or parameters. The instrument detection limits (IDLs), method detection limits (MDLs), minimum detectable concentrations (MDCs), minimum detectable activity (MDA), and the practical quantitation limits (PQLs) published within methods are based upon a reagent water matrix, and are not necessarily reflective of typical sample matrices; therefore, care will be taken in establishing limits for laboratory analysis. The published limits may not be achievable for all environmental samples, but they should compare reasonably with control samples. Sensitivity is expressed as an MDC or activities for radiological parameters. The MDC is the minimum concentration of an analyte that can be measured and reported with a 99% confidence that the analyte is above zero and is determined from analysis of a sample in a given matrix containing the analyte. The MDCs represent the lower limit of detection. The required MDCs and PQLs for the sampling activities are provided in **Exhibit 3-6**. The target analytes detected above the MDA but less than the method reporting limits (MRLs) will be reported as estimated values. Target analytes detected above the upper calibration standard will be diluted to be within established calibration windows. The gamma spectroscopy data should have a sensitivity of 1 pCi/g. The screening values (SVs) desired for this project dictate the sensitivity requirements.

3.5.3 Applicable or Relevant and Appropriate Requirements

The applicable or relevant and appropriate requirements (ARARs) addressing contaminated environmental media are identified in this section. The National Contingency Plan (NCP) (40 CFR 300.5) defines "applicable" requirements as: "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility citing laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site." Only those promulgated State standards that are identified by a State in a timely manner and that are equally or more stringent than Federal requirements may be applicable.

The NCP (40 CFR 300.5) further defines "relevant and appropriate" requirements as: "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility citing laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site." Like "applicable" requirements, the NCP also provides that only those promulgated State requirements that are identified in a timely manner and are more stringent than corresponding Federal requirements may be relevant and appropriate.

USEPA identifies three basic types of ARARs. They include the following: chemical-specific, action-specific, and location-specific.

- Chemical-specific ARARs are generally health- or risk-based values which, when applied to site-specific conditions, result in numerical values. These values establish the acceptable concentration of a chemical that may be found in, or discharged to, the ambient environment.
- Location-specific ARARs are restrictions placed upon removal activities of hazardous substances solely because they are occurring in a particular place.
- Action-specific ARARs are generally technology or activity-based requirements on actions taken with respect to hazardous substances. These requirements are triggered by the particular activities that are selected to accomplish a remedy. Thus, action-specific requirements do not in themselves determine the removal alternative; rather, they indicate how a selected alternative must be achieved.

ARARs, presented in **Exhibit 3-7**, were determined for the field activities described in this report. The objective of this SI is to determine absence/presence of radiological contamination and if present to evaluate metals contamination for waste characterization. Additional chemical-specific ARARs for metals and radiologicals and location-specific ARARs will be determined prior to future risk evaluations after the completion of the SI.

3.6 SAMPLING LOCATIONS AND RATIONALE

A summary of the sampling locations and rationale is provided in **Exhibit 2-1**. Specific information on sampling locations and procedures is contained in the SI Work Plan (USACE, 2003a).

3.7 SAMPLE MANAGEMENT

3.7.1 Sample Number and Type

The numbers and types of environmental and QC samples to be collected during this scope of work for the SI are listed in **Exhibit 3-8**. The on-site radiological parameters for the SI include gamma screening using a PGM. The off-site radiological parameters include the analysis of radiological isotopes using gamma and alpha spectroscopy. The chemical parameters for the metals waste characterization include TCLP metals. Confirmation waste samples will also be collected and analyzed for full TCLP, ignitability, corrosivity, and reactivity. Full TCLP includes TCLP VOCs, TCLP semi-volatile organic compounds (SVOCs), TCLP metals, TCLP herbicides, and TCLP pesticides.

Sample collection, preservation, handling, storage, packaging, and shipping will be performed in a manner that minimizes damage, loss, deterioration, and artifacts. Procedures described are designed to eliminate external contamination and to ensure data quality through the use of approved standardized sampling procedures. References to methods of collection and detailed SOPs are provided in **Appendix B**.

3.7.2 Sample Containers

The integrity of containers for sediment samples is ensured by the use of appropriate cleaning techniques as specified by USEPA and USACE. The contract laboratory will purchase pre-cleaned sample bottles for chemical analyses according to requirements set forth in USACE Guidelines. Sample container requirements for analyses to be performed for the SI are provided in **Exhibit 2-3**.

3.7.3 Sample Preservatives

Preservatives will be used, as applicable, to retard hydrolysis of chemical compounds and complexes, to reduce volatility of constituents, and to retard biological action during transit and storage prior to laboratory analysis. Preservation acids and bases will be added to the sample containers prior to sampling. Additional preservatives will be added to appropriate samples at the time of collection, if required. Sample preservation requirements for analyses to be performed are provided in **Exhibit 2-3**.

3.7.4 Holding Times

Sample holding time is defined as the interval between sample collection to sample extraction and analysis such that a sample may be considered valid and representative of the sample matrix. Sample holding time requirements for the project-specific criteria may be found in **Exhibit 2-3**. The laboratory QA program will be responsible for ensuring the adequacy of the sample tracking system in precluding holding time deficiencies.

3.7.5 Sample Identification

Each sample will be assigned a unique sequential number at the time of sampling on the sample label, which will be permanently affixed to the sample container using polyethylene tape. The sample identification number consists of an alphanumeric designation related to the Colonie FUSRAP Site, media type, location code, and sequential collection order according to the following convention:

- Site:

  C = Colonie FUSRAP Site

- MediaType: The following media type include:

  SD = Sediment sample

- Location Code: The following are the locations for sampling:

  US = Upstream of the Colonie FUSRAP Site

UT = Unnamed Tributary that crosses the Colonie FUSRAP Site
PC = Patroon Creek from the unnamed tributary to the Three Mile Reservoir
3MR = Three Mile Reservoir
DS = Downstream of Three Mile Reservoir
IDM = Investigation-Derived Materials

- Sequential Collection Order: This consists of two digits such as 1, 2, 3 and so on.
- Sample Depth Interval: The sample depth interval will be noted in feet from top to bottom in parenthesis. Some examples include:

  (0.0-0.5) = zero to 6 inches
  (0.5-1.0) = 6 inches to 1 foot
  (0.5-1.5) = 6 inches to 1.5 feet

3.7.6 Field QC Samples

All field duplicates will have the following "blind" designation system:

- Site:

  C = *Colonie FUSRAP Site*

- MediaType: The following media type include:

  SD = Sediment sample

- QC Sample Code: The following are for the field duplicates:

  Duplicate

- *Sequential* Collection Order: This consists of two digits such as 1, 2, 3 and so on.

Rinse blanks will be designated with the date sampled, followed by "RB", ending with the sequenced number of the rinse blanks (e.g., 061703RB2 is the second rinse blank taken on June 17, 2003). All field QC blanks will use the following designation system:

- Date: This consists of the month, day, and year as:

  MMDDYY

- Type:

  RB = Rinse Blank

- Sequential Collection Order: This consists of one digit such as 1, 2, 3, and so on.

3.7.7 Documentation Requirements

Information pertinent to the sampling effort will be recorded in a field logbooks and a COC form will trace the sample. All entries will be made in indelible ink on consecutively numbered pages, and corrections will consist of lineout deletions that are initialed and dated.

At a minimum, required field logbook entries include:

Sampling Data:

- Sampler(s) Name and signature;
- Time and date of sample collection;
- Sample locations and type (sediment);
- Sampling methodology (grab and composite sample);

- GPS of sample locations;
- Weather conditions; and,
- Physical field measurements (if applicable).

Field Screening Data:

- Information as to the field testing using the PGM may be found in Appendix E.

Each sample will be assigned a unique sequential number at the time of sampling, which will be permanently affixed to the sample container with polyethylene tape to prevent the loss of the label during shipment. The sample label will be filled out using indelible ink and will include the following information:

- Project name and number;
- Sample location/site ID;
- Sampling date and time;
- Analyses to be performed;
- Preservative, as applicable; and,
- Sampler name.

3.7.8 Packaging and COC Requirements

Sample coolers will be shipped to arrive at the laboratory the morning after sampling (priority overnight) or will be sent by a courier to arrive the same day. The laboratory will be notified of the sample shipment and the estimated date of arrival of the samples being delivered.

3.7.8.1 Sample Packaging and Shipment

Samples will be transferred to the contract laboratory for analysis via waterproof plastic coolers. Before samples can be put in the cooler, any drains will be sealed with tape to prevent leaking. The sampling packaging and shipment SOP (SOP S.9) may be found in **Appendix B**. Each cooler will be packed in the following manner:

1. Ensure sample lids are tight.
2. Wrap environmental samples and associated QC samples in bubble wrap and place in a watertight plastic bag.
3. Place a plastic garbage bag inside the cooler as extra barrier and place wrapped sample bottles inside.
4. Fill cooler with enough packing material to prevent breakage of glass bottles.
5. Place sufficient ice in cooler to maintain the internal temperature at 4±2°C during transport. The ice will be double-bagged to prevent contact of the melt water with the samples.
6. Place associated COCs in a water proof plastic bag, and tape it with masking tape to the inside lid of the cooler.
7. Seal coolers at a minimum of two locations with signed custody seals or evidence tape before being transferred offsite. Attach completed shipping label to top of the cooler. Cover seals with wide, clear tape, and continue around the cooler.

3.7.8.2 Chain-of-Custody

Sampling will be evidenced through the completion of a COC form, which accompanies the sample containers in the field, during transit to the laboratory, and upon receipt by the laboratory. The COC will be annotated to indicate time and date that samples are relinquished. A copy of the COC may be found in SOP F.3 in **Appendix B**. In addition, shipping containers will be affixed with custody seals.

The COC will be filled out using indelible ink and will include the following information:

- Project name and number;
- The signatures of the sampling personnel;
- The site code and sample number;
- Sampling dates, locations, and times (military format);
- List of the chemical analysis, volume, and preservatives used;
- Type of sample, whether "grab" or "composite";
- The total number of containers per location;
- The custody seal number;
- Sample relinquisher, date and time; and,
- Courier, or carrier airbill number, and analytical laboratory.

3.8 ANALYTICAL PROCEDURES

3.8.1 Laboratory Procedures for Chemical Analyses

The analytical protocols to be performed by the on-site laboratory will include the testing for gamma radiation using a PGM instrument. The off-site analysis will included the testing for isotopes actinium-228, cesium-137, potassium-40, radium-226, radium-228, thorium-232, uranium-234, uranium-235, and uranium-238 using gamma and alpha spectroscopy. The analytical methods will be performed in accordance with USEPA and USDOE approved methods provided on **Exhibit 3-6**. All samples will be performed following the method requirements as outlined in the cited USDOE HASL-300, 28th Edition EML Procedures Manual (USDOE, 1997), USEPA Prescribed Procedures for Measurement for Radioactivity in Drinking Water Methodology (USEPA, 1980), and USEPA SW-846 Update III (USEPA, 1996), and USACE Shell for Analytical Chemistry Requirements (USACE, 2001b), as appropriate.

3.8.1.1 Radiological Parameters

Sediment samples will be analyzed for the radiological parameters. Radiological testing will be performed both onsite and offsite as noted in **Exhibit 2-1**. The subcontracting laboratory will perform analytical activities according to pre-scribed methods. The on-site method SOPs may be found in **Appendix A**. The following sections briefly describe the analytical methodologies to be used.

<u>Gamma Radiation Analysis</u>

Samples will be analyzed by a PGM instrument for on-site screening using EDI SOP 5A.2. Sediment cores will be scanned with a Geiger-Mueller (GM) detector. The results of these scans will provide data to identify absence or presence of gamma radiation within the sediment cores. GM measurements provide readings (in units of counts per minute) that are proportional to the core surface beta emission rate at the measurement locations. Although these measurements are quantitative in nature, detector readings are influenced by any beta-emitting radionuclides and are not specific to uranium.

These scans will be performed using a 15-cm-diameter pancake GM detector coupled to a ratemeter. Following core withdrawal, the cores will be opened and the GM detector will be held as close as practical to the exposed media and slowly moved along the entire length of the core. The audible output of the detector and deflection of the count rate needle will be monitored during the scan. The detector count rate will be recorded at 6 inch intervals along the core and any areas clearly in excess of the ambient level (between the 6 inch intervals) will be noted.

Off-site confirmation will be performed using USDOE Method HASL-900. Gamma emission spectroscopy enables the identification of specific isotopes based on the activity at a specific energy level. After oven drying and homogenization, sediment samples are counted for approximately 900 seconds with a high purity lithium drifted germanium detector. The detector is based upon a layered semiconductor that acts to create a current pulse proportional to the energy of the absorbed photon.

Depleted Uranium

Samples will be analyzed off-site by alpha spectroscopy for uranium 234, 235 and 238. Off-site confirmation will be performed using USEPA Method 908.1 Modified. The sample, after wet and dry washing as appropriate, is acidified with HCl. Uranium is absorbed onto an anion exchange resin from a dilute HCl solution. Thorium is washed through the column and the uranium is desorbed from the resin with a weak HNO3. Further treatment on the same anion exchange column will remove excessive iron and/or plutonium if present. The sample is then electro-deposited onto a stainless steel disk for counting by alpha pulse height analysis using a silicon surface barrier detector.

3.8.1.2 Metals Waste Characterization Parameters

All IDM generated will be drummed for disposal. Samples for TCLP metals analysis will be collected if the on-site gamma scanning indicates the presence of radiological contamination above 1.5 times the instrument background. After the samples have been collected, the IDM will be drummed for transport to the Colonie FUSRAP Site. Only a limited quantity of decontamination water will be generated. IDM will be primarily comprised of clean water and be drummed, appropriately labeled, and consolidated with other Colonie generated waste for disposal. Disposal will be performed following established procedures specific to the Colonie FUSRAP site.

Samples for metals waste characterization will be analyzed for the TCLP metals parameters if radiation has been detected greater than 1.5 time instrument background. Radiological testing will be performed both onsite and offsite as noted in **Exhibit 2-1**. The subcontracting laboratory will perform analytical activities according to pre-scribed methods. The following sections briefly describe the analytical methodologies to be used.

TCLP Extraction

Samples for disposal will undergo TCLP extraction by SW-846 Method 1311 for TCLP metals. Samples are separated by phase, particle size reduced (for solids), and extracted for 18 hours in an extraction fluid. The final liquid extract is separated from the solid material and combined with the initial liquid phase (if applicable). The sample TCLP extract is then treated as an aqueous leachate sample for analysis as described herein.

TCLP Metals

Samples will be analyzed for USEPA TCLP (SW-846 1311) metals using a combination of inductively coupled plasma (ICP) and cold vapor atomic absorption (CVAA). After the TCLP extraction, samples will be analyzed for the trace metals using ICP using USEPA SW-846 Method 3010A/6010B for leachate TCLP samples. The ICP method involves the simultaneous or sequential multi-element determination of trace elements in solution. The basis of the method is the measurement of atomic emission by optical spectrometry. Samples are nebulized and the aerosol that is produced is transported to the plasma torch where excitation occurs. Characteristic atomic-line emission spectra are produced by a radio-frequency ICP. A background correction technique is utilized to compensate for variable background contributions during the determination of trace elements. Mercury will be analyzed according to USEPA SW-846 Method 7470A for TCLP leachate samples. A sample aliquot is initially digested with nitric acid to free any combined mercury. The mercury is then reduced to its elemental state and aerated from the solution into a closed system. The mercury vapor is passed through a cell positioned in the path of the mercury light source and the measured abundance is proportional to the concentration of mercury in the sample.

3.8.1.3 Confirmation Waste Characterization Parameters

Samples for confirmation waste characterization will be analyzed for the full TCLP list, ignitability, corrosivity, and reactivity. Full TCLP includes TCLP VOCs, TCLP SVOCs, TCLP metals, TCLP herbicides, and TCLP pesticides. Confirmation waste characterization testing will be performed offsite as noted in **Exhibit 2-1**. The subcontracting laboratory will perform analytical activities according to prescribed methods. The following sections briefly describe the analytical methodologies to be used. The TCLP extraction and metals discussion may be found herein.

TCLP VOCs

Samples will be analyzed for TCLP VOCs using USEPA SW-846 Method 1311/5030B/8260B for leachate samples using purge and trap technology. An inert gas is bubbled through a 25 mL leachate sample contained in a specifically designed purging chamber at ambient temperature for water. The vapor is swept through a sorbent column where the purgeable compounds are trapped. After purging is completed, the sorbent column is heated and backflushed with the inert gas to desorb the purgeable compounds onto a GC programmed to separate the purgeable compounds which are then detected with a mass spectrometer.

TCLP SVOCs

Samples will be analyzed for TCLP semivolatiles using USEPA SW-846 Method 8270C. Leachate samples are prepared for analysis using extraction techniques. Leachate samples will be extracted using a continuous liquid-liquid extraction technique according to USEPA SW-846 Method 1311/3520C or separatory funnel technique Method 1311/3510C. Gel Permeation Chromatography (GPC) may be used to clean the samples for fatty acids. The extract is injected onto a GC programmed to separate the compounds, which are then detected with a mass spectrometer.

TCLP Pesticides

Samples will be analyzed for TCLP pesticides using USEPA SW-846 Method 8081A. Leachate samples are prepared for analysis using extraction techniques. Leachate samples will be extracted using a continuous liquid-liquid extraction technique according to USEPA SW-846 Method 1311/3520C or separatory funnel technique Method 1311/3510C. The extract is injected onto a GC programmed to separate the compounds, which are then detected with an electron capture detector (ECD). A variety of cleanups (silica gel, florisil, sulfur, GPC) may be employed to aid in the quantification, depending upon the matrix interferences.

TCLP Herbicides

Samples will be analyzed for TCLP herbicides according to USEPA SW-846 Method 1311/8151A. Leachate samples are extracted with diethyl ether and then esterified with either diazomethane or pentafluorobenzyl bromide. The derivatives are determined by gas chromatography with an electron capture detector (GC/ECD). The results are reported as acid equivalents.

Reactive Cyanide

Reactive Cyanide will be analyzed in solid samples using USEPA SW-846 Chapter 7. The cyanide as hydrocyanic acid (HCN) is released from cyanide complexes by means of a reflux-distillation operation and absorbed in a scrubber containing sodium hydroxide solution. The cyanide ion in the absorbing solution is then determined by volumetric titration or colorimetrically. In the colorimetric measurement, the cyanide is converted to cyanogen chloride, CNCl, by reaction with chloramine-T at a pH less than 8.0 without hydrolyzing the cyanate. After the reaction is complete, color is formed on the addition of pyridine-pyrazolone or pyridine-barbituric acid reagent. The absorbance is read at 620 nanometers (nm) when using pyridine-pyrazolone or 578 nm for pyridine-barbituric acid. To obtain colors of comparable intensity, the sample and the standards will contain the same salt content. The titrimetric measurement uses a standard solution of silver nitrate to titrate cyanide in the presence of a silver sensitive indicator.

Reactive Sulfide

Reactive Sulfide will be analyzed in solid samples using USEPA SW-846 Chapter 7. This procedure is a colorimetric determination. Sulfide reacts with dimethyl-p-phenylenediamine in the presence of ferric chloride to produce methylene blue.

Ignitability

Ignitability will be analyzed in using USEPA SW-846 1010. A sample is heated at a slow, constant rate with continual stirring. A small flame is directed into the cup at regular intervals with simultaneous interruption of stirring. The flash point is the lowest temperature at which application of the test flame ignites the vapor above the sample.

Corrosivity as pH

Corrosivity as pH will be analyzed using USEPA SW-846 Method 9045C for solid samples. A sample pH is directly measured electrometrically using either a glass electrode in combination with a reference potential or a combination electrode. For solids, samples are mixed 1:1 with reagent water prior to measurement.

3.8.2 Quantitation, Reporting, and Detection Limits

For radiological parameters, the laboratory will report an activity and counting error for each isotope. Sensitivity is expressed as MDC or MDA for radiological parameters. The MDC is the minimum concentration of an analyte that can be measured and reported with a 99% confidence that the analyte is above zero and is determined from analysis of a sample in a given matrix containing the analyte. The MDCs represent the lower limit of detection. A discussion as to how the MDCs are calculated may be found in **Appendix D**. The required MDCs for the sampling activities are provided in **Exhibit 3-6**.

For chemical parameters, the method PQLs, levels of concern or SVs for the sampling activities are provided in **Exhibit 3-6**. The laboratory will establish MDLs for each compound. The MDL is the minimum concentration of an analyte that can be measured and reported with a 99% confidence that the analyte is above zero and is determined from analysis of a sample in a given matrix containing the analyte. MDLs are instrument- and method-specific as well. Laboratory's may report the most conservative MDL if multiple instruments are used. The MDLs are derived by the method based upon 40 CFR Chapter 136 **Appendix B**. The MDL determined using this procedure is used to assess the importance of the measurement of a future sample. The laboratory will use an MRL for each sample. The MRL should be 3 times the MDL, but must be at least 2 times the MDL. The reporting limit is the threshold value below which the laboratory reports any non-detected value as "U", "ND", or "<" and will vary for each sample based upon dilution, sample volumes, percent moistures (for solids), and the method performed. The PQL is the value at which the laboratory has demonstrated the ability to reliably quantitate the target value of an analyte for the method performed. USACE defines the PQL based upon the lowest calibration standard or the lowest verification standard used for the initial calibration performed. The PQL should be 5 times the MDL, but must be at least 3 times the MDL. Any positive value found above the MDL for a given sample and below the reporting limit must be reported as estimated. Also, all positive values found in blanks (method, rinse) above the MDL must be reported. Further discussion as to sensitivity may be found in **Section 3.5.2.6**.

3.9 CALIBRATION PROCEDURES

3.9.1 Laboratory Calibration

Prior to sample analysis, chemical calibration of each target analyte/compound must be performed to ensure analytical instrumentation is functioning within the established sensitivity range. Laboratory calibration steps include the performing of solution validation, initial calibration, daily calibration, and continuing calibration procedures. Protocols defining the QC procedures, rounding rules, corrective actions, and QC measurements for instrument calibration should be done in accordance with criteria specified in this QAPP, USACE Shell requirements, the analytical method, laboratory QA plan, and the prime contractor's SOPs. The units and PQLs for the analytical methods to be used are found on **Exhibit 3-6**. The QA/QC method calibration requirements may be found in **Exhibit 3-19 through 3-16**.

3.9.2 Field Calibration

The proper calibration and documentation of field equipment are designed to assure that the field equipment is functioning optimally. Field equipment and calibration requirements may be found in **Appendix B** SOP C1 for the PID and **Appendix A** EDI SOPs for the radiological survey equipment. Equipment logbooks are required to record usage, maintenance, calibration, and repair. The PID will be calibrated upon arrival to the site and daily while in the field. The calibration will include a daily initial measurement prior to calibration, a measurement after calibration, and measurement at the end of the day. The lamp used in the PID should be 10.6 eV standard (11.8 eV when specified). The field personnel performing the calibration will document in the field logbook or on a separate calibration log form the measurements taken.

3.10 INTERNAL QUALITY CONTROL CHECKS

3.10.1 Laboratory Quality Control Elements

Laboratory analytical criteria are summarized for parameters specified in **Section 3.5**. **Exhibit 3-9 through 3-11** outline specific method QC criteria requirements.

3.10.1.1 USEPA and USACE Quality Control Criteria

USEPA and USACE QC criteria will be followed in accordance with USEPA method and USACE Shell protocols. Specific QC method criteria for gamma screening, depleted uranium, and waste characterization and confirmation analysis may be found in **Exhibit 3-9 through Exhibit 3-16**. QC criteria will be assessed to provide quantitative data for determining method performance. The following general QC criteria will be included in each analytical lot as appropriate:

- Initial Calibration;
- Continuing Calibration;
- Independent Source Standards;
- Method and/or Preparation Blanks;
- Calibration blanks;
- MSs and MSDs;
- Laboratory Duplicates;
- Field Duplicates (from field sampling);
- Serial Dilutions (for ICP metals);
- Interference Check Sample (for ICP metals);
- Surrogates (for organics);
- Internal Standard (if necessary);
- Post Digestion Spikes (for metals);
- LCSs; and,
- Instrument Performance Check (Tune) Sample (for GC/MS).

Method-specific QC measures will be enforced for this scope of work for the Unnamed Tributary, Patroon Creek, and Three Mile Reservoir SI.

3.10.2 Field Quality Control Samples

Rinse blanks and field duplicates will be collected during the acquisition of environmental samples at Colonie. The rinse blanks are to be analyzed for the off-site gamma spectroscopy and alpha spectroscopy analysis. Field duplicates are to be analyzed for both the off-site analysis and the on-site PGM analysis. The field QC samples are not required for the IDM characterization and IDM confirmation samples. Every cooler transporting samples will have a temperature blank. If a target analyte is detected in any of the QC blanks, data will be evaluated to determine if corrective action measures will be required. Field operations performed during the Unnamed Tributary, Patroon Creek, and Three Mile Reservoir SI will include the collection of several types of QC samples on **Exhibit 3-17**. Field QC elements are summarized on **Exhibit 3-18**.

3.11 DATA COLLECTION, REDUCTION, VALIDATION, AND REPORTING

The collection, reduction, validation, and reporting of environmental data are described in this section. The intended use of the data and the associated acceptance criteria for data quality will be determined before the data collection effort begins. Reported data will include, when appropriate, statements of precision, accuracy, representativeness, completeness, comparability, and sensitivity. Data processing procedures will be documented, reviewed, and revised by the QC Manager, as required to meet USEPA Region II data quality requirements. The laboratory QA Manager will be responsible for data processing at the contract laboratory.

3.11.1 Lab Data Collection

Data are initially collected, converted to standard reporting units and recorded by the laboratory chemist. The laboratory chemist conducts preliminary data analyses using a variety of methods and procedures. Because many analytical instruments are microprocessor controlled, some of the requisite analyses can be performed directly in the instrument's operating or outputting mode. Those instruments interfaced to stand-alone computers or microprocessors often permit data analysis programs to be written and modified to produce data formats specifically suited to end user requirements. Data requiring manual recording, integration, and/or analysis may be converted to a more appropriate format prior to subsequent analyses. Through all stages and aspects of data processing, the data are double-checked for translation or transcription errors and are initialed by both the recorder and the checker. The laboratory QA Manager or other designated individual not directly involved in the analysis reviews the data for acceptability.

3.11.2 Lab Data Reduction

Data reduction frequently includes computation of analytical results from raw instrument data and summary statistics, including standard errors, confidence intervals, test of hypotheses relative to the parameters, and model validation. Data reduction procedures address the reliability of computations and the overall accuracy of the data reduction. The numerical transformation algorithms used for data reduction will be verified against a known problem set to ensure that the reduction methods are correct. The equations and the typical calculation sequence that should be followed to reduce the data to the acceptable format are instrument- and method-specific. Where standard methods are modified, data reduction techniques will be described in a report accompanying the data.

3.11.3 Data Validation

Data validation is the process whereby data are determined to be of acceptable or unacceptable quality based on a set of predefined criteria by Shaw. These criteria depend upon the type(s) of data involved and the purpose for which data are collected. Data packages will be validated to ensure compliance with specified analytical, QA, and data reduction procedures; data reporting requirements; and required accuracy, precision, and completeness criteria. Off-site gamma spectroscopy and alpha spectroscopy samples will be validated for the SI. The waste characterization and waste confirmation samples do not require data validation. Samples are to be validated against the QAPP requirements, Shell requirements, analytical method criteria, and laboratory SOP. Data qualifiers will be consistent with the Region II criteria. Specific validation levels may be found in the DQO tables in **Section 3.5.1**. Data validation results will be reported with the final findings. Data generated will be assessed for accuracy, precision, comparability, representativeness, completeness, and sensitivity.

3.11.4 Blank Contamination Assessment

Blank contamination assessment will be performed for the off-site radiological analysis to determine the impact of field sampling and laboratory analysis environments on data quality. Field and laboratory QC blank data will be reviewed in accordance with the Region II criteria. Method blanks, calibration blanks, and rinse blanks will be evaluated for the sediment samples collected under this QAPP. After data qualification, any flagged data will be evaluated against USEPA Region II criteria for usability. From a data usability standpoint, samples found due to blank contamination will be considered non-detect because of the probability that concentrations are from lab contamination and not necessarily indicative of conditions at the site. This is consistent with USEPA guidance and past blank assessments conducted at Colonie. Field and laboratory blanks will be collected and processed at the frequencies specified in **Sections 3.11.4.1 and 3.11.4.2**.

The criterion for the evaluation of blank contamination applies to any blank associated with the samples, and states that no contamination should be in the blank. If contamination is detected, data associated with the blank will be carefully evaluated to determine if there is an inherent variability in the data for the lot, or if the problem is an isolated occurrence not affecting all samples in the lot. The Project Manager will make project decisions (use qualified data, resample, reanalyze) based upon the analytical limitations of the data.

3.11.4.1 Field Rinse Blanks

The integrity of decontamination events and sample cross-contamination will be evaluated by the rinse blank for off-site radiological analysis for the sediment samples collected. A rinse blank will be collected at the beginning of the project when equipment is first decontaminated at a frequency of five percent of the total number of samples collected or per sampling event, whichever is greater per sampling technique.

The blank contamination assessment for rinse blanks will be performed to assess the impact of contaminant contributions originating from non-point sources, such as field sampling equipment decontamination procedures. Rinse blanks are intended to identify cross-contamination between samples as a result of sampling equipment decontamination procedures. Rinse blanks will be collected by pouring the required volume of deionized, organic-free water over the equipment and collecting the water in the appropriate sample containers. Rinse blanks will be performed at a rate of one per 20 samples collected or 5% per matrix per sampling technique.

The rinse blank results are evaluated for the analytes of concern to ascertain the efficiency of decontamination and assess the potential for cross-contamination. In accordance with USEPA Region II data validation guidelines, the detected concentration in the sample will be qualified "U" for blank contamination and is considered non-detect if the sample concentration was within five times (10 times for common laboratory contaminants such as acetone, 2-butanone, methylene chloride, OCDD/OCDF, and phthalate esters) the concentration in the associated equipment blank. Rinse blanks are aqueous samples and were reported in micrograms per liter (µg/L) or milligrams per liter (mg/L) units. Performing blank assessments for solid matrix samples, action levels will be calculated and expressed in solid matrix units micrograms per kilogram (µg/kg) or micrograms per gram (µg/g) from the given aqueous rinse blank concentrations to be compared against actual solid sample concentrations. This conversion is dependent upon the method performed, sample amounts used, and final digestate or extract volumes used during the analytical analysis. Action levels will be based upon 100% solids and 1x dilution factor and adjusted for each sample as appropriate.

3.11.4.2 Laboratory Blanks

Method blanks will be used to determine the potential contamination from the laboratory environment and analytical method used to process the sample. Method blanks will be processed at the beginning of each analytical run by the laboratory to determine whether the internal laboratory environment, reagents used during analyses, analytical techniques, or the instrumentation system are sources of contamination that could affect the integrity of the sample.

A method blank is a volume of analyte-free water or soil that is processed through the entire analytical scheme (i.e., extraction, digestion, concentration, and analysis) as with the actual samples. Results were qualified "B" for blank contamination by the laboratory and/or through the data validation process. In accordance with USEPA Region II data validation guidelines, reported sample results were considered "non-detect" and qualified with the letter "U" if the detected sample concentration was within 5 times (10 times for common laboratory contaminants: methylene chloride, acetone, 2-butanone, OCDD/OCDF, and common phthalate esters) the concentration in the associated method blank.

The method blank contamination assessment will be evaluated during the data validation process. Method blanks are compared against the same matrix environmental samples on a batch-specific basis, therefore, no unit conversions were necessary for method blanks since they were treated in the same manner as the samples. Calibration blanks will also compared against the environmental samples. Calibration blanks are aqueous samples and are reported in µg/L or mg/L units. Performing blank assessments for solid matrix samples, action levels will be calculated and expressed in solid matrix units µg/kg or µg/g from the given aqueous blank concentrations to be compared against actual solid sample concentrations. This conversion is dependent upon the method performed, sample amounts used, and final digestate or extract volumes used during the analytical analysis. Action levels will be based upon 100% solids and 1x dilution factor and adjusted for each sample as appropriate.

3.11.5 Data Reporting

The contract laboratory will provide electronic and hard copy chemistry data to Shaw. All non-detects will be reported as "less than" the reporting limit for each analyte. See **Section 3.5.2.6** for further discussion on sensitivity. Any positive value below the reporting limit and above the MDL or MDA will be reported as estimated. In some cases, data may be reported at the MDL or MDA level. Any positive value above the MDL or MDA must be reported for the method blanks. Values detected above the reporting limit will be reported as determined to no more than three significant figures.

3.11.6 Data Management

Hard-copy documentation will be transferred from the laboratory to Shaw. A third party will validate the data. Shaw will maintain the laboratory documentation until work assignment closeout, when records will be transferred to USACE.

3.11.7 Laboratory Turnaround Time

The laboratory is required to meet a maximum 28 day deliverable turnaround time (TAT) for the project as specified in the SOW. If for any reason the laboratory realizes that the TAT will not be met, Shaw must be notified of the affected samples, analysis, reason for lateness, and revised due dates prior to the original due date. The TAT starts from the time of receipt the samples at the laboratory.

3.12 CORRECTIVE ACTION PROCEDURES

Corrective action will be initiated through the development and implementation of routine internal QC checks. Specific limits beyond which corrective action is required will be established for each system. Corrective action requirements will be implemented in response to deficiencies encountered during system inspections.

A closed-loop corrective action system will be used to address system and data quality issues. Steps comprising a closed-loop corrective action system include:

- Defining the problem;
- Assigning responsibility for problem investigation;
- Investigating and determining the cause of the problem;
- Assigning responsibility for problem resolution; and,
- Verifying that the resolution has corrected the problem.

Documentation will be done on all of the steps of the corrective action system, including the dates and parties involved. Such documentation will be reviewed during system inspections. Problems identified by assessment procedures will be resolved at the level it occurred with support from upper management. Problems that cannot be resolved at this level will be reported to the QC Manager for resolution, who will determine at which management level the problem can best be resolved, and will notify the appropriate manager.

Corrective actions will be categorized as either routine or non-routine and will require short-term or long-term action. Both types will require administrative coordination between the person initiating the corrective action and the QC staff.

3.12.1 Routine Corrective Action

Work plans and SOPs will establish technical procedures and the associated QC requirements. Where possible, SOPs will include specific criteria for determining the expected quality and examples of the appropriate corrective action procedures that may be taken if the criteria are not met. Routine corrective action will involve either short-term action for sporadic problems or long-term action for more chronic problems. Corrective action initiated at the project level will be reported to the QC Manager to ensure corrective action is implemented and the problem is resolved.

3.12.2 Non-Routine Corrective Action

Activities that are not covered by a specific SOP require an iterative process whereby the systems and QC specifications are estimated prior to the activity, and adjustments are made, as needed, during the course of the activity. Documentation on the corrective action requirements, the assignment of responsibility for corrective action, due dates for completion of corrective action, and validation of completion will be maintained. Such documentation will be reviewed during system inspections.

Problems identified by assessment procedures will be resolved at the level it occurred with support from upper management. Problems that cannot be resolved at this level will be reported to the QC Manager for resolution, who will determine at which management level the problem can best be resolved, and will notify the appropriate manager.

3.12.3 Quality Improvement

Continuous development and improvement of the quality system is to be initiated through the quality improvement process (QIP). The Shaw QIP is based on problem prevention, resolution, and corrective action. QIP goals include the timely identification and resolution of the quality problems in manner that minimizes their impact on work products and prevents their reoccurrence.

3.12.4 Problem Prevention

The preventive action program is intended to identify problems before they are adverse to quality. Inspections, self-assessments, and peer review are examples of the tools that will be used by the project staff to identify potential quality problems. Input regarding project operations will be regularly sought from clients, subcontractors, and staff. The Project Manager will foster a no-fault attitude for problem identification, and staff is encouraged to identify process improvement opportunities, problems, and solutions.

3.12.5 Stop Work Protocols

The Shaw Program Manager, Project Manager, SSHO, and QA Manager have the authority to issue a stop work order. A stop work order will be issued under conditions such that the quality of work jeopardizes the attainment of the project objectives. A stop work order must not create an operational, safety, public health, or environmental hazard. Any project employee may also issue a stop work order if a safety concern exists or should arise.

Under a stop work order, work may not be conducted within affected activities until the responsible manager acknowledges the implementation of a corrective action in accordance with the resolution criteria of the order. Immediate notification of work stoppage will be made to USACE.

3.13 QUALITY ASSESSMENTS

This section discusses the inspection program used to monitor the total measurement system and to evaluate the quality of operation in the field and at the laboratory. A performance inspection is a planned independent check of the operation of a system to obtain a quantitative measure of the quality of data generated, and involves the use of standard reference samples or materials which are certified as to their chemical composition or physical characteristics. Systems inspection is of a qualitative nature and consists of on-site review of a system's QA system and physical facilities for sampling/analysis, calibration, and measurement.

3.13.1 Document Review

Project plans will be reviewed and approved prior to implementation. The Project Manager and QC Manager will provide a qualitative self-evaluation for establishing whether the prevailing management structure, polices, practices, and procedures are adequate to ensuring that the results needed are obtained. The Project Manager will provide an independent qualitative evaluation of a particular program operation and/or organization to establish whether the prevailing management structure, policies, practices, and procedures are adequate for ensuring that the results needed are obtained.

3.13.2 Document Control

The goal of Shaw's Document Control Program is to ensure that the project documents issued or generated will be accounted for upon completion of the project. The program includes a numerical document control system, document inventory procedure, and a central filing system with a designated person(s) responsible for its maintenance. Documents used or generated during the course of the project are accounted for and become a part of the project files upon completion of the task. These may include but are not limited to the following:

- Project Deliverables;
- Investigation Requirements;
- Reports and correspondence material; and,
- Contract Documents.

3.13.3 Field System Audits

A field audit of the activities will be accomplished at the discretion of the QC Manager by an inspection of all field site activities by an Shaw technical audit team. If elected to be performed, the audit team will compare current field practices with procedures outlined in the project work plans (i.e., Work Plan, SAP, and EM 1110-1-4000 *Monitor Well Design, Installation, and Documentation at Hazardous and/or Toxic Waste Sites* (USACE, 1994). The following elements would be evaluated during field activities at the unnamed tributary, Patroon Creek, and Three Mile Reservoir:

- Overall level of organization and professionalism;
- Project activities;
- Document control and management;
- Level of QC conducted per each field team; and,
- Task-specific activities.

After audit completion, deficiencies would be discussed with the field staff and corrections will be identified. If any of these deficiencies could affect the data integrity, the audit team will inform the Project Manager so corrections can be implemented immediately. Corrective action procedures are outlined in **Section 3.12**.

4.0 REFERENCES

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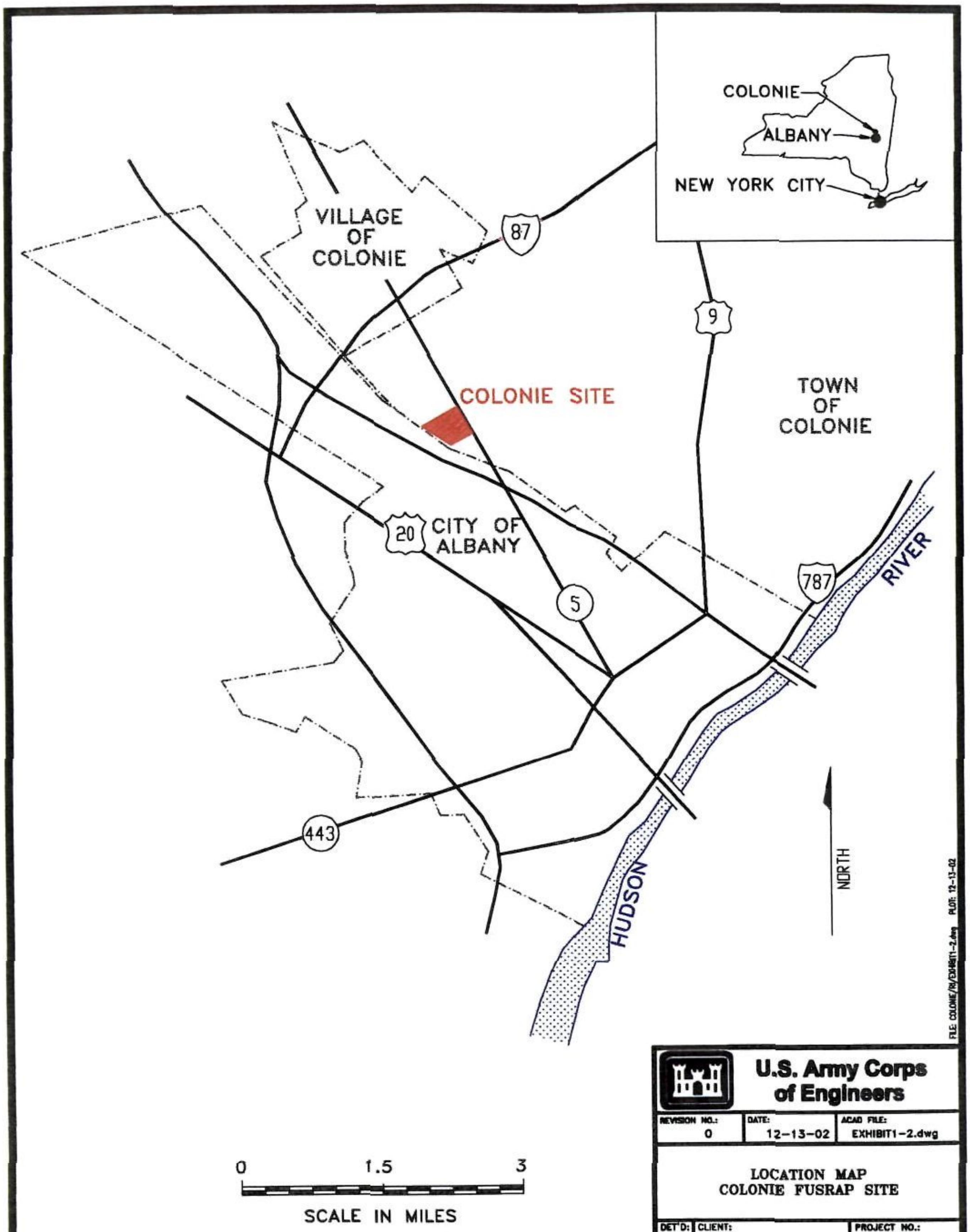
EXHIBITS



FILE: COLONIE/RI/EXHIBIT1-2.dwg PLOT: 12-13-02

U.S. Army Corps of Engineers

REVISION NO.:	DATE:	ACAD FILE:
0	12-13-02	EXHIBIT1-2.dwg

LOCATION MAP
COLONIE FUSRAP SITE

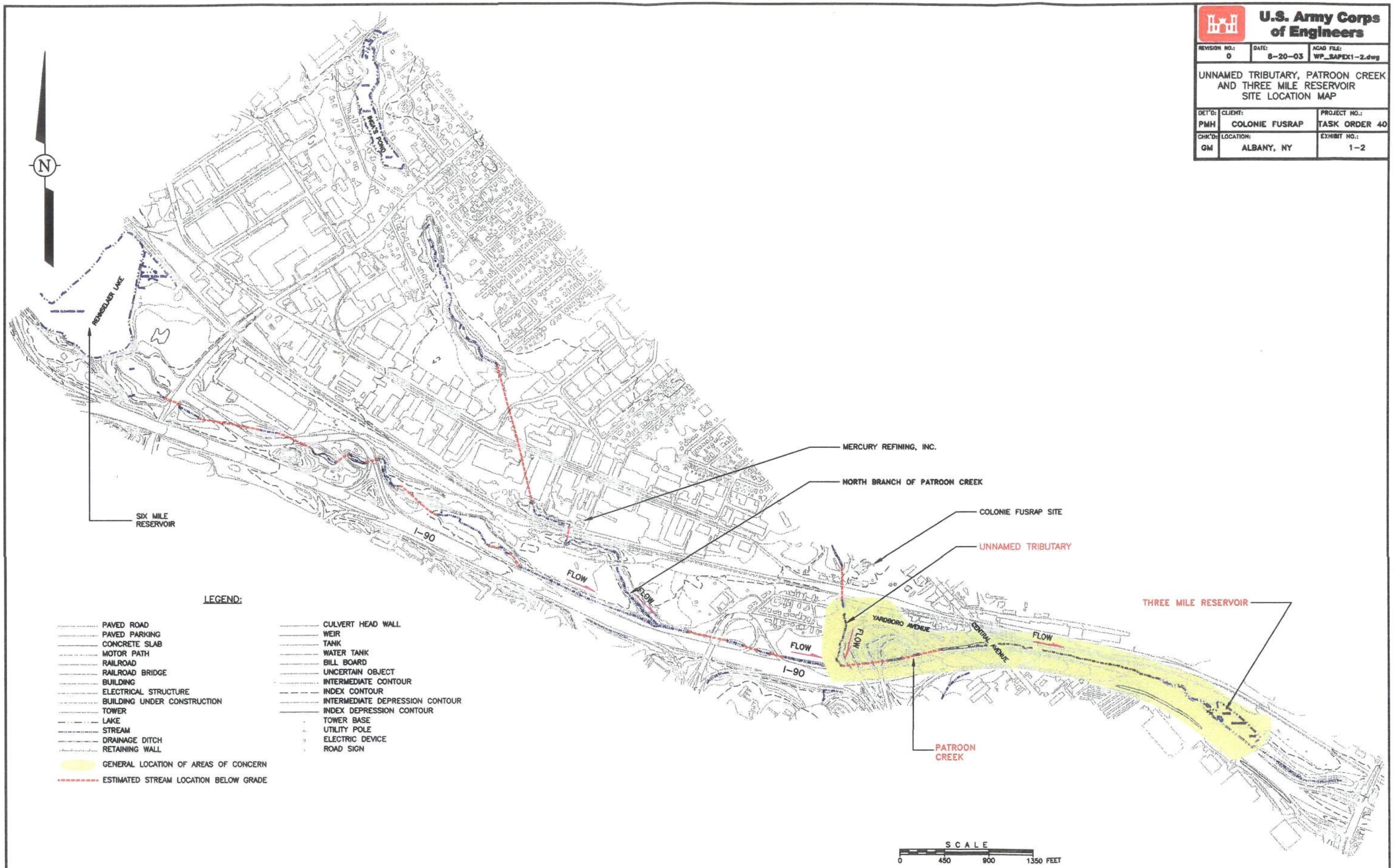
DET'D:	CLIENT:	PROJECT NO.:
PMH	COLONIE FUSRAP	TASK ORDER 4
CHK'D:	LOCATION:	EXHIBIT NO.:
MI	ALBANY, NY	1-1

U.S. Army Corps of Engineers

REVISION NO.:	DATE:	ACAD FILE:
0	8-20-03	WP_SAPEX1-2.dwg

UNNAMED TRIBUTARY, PATROON CREEK
AND THREE MILE RESERVOIR
SITE LOCATION MAP

DET'D:	CLIENT:	PROJECT NO.:
PMH	COLONIE FUSRAP	TASK ORDER 40
CHK'D:	LOCATION:	EXHIBIT NO.:
GM	ALBANY, NY	1-2



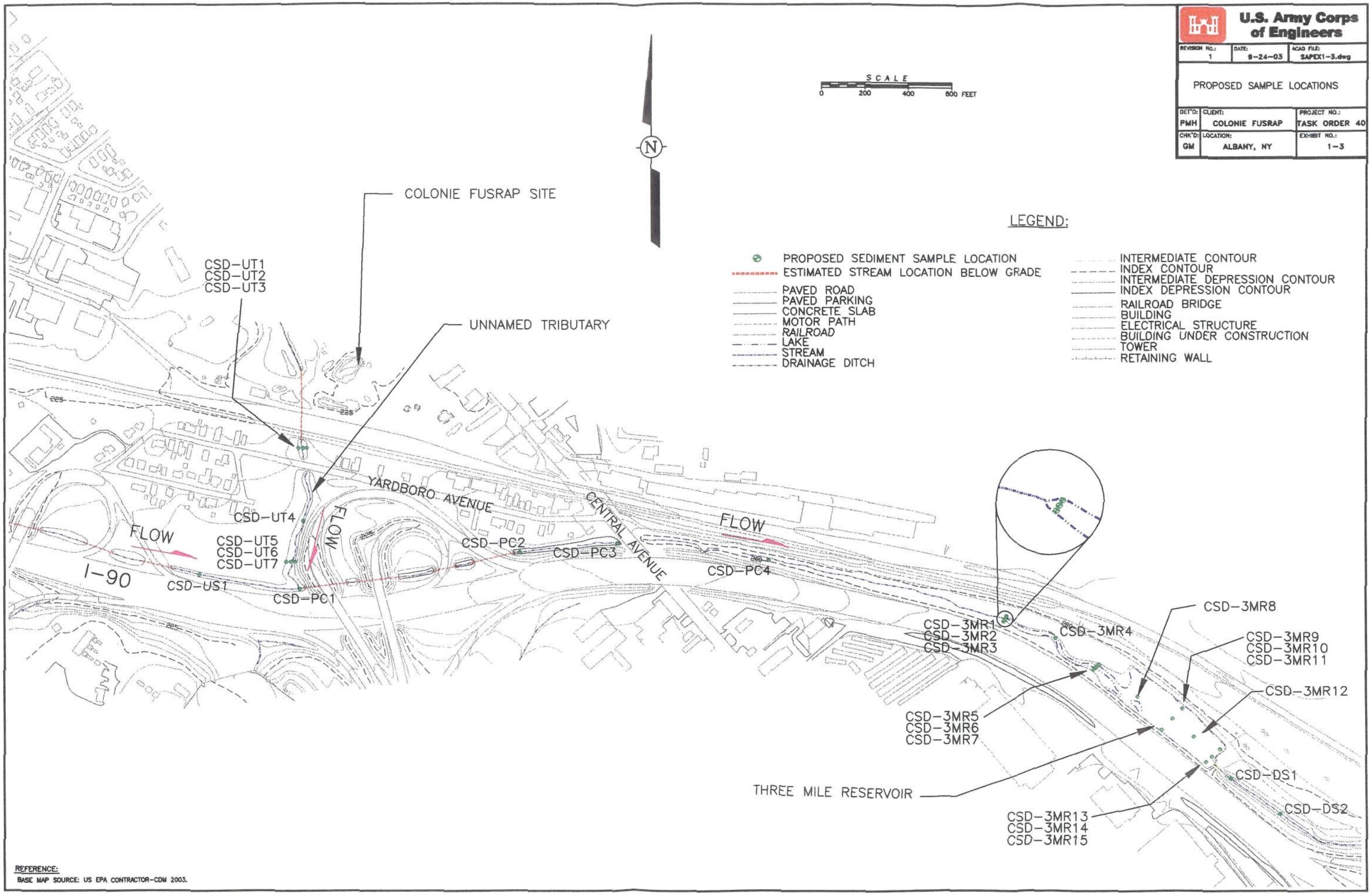
REFERENCE:
BASE MAP SOURCE: US EPA CONTRACTOR-CDM 2003.

U.S. Army Corps of Engineers

REVISION NO.: 1	DATE: 9-24-03	ACAD FILE: SAPEX1-3.dwg

PROPOSED SAMPLE LOCATIONS

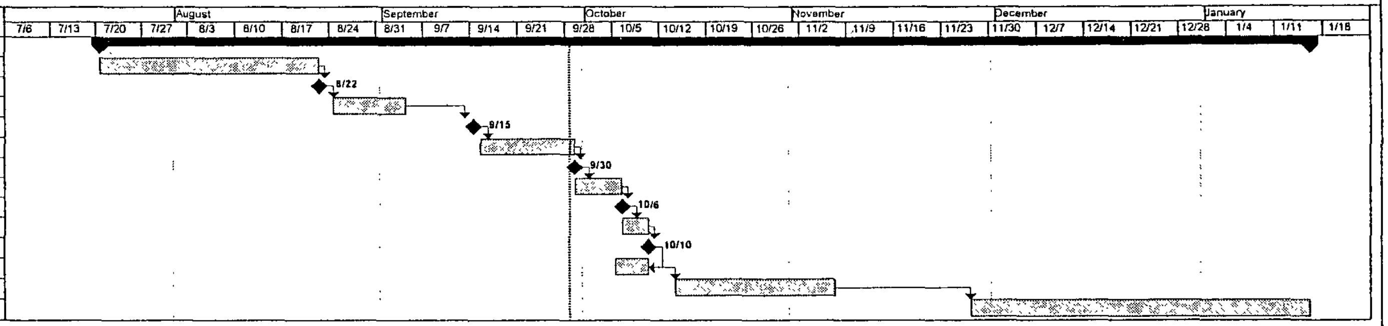
DET'D: PMH	CLIENT: COLONIE FUSRAP	PROJECT NO.: TASK ORDER 40
CHK'D: GM	LOCATION: ALBANY, NY	EXHIBIT NO.: 1-3



REFERENCE:
BASE MAP SOURCE: US EPA CONTRACTOR-CDM 2003.

Exhibit 1-4
Schedule for Completion of Site Investigation Activities at the Unnamed Tributary, Patroon Creek, and Three Mile Reservoir

Task Name	Duration	Start	Finish
Patroon Creek Site Investigation	**130 days**	**Mon 7/21/03**	**Fri 1/16/04**
Prepare Draft Work Plan	25 days	Mon 7/21/03	Fri 8/22/03
Draft Work Plan (WP) to USACE	0 days	Fri 8/22/03	Fri 8/22/03
USACE Reviews Draft WP	9 days	Mon 8/25/03	Thu 9/4/03
Receive Comments on WP from USACE	0 days	Mon 9/15/03	Mon 9/15/03
Prepare Draft Final WP	10 days	Tue 9/16/03	Mon 9/29/03
Submit Draft Final WP	0 days	Tue 9/30/03	Tue 9/30/03
USACE Review of Draft Final	5 days	Tue 9/30/03	Mon 10/6/03
Receive Comments on Draft Final WP	0 days	Mon 10/6/03	Mon 10/6/03
Prepare Final Work Plans	4 days	Tue 10/7/03	Fri 10/10/03
Submit Final Work Plans	0 days	Fri 10/10/03	Fri 10/10/03
Prep for Field Work	5 days	Mon 10/6/03	Fri 10/10/03
Field Work - Site Investigation	18 days	Wed 10/15/03	Fri 11/7/03
Prepare Draft Site Investigation Report	36 days	Fri 11/28/03	Fri 1/16/04



Project: Patroon Creek
Date: Mon 9/29/03

Task	▨	Progress	▬	Summary	▬	Rolled Up Split	· · · · · · · ·	Rolled Up Progress	▬	Project Summary	▨	Deadline	⇩
Split	· · · · · · · ·	Milestone	◆	Rolled Up Task	▨	Rolled Up Milestone	◇	External Tasks	▨	External Milestone	◇		

Exhibit 2-1. Unnamed Tributary, Patroon Creek, and Three Mile Reservoir SI Sampling Program

Summary of Sediment and IDM Samples To Be Collected						
Sample Location	**No. of Samples**	**Sample Locations**	**On-site Analysis** Pancake Geiger-Mueller	**Off-site Split Confirmation Analysis** Gamma Spectroscopy and Depleted Uranium (20% of total samples or min=5)	**Off-site IDM Characterization Analysis** TCLP Metals	**Off-site IDM Confirmation Analysis** Full TCLP (10% of total IDM samples or min=1)
Along Patroon Creek Upstream of Colonie FUSRAP Site	1	CSD-US1	X	X		
Unnamed Tributary that crosses the Colonie FUSRAP Site	7 (1 duplicate)	CSD-UT1	X	X		
		CSD-Duplicate 1	X	X		
		CSD-UT2	X			
		CSD-UT3	X			
		CSD-UT4	X			
		CSD-UT5	X			
		CSD-UT6	X			
		CSD-UT7	X			
Patroon Creek from the Unnamed Tributary to the Three Mile Reservoir	4 (1 duplicate)	CSD-PC1	X	X		
		CSD-Duplicate 2	X			
		CSD-PC2	X			
		CSD-PC3	X			
		CSD-PC4	X			
Three Mile Reservoir	15 (1 duplicate)	CSD-3MR1	X	X		
		CSD-3MR2	X			
		CSD-3MR3	X			
		CSD-3MR4	X			
		CSD-3MR5	X			
		CSD-3MR6	X			
		CSD-3MR7	X			
		CSD-3MR8	X			
		CSD-3MR9	X			
		CSD-3MR10	X			
		CSD-3MR11	X	X		
		CSD-3MR12	X			
		CSD-Duplicate 3	X			
		CSD-3MR13	X			
		CSD-3MR14	X			
		CSD-3MR15	X			
Downstream of Three Mile Reservoir	2	CSD-DS1	X	X		
		CSD-DS2	X			
Investigation-Derived Material (IDM)	1 (only for the radioactive contaminated areas)	CSD-IDM1 (To be collected in radioactive contaminated areas)			X (# dependent upon if radioactive contamination is found)	X (# dependent upon if radioactive contamination is found)
Rinse Blank	1 per matrix per sampling technique (i.e. Vibracore for Three Mile Reservoir and Slam Bar for other areas)	MMDDYYRB1		X		
		MMDDYYRB2		X		

Exhibit 2-2

Description and Use of Typical Field Instruments

Shaw E&I Project Number 823485
Unnamed Tributary, Patroon Creek and Three-Mile Reservoir
Colonie, New York

INSTRUMENT	DESCRIPTION	TYPICAL USE	PARAMETER(S) DETECTED
Radiological - Field			
Eberline AC-3	alpha detector	direct surface surveys of equipment, personnel, or surfaces for release	total surface alpha activity (cpm)
Eberline HP-210	shielded beta gamma detector	direct surface surveys of equipment, personnel, or surfaces for release; used in conjunction with AC-3/Ludlum 43-5.	total surface beta/gamma (cpm)
Alpha Spectra/Rexon (FIDLER)	probe with sodium iodide [Na(I)] crystal	radiological surface surveys (including walkover surveys)	low-level gamma radiation; capable of detecting low energy uranium (cpm)
Ludlum 44-10 (or equivalent)	probe with 2 x 2 Na(I) crystal	radiological surface surveys (including walkover surveys)	usually calibrated for higher energy gamma radiation, typically used to detect isotopes with decay energies greater than 1 MeV
Ludlum 2221	rate meter/scaler	used for all of the above probes	energy source for attached probes
Eberline RO-2	dose rate meter	dose rate surveys for release of shipping containers, surveys of on-Site storage areas	beta/gamma activity in mR/hr (range of 0-3000 mR/hr)
Ludlum 12S	dose rate meter	dose rate survey for release of sample containers for shipment	low energy gamma (uR range)
Ludlum 177	rate meter	frisking of personnel and equipment for release from controlled areas	beta/gamma activity (cpm)

Exhibit 2-2

Description and Use of Typical Field Instruments

Shaw E&I Project Number 823485
Unnamed Tributary, Patroon Creek and Three-Mile Reservoir
Colonie, New York

INSTRUMENT	DESCRIPTION	TYPICAL USE	PARAMETER(S) DETECTED
Radiological - Lab			
Eberline SAC - 4	counting instrument	counts activity of smears and air filters	alpha activity (cpm)
Eberline MS-3 w/ Eberline HP210	counting instrument	counts activity of smears and air filters	total beta/gamma activity (cpm)
Ludlum 2929	counting instrument	counts activity of smears and air filters	total alpha and beta/gamma activity (cpm)
EG&G Ortech HPGe unit	laboratory grade counting instrument	analyzes gamma activity for samples	gamma isoptopic activity (pCi/g)
Industrial Hygiene – Field			
TVA-1000 PID/FID	organic vapor detector	screening instrument	total organic vapors

Exhibit 2-3. Analysis Container, Preservation, and Holding Time Requirements

Parameter	Sample Container*		Preservation Requirement*	Holding Time
	Solid	Aqueous		
Site Investigation				
Gamma Spectroscopy	1x, 8 oz, wide mouth glass with Teflon cap	1x, 1-L HDPE	HNO_3 to pH<2 for aqueous	Aqueous and Solid: 180 days
Alpha Spectroscopy	1x, 8 oz, wide mouth glass with Teflon cap	1x, 1-L HDPE	HNO_3 to pH<2 for aqueous	Aqueous and Solid: 180 days
Metals IDM Waste Characterization				
TCLP Metals (ICP and Mercury)	1x, 8 oz, wide mouth glass with Teflon cap	1x, 1-L HDPE	HNO_3 to pH<2 for aqueous	Aqueous and Solid: Metals: 180 days Mercury: 28 days
IDM Waste Confirmation Characterization				
TCLP Metals (ICP and Mercury)	1x, 8 oz, wide mouth glass with Teflon cap	1x, 1-L HDPE	HNO_3 to pH<2 for aqueous	Aqueous and Solid: Metals: 180 days Mercury: 28 days
TCLP VOCs	1x 4 oz wide mouth glass, Teflon Septum	3x 40 mL, amber glass, Teflon-lined septum	Cool: 4 ± 2°C, Zero Headspace	Aqueous: TCLP Extr: 14 Days Analysis: 14 Days Solid: TCLP Extr: 14 Days Analysis: 14 Days
TCLP SVOCs	1x 8 oz wide mouth glass, Teflon Lined Cap	2x 1L amber glass, Teflon Lined Cap	Cool: 4 ± 2°C	Aqueous: TCLP Extr: 14 Days Extraction: 7 Days Analysis: 40 Days Solid: TCLP Extr: 14 Days Extraction: 7 Days Analysis: 40 Days
TCLP Pesticides	1x 8 oz wide mouth glass, Teflon Lined Cap	2x 1L amber glass, Teflon Lined Cap	Cool: 4 ± 2°C	Aqueous: TCLP Extr: 14 Days Extraction: 7 Days Analysis: 40 Days Solid: TCLP Extr: 14 Days Extraction: 7 Days Analysis: 40 Days

Exhibit 2-3. Analysis Container, Preservation, and Holding Time Requirements, Continued

Parameter	Sample Container*		Preservation Requirement*	Holding Time
	Solid	Aqueous		
IDM Waste Confirmation Characterization				
TCLP Herbicides	1x 8 oz wide mouth glass, Teflon Lined Cap	2x 1L amber glass, Teflon Lined Cap	Cool: 4 ± 2°C	Aqueous: TCLP Extr: 14 Days Extraction: 7 Days Analysis: 40 Days Solid: TCLP Extr: 14 Days Extraction: 7 Days Analysis: 40 Days
Reactive Cyanide	1x 4 oz wide mouth glass, Teflon Lined Cap	1x 500 ml HDPE	Cool: 4 ± 2°C	Aqueous: 14 days Solid: 14 days
Reactive Sulfide	1x 4 oz wide mouth glass, Teflon Lined Cap	1x 500 ml HDPE	Cool: 4 ± 2°C	Aqueous: 7 days Solid: 7 days
Ignitability	1x 4 oz wide mouth glass, Teflon Lined Cap	1x 125 ml HDPE	Cool: 4 ± 2°C	Aqueous: 28 days Solid: 28 days
Corrosivity as pH	1x 4 oz wide mouth glass, Teflon Lined Cap	1x 125 ml HDPE	Cool: 4 ± 2°C	Aqueous: ASAP Solid: ASAP

*Parameters with same preservation requirements may be combined at laboratory's discretion.
NA = Not Applicable
Ref: USDOE HASL-900 EML Procedures Manual (USDOE), USEPA Prescribed Procedures for Measurement for Radioactivity in Drinking Water Methodology (USEPA, 1980), and USEPA Test Methods for Evaluating Solid Waste Physical/Chemical Methods, Update III (USEPA, 1996).

Exhibit 3-1

Unnamed Tributary, Patroon Creek and Three Mile Reservoir Sampling Effort Organizational Chart

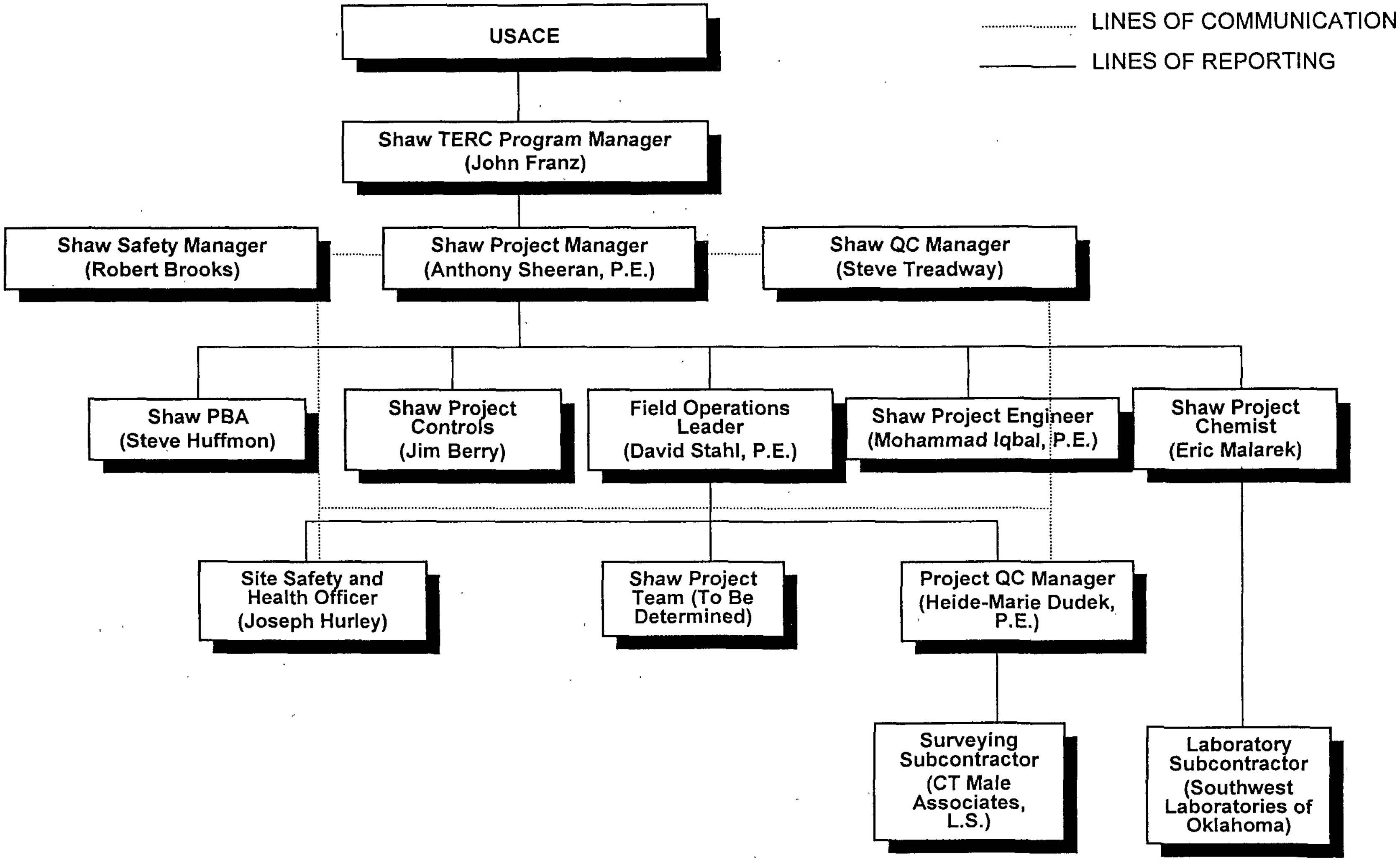


Exhibit 3-2. Lines of Authority

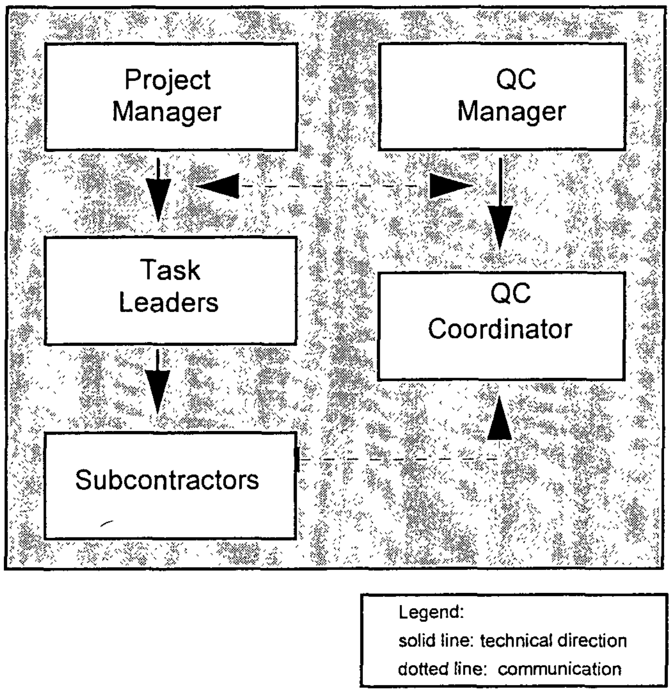


Exhibit 3-3. Shaw Environmental, Inc. and Subcontractor Key Points of Contact

Name/Affiliation	Key Point of Contact
Anthony Sheeran, P.E., Shaw Environmental, Inc. Project Manager Anthony.Sheeran@shawgrp.com	1118 Central Ave Colonie, NY 12205 Phone: (518) 482-0237 Fax: (518) 482-0343
David Stahl, P.E., Shaw Environmental, Inc. Lead Field Coordinator David.Stahl@shawgrp.com	13 British American Blvd. Latham, NY 12110 Phone: 518-783-1996 Fax: (518) 482-0343
Heide-Marie Dudek, P.E., Shaw Environmental, Inc. Project QC Manager Heide-MarieDudek@shawgrp.com	13 British American Blvd Latham, NY 12210 Phone: (518) 783-1996 Fax: (518) 783-8397
Joseph Hurley, Shaw Environmental, Inc. Site Safety and Health Officer Joseph.Hurley@shawgrp.com	1130 Central Avenue Albany, NY 12205 Phone: (518) 482-0237 Fax: (518) 482-0343
Mohammad Iqbal, P.E., Shaw Environmental, Inc. Project Engineer Mohammad.Iqbal@shawgrp.com	2113 Emmorton Park Road Edgewood, MD 21040 Phone: (410) 612-6381 Fax: (410) 612-6351
Eric Malarek, Shaw Environmental, Inc. Project Chemist / Data Validation Manager Eric.Malarek@shawgrp.com	2113 Emmorton Park Road Edgewood, MD 21040 Phone: (410) 612-6322 Fax: (410) 612-6351
Kert Surface, Southwest Laboratories of Oklahoma Analytical Laboratory Subcontractor Ksurface@swlab.com	1700 West Albany Broken Arrow, OK 74012 Phone: (918) 251-2858 Fax: (918) 251-2599
Ed Garrigan, CT Male Associates, L.S. Licensed Land/Civil Surveying Subcontractor C.T. Male Associates, P.C.	50 Century Hill Drive PO Box 727 Latham, NY 12110 Phone: (518) 786-7400 Fax: (518) 786-7299

Exhibit 3-4. Components of Project-Specific Data Quality Objectives

DQO Elements		***Definition***
Problem Statement	Problem and Objectives	Describes the activity objectives and problem of focus associated with the scope of work.
Decision Identification	Decision Statement and Alternative Actions	Describes the decision statement that the study will attempt to resolve and the alternative actions.
Decision Inputs	Chemical Data	Defines the chemical analytical parameters to be conducted.
	Physical Data	Defines the physical analytical parameters or measurements to be conducted.
	Sampling Method	Defines the type of sampling method to be used.
	Data Use	Provides the data's end use.
	Validation Level	Defines the USEPA or USACE validation level to be performed.
	Analytical Method	Specifies the USEPA methodology for chemical and physical analyses.
	Minimum Quantitation Limit	Specifies the MQLs for the chemical analyses.
	Field Quality Control Samples	Provides the field QC samples to be performed.
	Action Levels	Provides the levels of concern.
Study Boundary	*Spatial and temporal* boundaries	Provides the spatial, population characteristics, and sample collection constraints.
Decision Rule Development	Decision Rule	Defines the compounds of concern and action levels for which decisions are to be made.
Tolerance Limits on Decision Errors	Acceptable Tolerance Limits	Specifies the decision maker's tolerable limits on decision errors.
Design Optimization	Sampling Design	Specifies the optimal design for collection of data.

Exhibit 3-5. Data Quality Objectives for Sediment SI at the Unnamed Tributary to Patroon Creek, Patrook Creek, and Three Mile Reservoir

DQO Elements		DQO Output
1. STATE THE PROBLEM	PROBLEM STATEMENT	1. As a result of historical data, need to determine the absence/presence of radioactive contamination as a result of historical operations that may have allowed radioactive contamination to migrate from the Colonie FUSRAP Site. 2. Evaluate the IDM for metals to determine order-of-magnitude estimation for waste characterization analysis for disposal..
2. IDENTIFY THE DECISION	DECISION STATEMENT	Investigate the absence/presence of radiological contamination at Unnamed Tributary to Patroon Creek, Patroon Creek, and Three Mile Reservoir; and if present above 1.5 times background, evaluate IDM for metals for waste characterization analysis for disposal and possible future removal actions. Samples will be screened for radiological contamination over the entire core collected at 6 inch intervals. If detected, samples for off-site radiological confirmatory analysis will be composited over the 6 inch area of the core detected with the highest radiological contamination. Samples for waste characterization will also be collected from the interval exhibiting the highest radiological contamination. However, if sufficient sample volume cannot be collected from that interval, the adjacent intervals may be composited to obtain the required volume such that the sample will be representative of media that may be encountered during future potential removal actions.
	ALTERNATIVE ACTIONS	1. No additional study is necessary. 2. Further study is warranted.
3. IDENTIFY THE INPUTS TO THE DECISION	CHEMICALS OF INTEREST	1. Sediment samples will be collected and analyzed onsite for radiation using a Pancake Geiger-Mueller instrument. 2. Off-site confirmation split samples will be taken at a frequency of 20% or minimum of 5 samples, whichever is greater. They will be analyzed for radiological isotopes using gamma spectroscopy and alpha spectroscopy. 3. IDM will be analyzed for and TCLP metals offsite at radioactive contaminated areas. Ten percent of the IDM samples will be analyzed for full TCLP, ignitability, corrosivity as pH, and reactivity as confirmation.
	PHYSICAL DATA	Map locations for all sample locations will be generated. Each sampling location will surveyed using Differential Global Positioning System (DGPS) and marked in the field.
	ANALYTICAL METHODS	<u>On-Site Radiological Data</u>: Pancake Geiger-Mueller: EDI SOPs 3B.2 and 5A.2 <u>Off-Site Radiological Data</u>: Gamma Spectroscopy: USDOE HASL 300 Alpha Spectroscopy: USEPA 908.1 Modified <u>Metals IDM Waste Characterization</u>: TCLP Metals: SW-846 1311/6010B/7470A <u>Waste IDM Confirmation:</u> Full TCLP: SW-846 1311/6010B/7470A/8260B/8270C/8081A/8151A Reactivity, Ignitability, Corrosivity: SW-846 Chapter 7, SW-846 1010
	METHOD QUANTITATION LIMITS	Refer to **Exhibit 3-6**.
	FIELD QUALITY CONTROL SAMPLES	<u>For Radiological Confirmation Data:</u> Rinse Blank (5% frequency per matrix per sampling technique) Field Duplicate (10% frequency per matrix) <u>For Waste Characterization/Confirmation Data</u>: Not Applicable
	DATA USE	Site Investigation

Exhibit 3-5. Data Quality Objectives for Sediment SI at the Unnamed Tributary to Patroon Creek, Patroon Creek, and Three Mile Reservoir, Continued

DQO Elements		DQO Output
	VALIDATION DATA LEVEL	USACE Level IV (USEPA Region II SOP Guidance)
4. DEFINE THE BOUNDARIES OF THE STUDY	ACTION LEVELS	For Metals Waste Characterization Data: State of New York guidance, disposal facility permit levels, and/or USEPA disposal criteria (40 CFR 261.24 and USEPA SW-846 Chapter 7)
	MEDIA TO SAMPLE	Sediment
	SPATIAL BOUNDARIES	Discrete samples along Patroon Creek upstream of the Colonie FUSRAP site, within the Unnamed Tributary to Patroon Creek, within the Patroon Creek, within the Three Mile Reservoir, and below the Three Mile Reservoir.
	TIME FRAME	Not critical to meet DQOs.
	PRACTICAL CONSTRAINTS	1. Real estate access is needed from CSX, State DOT, Niagara Mohawk, and City of Albany. 2. Permits may be required to work in the stream bed (state) or wetlands. 3. Proposed raising of water levels in Three Mile Reservoir may contribute to dam instability issues and may impact the need for permit(s) if the stream bed or wetland areas may be impacted. 4. Winter conditions will prevent fieldwork due to icy dangerous conditions. Work should be completed in fall or spring. November 7 is the anticipated cutoff for fall work. 5. Underground utilities will need to be cleared
	SCALE	See Sampling Design
5. DEVELOP A DECISION RULE	DECISION RULE	If radiological contamination is absent (i.e. below 1.5 times natural background levels), then no additional evaluation is necessary. Instrument background is to be determined at each location measured using a Pancake Geiger-Mueller detector.
6. SPECIFY TOLERABLE LIMITS ON DECISION ERRORS	NOT APPLICABLE	Statistical comparisons will not be made for this screening investigation, therefore, no limits on decision errors have been made.
7. OPTIMIZE THE DESIGN FOR OBTAINING DATA	SAMPLING DESIGN	Select sampling locations (number of points) have been determined upstream of the Colonie FUSRAP Site (1 point), within the unnamed tributary that crosses the Colonie FUSRAP Site (7 points; transects 1/2/3 and 5/6/7, and point 4), within Patroon Creek from the Unnamed Tributary to the Three Mile Reservoir (4 points), within the Three Mile Reservoir (15 points), and downstream of the Three Mile Reservoir (2 points). To minimize the potential for cross contamination during sampling, sample CSD-US1, located along Patroon Creek upstream of the Colonie FUSRAP Site, will be collected first. The sampling sequence will than proceed from the downgradient-most location (sample CSD-DS2) incrementally upstream towards the site.

Exhibit 3-6. Laboratory Analysis Analyte Lists, Methods, PQLs/MDCs, and Screening Values

Radiological Analysis using Gamma Spectroscopy – USDOE HASL-300

Nuclide	MDC	SVs
Actinium 228	1.0 pCi/g	NA
Cesium 137	1.0 pCi/g	NA
Potassium 40	1.0 pCi/g	NA
Radium 226	1.0 pCi/g	NA
Radium 228	Based on Ac-228	NA
Thorium 232	Based on Ac-228	NA
Uranium 234	Not applicable to gamma	NA
Uranium 235	1.0 pCi/g	NA
Uranium 238	1.0 pCi/g (Based on Th-234)	NA

Radiological Analysis using Alpha Spectroscopy by USEPA 908.1 Modified and EMLU-02-Modified

Nuclide	MDC	SVs
Uranium 234	1.0 pCi/g	NA
Uranium 235	1.0 pCi/g	NA
Uranium 238	1.0 pCi/g	NA

TCLP Metals – SW-846 1311/3010A/6010B/7470A

Compound	PQL	SVs
Arsenic	0.1 mg/L	5.0 mg/L
Barium	2 mg/L	100 mg/L
Cadmium	0.05 mg/L	1.0 mg/L
Chromium	0.1 mg/L	5.0 mg/L
Lead	0.03 mg/L	5.0 mg/L
Mercury	0.002 mg/L	0.2 mg/L
Selenium	0.05 mg/L	1.0 mg/L
Silver	0.1 mg/L	5.0 mg/L

TCLP Pesticides – SW-846 1311/3510C/3520C/8081A

Compound	PQL	SVs
Chlordane	0.00050 mg/L	0.03 mg/L
Endrin	0.001 mg/L	0.02 mg/L
gamma-BHC (Lindane)	0.00050 mg/L	0.4 mg/L
Heptachlor	0.00050 mg/L	0.008 mg/L
Heptachlor epoxide	0.00050 mg/L	0.008 mg/L
Methoxychlor	0.005 mg/L	10.0 mg/L
Toxaphene	0.030 mg/L	0.5 mg/L

Exhibit 3-6. Laboratory Analysis Analyte Lists, Methods, PQLs/MDCs, and Screening Values, *Continued*

TCLP SVOCs – SW-846 1311/3510C/3520C/8270C		
Compound	PQL	SVs
1,4-Dichlorobenzene	0.10 mg/L	7500 mg/L
2-Methylphenol (o-Cresol)	0.10 mg/L	200 mg/L
2,4-Dinitrotoluene	0.10 mg/L	0.13 mg/L
3-Methylphenol (m-Cresol)	0.10 mg/L	200 mg/L
4-Methylphenol (p-Cresol)	0.10 mg/L	200 mg/L
Hexachlorobenzene	0.10 mg/L	0.13 mg/L
Hexachlorobutadiene	0.10 mg/L	0.5 mg/L
Hexachloroethane	0.10 mg/L	3.0 mg/L
Nitrobenzene	0.10 mg/L	2.0 mg/L
Pentachlorophenol	0.25 mg/L	100 mg/L
Pyridine	0.10 mg/L	5.0 mg/L
2,4,5-Trichlorophenol	0.25 mg/L	400 mg/L
2,4,6-Trichlorophenol	0.10 mg/L	2.0 mg/L

TCLP VOCs – SW-846 1311/5030B/8260B		
Compound	PQL	SVs
Benzene	0.10 mg/L	0.5 mg/L
Carbon tetrachloride	0.10 mg/L	0.5 mg/L
Chlorobenzene	0.10 mg/L	100 mg/L
Chloroform	0.10 mg/L	6.0 mg/L
1,2-Dichloroethane	0.10 mg/L	0.5 mg/L
1,1-Dichloroethene	0.7 mg/L	0.10 mg/L
Methyl ethyl ketone	0.10 mg/L	200 mg/L
Tetrachloroethene	0.10 mg/L	0.7 mg/L
Trichloroethene	0.10 mg/L	0.5 mg/L
Vinyl chloride	0.10 mg/L	0.2 mg/L

TCLP Herbicides – SW-846 1311/8151A		
Compound	PQL	SVs
2,4-D	0.03 mg/L	10.0 mg/L
2,4,5-TP (Silvex)	0.03 mg/L	1.0 mg/L

Exhibit 3-6. Laboratory Analysis Analyte Lists, Methods, PQLs/MDCs, and Screening Values, Continued

Ignitability/Corrosivity/Reactivity – SW-846 1010/Chapter 7/9045C		
Compound	PQL	SVs
Ignitability	±1 °F	140 °F
Corrosivity as pH	±0.1 units	<2 or >12 units
Reactive Cyanide	1.0 mg/kg	250 mg/kg
Reactive Sulfide	1.0 mg/kg	500 mg/kg

SVs = *Screening Values*
TCLP = Toxicity Characteristics Leachate Procedure

Exhibit 3-7
Potential ARARs and TBC Guidance
Unnamed Tributary, Patroon Creek, and 3-Mile Reservoir
Page 1 of 2

Action	Law/Regulation	Requirement of Law/Regulation	ARAR/TBC Status
Sampling and Analysis	40 CFR 261 6 NYECRR 371-3 40 CFR 136, App. A, (SW-846 sampling methods)	Specific requirements for identifying hazardous wastes. Establishes analytical requirements for testing and evaluating solid, hazardous, and water wastes.	ARAR Applicable for identifying hazardous waste.
	10 CFR 20 Subpart F 6 NYECRR 380-6	Specific requirements for the identifying radioactive wastes.	ARAR Applicable for identifying radiological waste. 10 CFR 20 Subpart F is not an ARAR but is noted for relevance and appropriateness purposes only.
Indirect Discharges to POTW	33 USC Section 1317 40 CFR 403 6 NYECRR 380-4.2	Establishes list of toxic pollutants and promulgates pretreatment standards for discharge to POTWs.	ARAR Applicable for discharging decontamination water to a POTW.
Sediment Removal	40 CFR 230 and 231	Provides requirements for activities that will result in discharge of dredge or fill material into waters of the United States.	ARAR Potentially applicable to the removal of sediment from the stream.
IDW Identification	40 CFR 261.2(a)(2)	Regulations which identify when soils become a solid waste and if hazardous.	ARAR Applicable for determination of whether IDW is hazardous or non-hazardous.
	10 CFR 20 Subpart C and D 6 NYECRR 380-5.1	Regulations which identify when soils become radioactive.	ARAR Applicable for determination of whether IDW is radioactive. 10 CFR 20 Subpart C and D is not an ARAR but is noted for relevance and appropriateness purposes only.
General Remediation	40 CFR 262 6 NYECRR 373-2	Establishes standards for generators of hazardous waste.	ARAR Potentially applicable if hazardous waste is identified.
On-Site Storage	RCRA Treatment, Storage, and Disposal of Hazardous Waste 40 CFR 264, Subparts A, B, C, D, E, G, and I. 40 CFR 265, Subparts A, B, C, D, E, G, and I 6 NYECRR373-2.2-.5, .7. and .9 10 CFR 20 Subpart I and L 6 NYECRR380-8	Standards and requirements for facilities that treat, store, and dispose of hazardous waste. Requirements include: - General Facility Standards - Emergency Preparedness and Prevention - Contingency Plan and Emergency Procedures - Manifest System - Use and Management of Containers - Closure and Post Closure	ARAR Applicable to the substantive requirements if residuals from sediment sampling are classified as hazardous waste and stored on site beyond the accumulation times specified in 40 CFR 262.34 and 6 NYECRR 372.2(a).
Off-Site Disposal of Hazardous Waste	RCRA Land Disposal Restrictions: 40 CFR 268 Subparts A through E 6 NYECRR376-2(a) and (c)	Identifies hazardous wastes that are restricted from land disposal and defines those limited circumstances under which an otherwise restricted waste may continue to be land disposed.	ARAR Potentially applicable if sediments are disposed off site in a landfill as hazardous waste.

Exhibit 3-7
Potential ARARs and TBC Guidance
Unnamed Tributary, Patroon Creek, and 3-Mile Reservoir
Page 2 of 2

Action	Law/Regulation	Requirement of Law/Regulation	ARAR/TBC Status
Off-Site Disposal of Radioactive Materials	10 CFR 20 Subpart K 6 NYECRR 380-4	Specific requirements for disposal of radioactive materials.	ARAR Applicable for disposal or discharge of licensed material within the State, or whose loss of control of licensed material may result in the disposal or discharge of such material within the State. 10 CFR 20 Subpart K is not an ARAR but is noted for relevance and appropriateness purposes only.
Packaging, Labeling, and Storage	RCRA Hazardous Waste Generation 40 CFR 262 Subparts A through D	Specifies requirements for hazardous waste packaging, labeling, manifesting, record keeping, and accumulation time.	ARAR Applicable to the substantive requirements for the on-site accumulation of hazardous waste.
	USDOT Hazardous Materials Transportation Regulations 49 CFR 171-173 and 177-180.	Establishes classification, packaging, and labeling requirements for shipments of hazardous materials.	ARAR Potentially applicable if sediments or decontamination water are disposed off site as hazardous waste.
Transportation	RCRA Hazardous Waste Transportation 40 CFR 263, Subparts A, B, and C 6 NYECRR 372-3(b) Title 24 New York City Health Code Article 174 – Hazardous Waste Control	Specifies requirements for hazardous waste manifest compliance, record keeping, and hazardous waste discharges during hazardous waste transport.	ARAR Applicable if sediments or decontamination water are disposed off site as hazardous and/or radioactive waste.
	40 CFR 262.20(f)	This section excludes, from the requirements of Subpart B (The Manifest) transport of hazardous wastes on a public or private right-of-way within or along the border of contiguous property under control of the same person.	ARAR Applicable if radioactive and/or hazardous wastes are transported off site.
	Title 24 New York City Health Code Article 175 – Radiation Control	Specifies requirements for the transportation of radioactive wastes.	ARAR Applicable if radioactive wastes are transported off site.

ARAR - Applicable or Relevant and Appropriate Requirement
CFR - Code of Federal Regulations
DoD - U.S. Department of Defense
EPA - U.S. Environmental Protection Agency
NYECRR New York Environmental Conservation Rules and Regulations
POTW - Publicly-Owned Treatment Works
RCRA - Resource Conservation and Recovery Act
TBC - To-Be-Considered
USC - United States Code

Exhibit 3-8. Estimated Number and Types of Sediment Samples To Be Collected for the Unnamed Tributary to Patroon Creek, Patroon Creek, and Three Mile Reservoir – SI

Samples	On-Site Samples	Off-Site Samples	Off-Site IDM Samples
Pancake Geiger Mueller (on-site) or Gamma Spectroscopy (off-site)	29 + 3 Duplicates (On-site)	6 + 1 Duplicates	0
Alpha Spectroscopy	0	6 + 1 Duplicates (Sampled w/ gamma for off-site)	0
TCLP Metals	0	0	TBD*
Full TCLP, Reactivity, Ignitability, Corrosivity	0	0	TBD**
Total Environmental Samples	***29***	***12***	***TBD***
Field Duplicates	3	1	NA
MS/MSD Pairs	1	1	NA
Rinse Blank	0	2	NA
Total QC	***4***	***4***	***NA***
Total Samples	**33**	**16**	***TBD***

*The number of TCLP metals samples will be dependent upon the number of radioactive sediment samples found.

**The number of IDM samples will be dependent upon TCLP metals samples collected (10% frequency).

TBD = To be determined

NA = Not Applicable

Exhibit 3-9. Analytical Quality Control Criteria

Item	DQO	Parameter	Frequency of Association	Criteria Requirement
Analytical Method	C	All	Each analysis	Method analysis based on USEPA methods as defined on **Exhibit 3-6**.
Chemical Data Packages	A,P,C	All	Each lot/batch	Pass peer review and formal QA/QC check.
Quarterly Laboratory Internal Audit Reports	R	All	Per Lab QAPP	No deficiencies.
Laboratory System Controls	R	All	During laboratory operations	Custody of sample within laboratory fully accounted for and documented.
Holding Time	A,P,R	All	Each analysis	No deficiencies (**Exhibit 2-3**).
Method Blanks	A	All	Each lot/batch	No target analytes below 5% of the decision limit, 5% of the sample concentrations, or the 2 times the MDL or MDA, whichever is higher.
Laboratory Control Samples	A,P	All	Each lot/batch	Must meet QAPP criteria (**Exhibit 3-10 to 3-16**).
Matrix Spikes and duplicates	A,P	All	Each lot/batch	Must meet QAPP criteria (**Exhibits 3-10 to 3-16**).
Surrogates	A	Organics	Organic fractions, including QC samples	Must meet QAPP criteria (**Exhibits 3-10 to 3-16 as appropriate**).
Serial dilution	A	Metals	Each lot/batch	Must meet QAPP criteria (**Exhibit 3-14**).

Legend:
C = Comparability A = Accuracy R = Representativeness P = Precision

Exhibit 3-10. Quality Control Method Criteria for Gamma Spectroscopy by HASL-300

Procedure	Frequency of QC Procedure	Acceptance Criteria	Corrective Action
Calibration	Major maintenance, instrument modification, per manufacturer's specifications	Calibration std. NIST traceable; Counting error for not-counts ±5%; Efficiency of each detector at 0% solids ≥20%. The gamma spectroscopy provided detector information, geometry information, the calibration energy range (efficiency calibration) between 25 to 2,000 KeV, cobalt-60 photopeak of 1173 KeV and 1332 KeV, NIST-traceable standard (energy calibration) information, the *coefficient energy calibration*, and the *run* log. Energy differences between the measured and computed values should be within ±2 KeV for each nuclide.	If criteria are not met, reanalyze the daily standards. If the daily standard fails a second time, initial calibration must be repeated.
Preparation blank	1 per 20 samples per matrix	No target analytes > MDC.	Documented source of contamination.
Laboratory Control Sample	1 per 20 samples per matrix	75%≤%Rec.≤125%	Qualify associated data biased high or biased low as appropriate.
Matrix spike and sample duplicate	1 per 20 samples per matrix	75%≤%Rec.≤125% RER≤ 1.5	IF MS/MSD results do not meet criteria, the reviewer should review the data in conjunction with other QC results to determine if the problem is specific to QC samples or systematic. Qualify as appropriate.

Ref: USACE Shell for Analytical Chemistry Requirements (**USACE, 2001b; Appendix I**).

Exhibit 3-11. Quality Control Method Criteria for Alpha Spectroscopy by USEPA 908.1 Modified

Procedure	Frequency of QC Procedure	Acceptance Criteria	Corrective Action
Initial calibration curve (3 point)	Major maintenance, instrument modification, per manufacturer's specifications	Correlation coefficient $\geq$0.98.	If criteria are not met, reanalyze the daily standards. If the daily standard fails a second time, initial calibration must be repeated.
Continuing calibration verification (CCV)	Every 10 samples, end of analytical run	Recovery ±10% of true value.	Reanalyze CCV. If the CCV fails second time, the analysis must be terminated, the problem corrected, the instrument re-calibrated, and the calibration re-verified prior to continuing sample analyses.
Continuing calibration blank (CCB)	Every 10 samples, end of analytical run	No target analytes > MDC.	If not within criteria, terminate the analysis, correct the problem, re-calibrate, and reanalyze all samples analyzed since the last acceptable CCB.
Preparation blank	1 per 20 samples per matrix	No target analytes > MDC.	Documented source of contamination.
Laboratory Control Sample	1 per 20 samples per matrix	Specified QA limits or 80-120%.	Qualify associated data biased high or biased low as appropriate.
Matrix spike and duplicate	1 per 20 samples per matrix	%Rec. 75-125% RER≤ 1.5	If MS/MSD results do not meet criteria, the reviewer should review the data in conjunction with other QC results to determine if the problem is specific to QC samples or systematic. Qualify as appropriate.

Ref: USACE Shell for Analytical Chemistry Requirements (**USACE, 2001b; Appendix I**).

Exhibit 3-12. Quality Control Method Criteria for TCLP Volatile Organic Compounds by USEPA SW-846 1311/5030B/8260B

Procedure	Frequency	Acceptance Criteria			Corrective Action
Initial Calibration 5-pt curve	Set-up, major maintenance, and quarterly	RRF > 0.1 for SPCCs chloromethane, 1,1-dichloroethane, and bromoform RRF > 0.3 for SPCCs 1,1,2,2-tetrachloroethane and chlorobenzene RRF > 0.05 for the other target compounds (see **Exhibit 3-6**) RSD ≤ 30% for CCCs *response factors* RSD ≤ 15% for the other target compounds (see **Exhibit 3-6**) If linear regression is used r 〈0.990 ICV: %Rec. = 80-120%			If RSD of the average RRF for calibration check compounds > 30%, the initial calibration must be repeated. Data reviewer should review and judge the target compounds against the acceptance criteria.
Continuing calibration check	Every 12 hours	RRF > 0.1 for SPCCs chloromethane, 1,1-dichloroethane, bromoform RRF > 0.3 for SPCCs 1,1,2,2-tetrachloroethane and chlorobenzene RRF > 0.05 for the other target compound (see **Exhibit 3-6**) %D ≤ 20% for every target compound (see **Exhibit 3-6**)			Samples cannot begin until this criterion is met. Data reviewer should review and judge the target compounds against the acceptance criteria.
Method blanks	*Every 12 hours*	*< MDL; No target analytes below 5% of the decision limit, 5% of the* sample concentrations, or the MDL, whichever is higher.			*Document source of contamination.*
Tuning BFB	Prior to calibration	Must meet tuning criteria.			Re-tune, re-calibrated.
LCS	Every batch	<u>Standards</u> Every target compound (see **Exhibit 3-6**)	<u>Solid</u> <u>%Rec.</u> 75–125% (60–140% for sporadic marginal *failures – 3 allowed*)	<u>Aqueous</u> <u>%Rec.</u> 80–120% (60–140% for sporadic marginal *failures – 3 allowed*)	Qualify associated data biased high or biased low as appropriate.
Internal Standards	Every sample	<u>Standards</u> Bromochloromethane 1,4-difluorobenzene chlorobenzene	<u>Criteria</u> Retention time ±30 seconds of last CC Area changes by a factor of two (-50% to +100%)		Inspect for malfunction. Demonstrate that system is functioning properly. Reanalyze samples with standards outside criteria.
Surrogate	Every sample	<u>Standards</u> 4-bromofluorobenzene 1,2-dichloroethane-d$_4$ *toluene-d$_8$*	<u>Solid</u> 75–125% 75–125% 75–125%	<u>Aqueous</u> 80–120% 80–120% 80–120%	If surrogate compounds do not meet criteria, there should be a re-analysis to confirm that the non-compliance is due to the sample matrix effects rather than laboratory deficiencies.
Matrix Spike and Duplicate (Not required for TCLP VOCs)	1 per 20 per matrix	<u>Standards</u> Every target compound (see **Exhibit 3-6**)	<u>Solid</u> <u>%Rec.</u> <u>%RPD</u> 70–130% ≤30 (60–140% ≤40% for sporadic marginal failures – 3 allowed)	<u>Aqueous</u> <u>%Rec.</u> <u>%RPD</u> 70–130% ≤30 (60–140% ≤40% for sporadic marginal failures – 3 allowed)	If MS/MSD results do not meet criteria, the reviewer should review the data in conjunction with other QC results to identify whether the problem is specific to the QC samples or systematic.

Ref: USEPA Test Methods for Evaluating Solid Waste Physical/Chemical Methods, Update III (USEPA, 1996) and USACE Shell for Analytical Chemistry Requirements (**USACE, 2001b; Appendix I**).

Exhibit 3-13. Quality Control Method Criteria for TCLP Semivolatile Organic Compounds by USEPA SW-846 1311/8270C

Procedure	Frequency	Acceptance Criteria			Corrective Action
Initial calibration curve (5-pt curve)	Set-up, major maintenance	RRF > 0.05 for every target compound; RSD ≤30% for CCC compounds. RSD ≤15% for the other target compounds. If linear regression is used r ⟨0.990 ICV: %Rec. = 70-130%			Must meet criteria prior to sample analysis. Data reviewer should review and judge the target compounds against the acceptance criteria.
Continuing calibration standard	12 hours	RRF > 0.05 for every target compound. The percent difference must be ≤20% for response factors from initial calibration.			If criteria are not met, reanalyze the daily standard. If the daily standard fails a second time, calibration must be repeated. Data reviewer should review and judge the target compounds against the acceptance criteria.
Internal standards	Every sample	Retention time ±30 seconds of last CC Area changes by a factor of two (-50% to +100%)			Inspect for malfunction. Demonstrate that system is functioning properly. Reanalyze samples with standards outside criteria.
Tuning DFTPP	12 hours	Must meet tuning criteria.			Re-tune, re-calibrate.
Method blanks	Per extraction batch	< MDLs; No target analytes below 5% of the decision limit, 5% of the sample concentrations, or the MDL, whichever is higher.			Document source of contamination.
LCS	Every batch	Standards Every target compound (see **Exhibit 3-6**)	Aqueous (%Rec.) 60–120% (~15 analytes) 45–135% (~30 analytes) 20–150% (~15 analytes) (15–150% ≤50% for sporadic marginal failures – 5 allowed)	Solid (%Rec.) 60–120% (~20 analytes) 45–135% (~25 analytes) 30–150% (~15 analytes) (20–150% ≤60% for sporadic marginal failures – 5 allowed)	Qualify associated data biased high or biased low as appropriate.
Surrogate spikes	Every sample	Standards Nitrobenzene-d_5 2-fluorobiphenyl p-terphenyl-d14 phenol-d5 2-fluoroprophenol-d6 2,4,6-tribromophenol 2-chlorophenol 1,2-dichlorobenzene	Aqueous (%Rec.) 45–135% 45–135% 45–135% 35–140% 35–140% 35–140% 35–140% 45–135%	Solid (%Rec.) 45–135% 45–135% 45–135% 35–140% 35–140% 35–140% 35–140% 45–135%	If two base/neutral or acid surrogates are out of specification, or if one base/neutral or acid extractable surrogate has a recovery of less than 10%, then there should be a re-analysis to confirm that the non-compliance is due to sample matrix effects rather than laboratory deficiencies.
Matrix spike and duplicate (Not required for TCLP SVOCs)	1 per 20 samples per matrix	Standards Every target compound (see **Exhibit 3-6**)	Aqueous %Rec. %RPD 45–135% ≤50 (15–150% ≤50% for sporadic marginal failures – 5 allowed)	Solid %Rec. %RPD 45–135% ≤60 (20–150% ≤60% for sporadic marginal failures – 5 allowed)	If MS/MSD results do not meet criteria, the reviewer should review the data in conjunction with other QC results to identify whether the problem is specific to the QC samples or systematic.

Ref: USEPA Test Methods for Evaluating Solid Waste Physical/Chemical Methods, Update III (USEPA, 1996) and USACE Shell for Analytical Chemistry Requirements (**USACE, 2001b; Appendix I**).

Exhibit 3-14. Quality Control Method Criteria for TCLP Metals by 1311/6010B/7470A

Procedure	Frequency of QC Procedure	Acceptance Criteria	Corrective Action
Initial calibration curve (3-pt curve Hg) (1-pt curve low level ICP)	Daily or major maintenance, instrument modification, replacement of the torch, replacement of the mirror	r > 0.995 for each element r: linear correlation coefficient Low level check std. ± 20% recovery ICV 90-110% recovery If MSA performed, r> 0.995	If r < 0.995 for an element, the standards for that element must be prepared again and/or the lower/upper range standard must be used.
Continuing calibration verification (CCV)	Every 10 samples or 2 per 8 hr and end of run.	Recovery ±10% of true value for ICP Recovery ±20% of true value for Hg	Reanalyze CCV. If the CCV fails second time, the analysis must be terminated, the problem corrected, the instrument re-calibrated, and the calibration re-verified prior to continuing sample analyses.
Highest mixed standard	Before sample analysis	Recovery ±5% of true value for ICP Not applicable for Hg	If criteria are not met, reanalyze the daily standards. If the daily standard fails a second time, initial calibration must be repeated.
Interference check standard (ICS)	Beginning and end of each sample analytical run or 2 per 8 hr.	Recovery ±20% of true value for ICP Not applicable for Hg	Terminate the analysis, correct the problem, re-calibrate, re-verify the calibration, and reanalyze the samples.
Initial and continuing calibration blank (ICB/CCB)	Every 10 samples, end of analytical run	Concentration < 3 X s of the background mean (ICP). < MDL; No target analytes below 5% of the decision limit, 5% of the sample concentrations, or the MDL, whichever is higher.	If the average in not within criteria, terminate the analysis, correct the problem, re-calibrate, and reanalyze each sample analyzed since the last acceptable CCB.
Serial Dilution (ICP)	1 per 20 samples per matrix for samples >10x IDL	Difference between diluted and undiluted sample <10% for ICP Not applicable for Hg	Chemical or physical interference should be suspected. Investigate to identify cause.
Preparation/method blank	1 per batch per matrix	< MDL; No target analytes below 5% of the decision limit, 5% of the sample concentrations, whichever is higher.	Documented source of contamination.
Laboratory Control Sample	1 per 20 samples	80-120% (for sporadic marginal failure: 60-140% - 2 allowed)	Qualify associated data biased high or biased low as appropriate.
Matrix spike and duplicate and sample duplicate (Not required for TCLP metals)	1 per 20 samples per matrix	75%≤%Rec.≤125%; %RPD<25%; If spike(s) outside of limits, analyze PDS. PDS limits are 75–125% for 6010B 80%≤Rec.≤120; %RPD<20% for 7000 methods. PDS limits are 85–115% for 7000 methods.	If matrix spike recovery does not meet criteria (except Ag), a post digestion spike is required for each method except GFAA. Qualify results in accordance with Regional criteria.

Ref: USEPA Test Methods for Evaluating Solid Waste Physical/Chemical Methods, Update III (USEPA, 1996) and USACE Shell for Analytical Chemistry Requirements (**USACE, 2001b; Appendix I**).

Exhibit 3-15. Quality Control Method Criteria for TCLP Pesticides by USEPA SW-846 1311/8081A

Procedure	Frequency of QC Procedure	Acceptance Criteria			Corrective Action
Initial calibration curve Single/multi-component (5pt)	Set-up, major maintenance	%RSD<20% of the response factor from the initial curve. Lab may use first or higher order regression fit (r ≥ 0.99) if %RSD > 20%. ICV % Rec.: 85-115%			Must meet criteria prior to sample analysis
Continuing calibration standard	12 hours or every 20 samples	%D recovery ± 15% of the response factor from the initial curve for every single peak compound.			If criteria are not met, reanalyze the daily standard. If the daily standard fails a second time, initial calibration must be repeated.
Independent reference standard (LCS)	Per batch	Standards	Aqueous % Rec.	Solid % Rec.	Initiate investigation and document actions taken.
		Every target compound (see **Exhibit 2-3**)	50–130% (30–150% for sporadic marginal failures – 2 allowed)	50–130% (30–150% for sporadic marginal failures – 2 allowed)	
Endrin/4,4-DDT Breakdown	Per batch	endrin/4,4-DDT degradation ≤15%. Combined endrin/4,4-DDT degradation ≤30%.			If criterion is not met, system must be deactivated and the affected sample reanalyzed if endrin or 4,4-DDT or their degradation products are detected in the samples.
Instrument blank	12 hours, after analytical run and highly contaminated samples.	< MDL; No target analytes below 5% of the decision limit, 5% of the sample concentrations, whichever is higher.			Demonstrated "clean". Affected sample will be reanalyzed.
Method blanks	Per extraction batch	< MDL; No target analytes below 5% of the decision limit, 5% of the sample concentrations, whichever is higher.			Document source of contamination.
Surrogate spikes	Every sample	Surrogate	Aqueous %Rec.	Solid %Rec.	Investigate to assess cause, correct the problem, and document actions taken; re-extract and re-analyze sample. If still out, qualify.
		Dibutylchlorendate	40-140	40-140	
		2,4,5,6-Tetrachloro m-xylene	40-140	40-140	
Matrix spike and duplicate (Not required for TCLP pesticides)	1 per 20 samples per matrix	Standards	Aqueous %Rec. %RPD	Solid %Rec. %RPD	Data reviewer may use the MS and MSD results in conjunction with other QC sample results to assess the need for some qualification of the data. Specific method cleanups may be used to eliminate or minimize sample matrix effects.
		Every target compound (see **Exhibit 2-3**)	40–140% ≤50 (30–150% ≤60% for sporadic marginal failures – 2 allowed)	40–140% ≤50 (30–150% ≤60% for sporadic marginal failures – 2 allowed)	
Target Analyte Confirmation	Every detect	RPD ≤ 40%			Qualify data, as appropriate.

Ref: USEPA Test Methods for Evaluating Solid Waste Physical/Chemical Methods, Update III (USEPA, 1996) and USACE Shell for Analytical Chemistry Requirements (**USACE, 2001b; Appendix I**).

Exhibit 3-16. Quality Control Method Criteria for TCLP Herbicides by USEPA SW-846 1311/8151A

Procedure	Frequency of QC Procedure	Acceptance Criteria			Corrective Action
Initial calibration curve 5-pt curve	Set-up, major maintenance	%RSD<20% of the response factor from the initial curve for every compound. Lab may use first or higher order regression fit (r ≥ 0.99) if %RSD > 20%.			Must meet criteria prior to sample analysis
Continuing calibration (calibration check)	Daily	%D recovery ± 15% of the response factor from the initial curve for every target compound.			If criteria are not met, reanalyze the daily standard. If the daily standard fails a second time, initial calibration must be repeated.
Independent reference standard (LCS)	Every batch	Standards Every target compound (see **Exhibit 3-6**)	Aqueous % Rec. 70–130%	Solid % Rec. 70–130%	%Rec. are outside criteria, sample batch should be re-calibrated and re-analyzed. If still outside criteria, qualify associated data biased high or biased low as appropriate.
Method/preparation blanks	1 per batch	< MDL; No target analytes below 5% of the decision limit, 5% of the sample concentrations, whichever is higher.			Document source of contamination.
Surrogate spikes	Every sample	Standards 2,4-dichlorophenylacetic acid (DCAA)	Aqueous %Rec. 70-130%	Solid %Rec. 70-130%	Investigate to assess cause, correct the problem, and document actions taken; re-extract and re-analyze sample. If still out, qualify.
Matrix spike and duplicate (Not required for TCLP herbicides)	1 per 20 samples per matrix	Standards Every target compound (see **Exhibit 3-6**)	Aqueous %Rec. %RPD 50–150% ≤25	Solid %Rec. %RPD 50–150% ≤35	Data reviewer may use the MS and MSD results in conjunction with other QC sample results to assess the need for some qualification of the data. Specific method cleanups may be used to eliminate or minimize sample matrix effects.
Target Analyte Confirmation	Every detect	RPD ≤ 40%			Qualify data, as appropriate.

Ref: USEPA Test Methods for Evaluating Solid Waste Physical/Chemical Methods, Update III (USEPA, 1996) and USACE Shell for Analytical Chemistry Requirements (**USACE, 2001b; Appendix I**).

Exhibit 3-17. Field Quality Control Samples

Type of Control	Purpose of Sample	Collection Frequency
Duplicate Sample	• Ensure precision in sample homogeneity during collection and analysis	10% of field samples per matrix.
Rinse Blank	• Ensure the decontamination of sampling equipment has been adequately performed; to assess cross contamination and/or incidental contamination to the sample container	1 per 20 samples per matrix per sampling technique.
Temperature Blank	• Verify sample cooler temperature during transport	1 temperature blank per cooler
Source Water	• Characterize decontaminated water source onsite	1 per source per project.

Exhibit 3-18. Field Quality Control Elements of Quality Assurance Program

Item	DQO	Parameter	Frequency of Association	Criteria Requirement*
Source Water	R	All	1 per project	Less than USACE reporting limit or if detected approved by USACE
Field Duplicates	P	All	10% of samples per matrix	Radiological: RER ≤ 1.5 Organics: RPD ≤ 50% Solid Inorganics: RPD ≤ 35% Solid (qualify as appropriate*)
Rinse Blank	R	All	1 per 20 samples per matrix per equipment type	<MDL or <MDC; qualify as appropriate*
Chain of Custody	R	All	Every sample	Filled out correctly to include signatures; no missing or incorrect info
Field Instrument Calibration Logs	A	All	Every measurement	All measurements must have associated calibration reference

*Ref: USEPA Region II data validation guidelines.

Legend:
A = Accuracy R = Representativeness P = Precision

APPENDIX A

ENVIRONMENTAL DIMENSIONS, INC. (EDI) STANDARD OPERATING PROCEDURES

INDEX FOR APPENDIX A
EDi SOPS

EDi

Health Physics Operational Procedures Manual

Title: Personnel Monitoring

Procedure Number: 2B.2

Revision: 3

Date: April 18, 1997

Approved: Mike B ______ 4/18/97
Project Manager/Vice President, EDi — Date

Approved: Stanley ______ 4/18/97
CHP/President, EDi — Date

2B.2.1 PURPOSE

The purpose of this procedure is to describe the methodology to be used to monitor personnel for radioactive contamination on their skin and clothing.

2B.2.2 SCOPE

All personnel exiting a controlled area shall be monitored for radioactive contamination on their skin and clothing. This procedure describes the use of portable radiation detection equipment to conduct the contamination surveys, and the documentation to be completed if such surveys indicate contamination is present above the applicable release limits.

2B.2.3 REFERENCES

(a) EDi Health Physics Operational Procedures Manual, Section 5.0, Instrument Operation Procedures

(b) EDi Health Physics Operational Procedures Manual Procedure 2C.1, "Release of Equipment and Materials", 7/24/96, Revision 5

(c) EDi Health Physics Operational Procedures Manual Procedure 2B.3, "Decontamination of Personnel", 10/1/96, Revision 2

(d) 10 CFR 20, "Standards for Protection Against Radiation"

(e) EDi Health Physics Operational Procedures Manual Procedure 2A.2, "Access Requirements for Controlled Areas and Other Radiation Areas", 10/1/89, Revision 1

(f) DOE/EH 0256T, "Radiological Control Manual", June, 1992

(g) 1- CFR 835, "Occuptional Radiation Protections"

2B.2.4 EQUIPMENT AND MATERIALS

The equipment utilized to perform personnel monitoring shall be appropriate for detecting the potential radioactive contaminants present at detection limits that are less than the release limits.

(a) Portable Count Rate Meter/Scaler.

(b) Pancake Geometry Geiger Detector.

(c) Alpha Scintillation Detector.

(d) Contamination/Exposure Report Form, Form 2B.2, Attachment 1.

(e) Controlled Area Access Register, Form 2A.2 (Attachment 3)

2B.2.5 PERSONNEL MONITORING

A. General Considerations

(1) Select the appropriate radiation detection instruments based on the type of radioactive contaminant suspected. Verify that the instruments are calibrated, source checked, and are operating properly (Reference (a)).

(2) The Health Physics Technician designated as the access control point technician or other qualified personnel, designated by the Radiological Support Subcontractor (RSS) or the Site Safety & Health Officer (SSHO), shall perform the monitoring. Personnel who have been trained to survey themselves out of a controlled area may perform this survey, however proper survey documentation and RSS supervision (see Section 2B.2.7 of this procedure) will be required.

(3) Personnel surveying themselves out of controlled areas must immediately inform the RSS or SSHO if contamination levels on their skin or clothing exceed cpm cutoff limits denoted on Form 2A.2 (Attachment 3). Form 2A.2 will be located at the access control point. In addition, the use of alarming survey instruments which alarm when contamination limits are exceeded may be used.

(4) To the extent possible, all visible dirt/mud or other material shall be removed from a person's clothing before they leave the contaminated area. Every effort shall be made to preclude contact of clothing with dirt/mud or potentially contaminated material by using the correct personnel protective equipment (PPE). Removal techniques include washing, wiping, and brushing such areas as required. Personal clothing which cannot be decontaminated shall be confiscated and properly disposed of.

(5) Personnel on sites will be surveyed for both alpha and beta/gamma contamination, prior to their leaving a controlled area. The results of this survey shall be recorded on Form 2A.2 (see Section 2B.2.7B).

(6) Personnel decontamination, if necessary, will be done in accordance with the requirements of Reference (c).

(7) Release criteria for personal protective equipment (which includes any company-issued clothing or shoes) will be those site specific guidelines found in Reference (b).

2B.2.6 SURVEYS

A. Alpha Surveys

(1) Using the alpha scintillation detector, exposed skin and clothing should be scanned at a rate of less than 1 inch per second (2.5 cm/sec). The detector should be held as close to the surface to be scanned as possible without actually touching the surface (approximately 1/4 inch). Skin and clothing must be dry to facilitate alpha particle detection.

(2) Backgrounds for personnel surveys will be determined at the access control point and recorded on Form 2A.2.

(3) Personnel surveys will be performed in the following suggested order:

(a) Head (pause at mouth and nose for approximately 5 seconds). If respirators are worn, the head is surveyed after respirator is removed
(b) Neck and shoulders (pause at neck for approximately 5 seconds)
(c) Arms (pause at each elbow) and hands
(d) Chest and abdomen
(e) Back, hips, and seat of pants
(f) Legs (pause at each knee)
(g) Shoe tops
(h) Shoe bottoms (pause at sole and heel for approximately 5 seconds)
(i) Personnel and supplemental dosimeters
(j) Respirators, if worn, and head

Note: For personnel who will perform their own survey, hands will be surveyed prior to touching the detector. The detector should rest face up to accomplish this.

(4) The RSS will determine a daily cpm cutoff limit along with the conversion to dpm/100 cm^2 and record on Form 2A.2. This will allow personnel at the access control point to be aware of site contamination limits.

(5) If there is any reason to suspect the loss of integrity of PPE, then those areas of the body or clothes that were affected should be surveyed.

(6) PPE that has been surveyed and found to be below site criteria limits shall be disposed of as clean trash. In cases where chemical contamination may be present, the SSHO will determine the appropriate method for disposal of PPE. NOTE: From a practical standpoint, PPE or other items which are marked with the radiation trefoil symbol or with "CAUTION-Radioactive Materials" shall not be thrown away as clean trash regardless if survey results are below site criteria unless such markings are removed (i.e., rad trash bags).

(7) PPE that has been surveyed and found to be above site criteria limits, will be considered contaminated and treated as rad trash, unless it is reusable in which case it will be decontaminated and resurveyed per requirements in Reference (b). For localized contamination, contaminated portions of PPE may be cut out to reduce waste volume.

B. Beta-Gamma Surveys

(1) Using the pancake geometry Geiger-Mueller (G-M) detector, exposed skin and clothing should be scanned at a rate of approximately two inches (5 cm) per second. Maintain a distance of approximately 0.5 inches (1.5 cm) from the scanning area of the detector to the surface being monitored. If the count rate increases during surveying, pause for 5 - 10 seconds over the area to provide adequate time for instrument response.

(2) Backgrounds for personnel surveys will be determined at the access control point and recorded on Form 2A.2.

(3) The survey will be conducted in the same manner as outlined for alpha surveys in Section 2B.2.6A above.

(4) The RSS will determine a daily cpm cutoff limit along with the conversion to dpm/100 cm^2 and record on Form 2A.2. This will allow personnel at the access control point to be aware of site contamination limits.

(5) If there is any reason to suspect the loss of integrity of PPE, then those areas of the body or clothes that were affected should be surveyed.

(6) PPE that has been surveyed and found to be below site criteria limits shall be disposed of as clean trash. In cases where chemical contamination may be present, the SSHO will determine the appropriate method for disposal of PPE. NOTE: From a practical standpoint, PPE or other items which are marked with the radiation trefoil symbol or with "CAUTION-Radioactive Materials" shall not be thrown away as clean trash regardless if survey results are below site criteria unless such markings are removed (i.e., rad trash bags).

(7) PPE that has been surveyed and found to be above site criteria limits will be considered contaminated and treated as rad trash unless it is reusable in which case it will be decontaminated and resurveyed per requirements in Reference (b). For localized contamination, contaminated portions of PPE may be cut out to reduce waste volume.

2B.2.7 DOCUMENTATION

A. Contamination/Exposure Report (Form 2B.2)

(1) If radiological contamination is detected on any portion of the skin and/or personal clothing above limits specified in Attachment 2, the health physics technician shall notify the SSHO immediately and then the individual and/or his/her clothing shall be decontaminated before being allowed to leave

the restricted area.

(2) A Contamination/Exposure Report, Form 2B.2 (Attachment 1), shall be completed documenting the incident and submitted to the SSHO for review and investigation. The RSS will transmit Form 2B.2 to the EDi Project Office as soon as possible.

(3) If contamination levels cannot be reduced to less than the Attachment 2 limits, the SSHO or his designee shall determine the appropriate action to be taken. A contaminated individual shall not depart from a site until released by the SSHO unless circumstances do not permit this (i.e., threatening conditions, serious injury, etc.).

(4) A copy of Form 2B.2 shall be retained in the individual's personnel file.

(5) Partial body exposure (>100 cm^2 in area) resulting from contamination to personnel, in excess of limits shall be reported.

B. Controlled Area Access Register (Form 2A.2)

Prior to entering a restricted area, all personnel shall read and understand the requirements specified by the, respective, Hazardous Work Permit (HWP). In addition, all personnel must complete the appropriate information on Form 2A.2. NOTE: The signature block on Form 2A.2 denotes that he/she has read and understands the HWP requirements.

(1) Prior to an individual leaving a contaminated area, a health physics technician shall record the alpha/beta-gamma survey results on Form 2A.2 in the appropriate columns. It is vital that all information on Form 2A.2 is completed correctly.

(2) The backgrounds recorded for the alpha and beta-gamma survey instruments will be determined at the access control point.

(3) A cpm cutoff limit, for all applicable radiation detection equipment, with the conversion to dpm/100 cm^2 will be recorded by the RSS so that personnel at the access control point are informed of site contamination limits.

Attachments:

(1) Contamination/Exposure Report, Form 2B.2
(2) Acceptable Surface Contamination Levels
(3) Controlled Area Access Register, Form 2A.2

EDi

Formerly Utilized Sites Remedial Action Program

Health Physics Operational Procedures Manual

Title: Release of Equipment and Materials

Procedure Number: 2C.1

Revision: 5

Date: December 21, 1998

Approved: ______________________________ 12/23/98
Project Manager, Vice President, EDi Date

Approved: ______________________________ 12/23/98
CHP/President, EDi Date

2C.1.1 PURPOSE

This procedure describes the methods of surveying equipment, materials or vehicles for release for unrestricted use. This procedure also describes steps taken in the event contaminated material or equipment is to be transferred from site to site.

2C.1.2 SCOPE

This procedure applies to all sites and to all materials, equipment, etc., that are subject to release for unrestricted use or transferred from one site to another.

2C.1.3 REFERENCES

(a) U.S. Department of Transportation Regulations, 49 CFR Part 173

(b) EDi Health Physics Operational Procedures Manual Procedure 3A.2, "Direct Surface Contamination Survey"

(c) EDi Health Physics Operational Procedures Manual Procedure 3A.4, "Vehicle Surveys"

(d) 10 CFR 835, ▒Occupational Radiation Protection▒

(e) 10 CFR 20, Standards for Protection Against Radit ion

(f) EM 385-1-80, Radiation Protection Manual, USACE, May 30 , 1997

2C.1.4 EQUIPMENT AND MATERIAL

(a) Alpha Scintillation Detector

(b) Pancake-Geometry Beta-Gamma Detector

(c) Portable Ratemeter/Scaler

(d) Scintillation Alpha Counter

(e) SH-4A Holder

(f) Equipment and Materials Release Form 2C.1A (Attachment 2)

(g) Cloth Swipes and Envelopes

(h) Radiological Material Release Tags (Green) and Contaminated Material Tags (Red) (Attachment 3)

2C.1.5 INSTRUCTIONS

A. Release of Items for Unrestricted Use

(1) To control the spread of contamination from sites, surveys for both direct and transferable contamination (see Section 2C.1.6) shall be made on all equipment, materials or vehicles which have either been in a controlled area or which may be potentially contaminated.

(2) The Radiological Support Subcontractor (RSS) Site Supervisor (or designee), or the Site Safety and Health Officer (SSHO) will determine which items located outside a controlled area may be potentially contaminated based on their use, site history, or previous survey data. The potential for objects to have become contaminated by airborne dust particles must be considered. This could include items which are used to support site activities, such as office equipment, cleaning devices, furniture, trailers, etc., even though direct contact may not have occurred.

(3) The RSS shall review all survey data, and inspect items prior to their release. Without previous survey documentation, items leaving a site which the RSS or SSHO has evaluated to have the potential for contamination must be surveyed and properly tagged prior to their release. In the event the RSS has questions concerning the potential for internal contamination of an item, the item shall not be released until Health & Safety has been contacted to make a determination concerning the disposition of the item.

(4) All items to be released shall be surveyed in such a manner (see Section 2C.1.6) as to fully demonstrate that external and internal areas comply with surface contamination release limits specified in Attachment 1 (Reference (f)), "Acceptable Surface Contamination Levels". Items which have been surveyed and

do not meet the limits of Attachment 1 will be handled according to the requirements in Section 2C.1.7B.

(5) To the extent possible, visible dirt/mud or other material shall be removed from equipment/materials before they exit a controlled area. Removal techniques include washing, wiping, and brushing such areas as required.

2C.1.6 CONTAMINATION SURVEYS

A. Perform a direct surface contamination survey initially to determine the gross amount of activity on the item surveyed (Reference (d)). If direct survey measurement results for alpha <u>and</u> beta/gamma contamination are below the removable criteria in Attachment 1, transferable surveys are not required.

B. Surfaces <u>must</u> be dry for effective alpha contamination monitoring.

C. Vehicles transporting contaminated materials need only the exterior portions of the vehicle surveyed (fixed and/or transferable). This survey does not constitute a release for unrestricted use, but serves as contamination control per DOT and DOE requirements.

D. Items which have inaccessible surfaces (i.e., pumps) will be evaluated by the RSS or SSHO to determine if internal components may be contaminated. Based on this determination, items may be assumed contaminated and would be red tagged (see Section 2C.1.7B). If historical information and/or surveys around entry/exit ports indicate the item is not contaminated, it may be released in accordance with Section 2C.1.7A.

E. Direct Surface Contamination Surveys

(1) Direct Beta/Gamma Measurements

(a) Because it is not practical to survey 100% of an item, care will be taken to concentrate on areas most likely to be contaminated. The number of survey points selected is subjective, however the RSS will ensure that the survey is representative and that an adequate number of survey points have been selected.

(b) Using the fixed point measurement technique, hold the G-M detector approximately 1/2 inch from the surface of the item to be surveyed, and allow 0.5 minutes for a measurement.

(c) Record and identify all locations surveyed on the Equipment/Materials Release Form, Form 2C.1A, (Attachment 2). If practical, sketch the item and identify the measurement locations on the sketch.

(d) All measurements shall be reported in units of dpm per 100 cm^2.

(2) Direct Alpha Measurements

(a) Place the alpha scintillation detector near the surface to be surveyed (approximately 1/4 inch). If detector is placed on a surface, care must be taken not to contaminate or damage the detector face.

(b) Because it is not practical to survey 100% of an item, care will be taken to concentrate on areas most likely to be contaminated. The number of survey points selected is subjective, however the RSS will ensure that the survey is representative and that an adequate number of survey points have been selected.

(c) Survey the item using the fixed point measurement technique and allowing 30 seconds (0.5 minutes) per measurement.

(d) Record and identify all locations surveyed on Form 2C.1A using a sketch, if practical.

(e) All measurements shall be reported in units of dpm per 100 cm^2. Note: 0.5 minute count time, if applicable, will be used for this calculation.

F. Transferable Surface Contamination Survey

(1) Measurement Technique

(a) Transferable contamination shall be measured using paper or cloth smears, measuring approximately 2 inches in diameter.

(b) With the smear, swipe an area of 100 cm^2 (4 inch square area or equivalent) of the surface at the selected location. Smear surveys should be performed at the same location that direct surveys were performed.

(c) Place the smear in an envelope which is labeled with the survey location. Glassine envelopes are preferred.

(2) Counting Instructions

Assign a sequential number to each smear for each piece of equipment/material. Record smear survey results on Form 2C.1A.

(a) Gross Alpha Counting

(i) Using the scintillation alpha counter, count each smear for 1 minute.

(ii) Record the results on Form 2C.1A.

(iii) Compute the dpm per 100 cm^2.

(b) Gross Beta/Gamma Counting

(i) Using the gross beta/gamma counting system, count each smear for 1 minute.

(ii) Record the results on Form 2C.1A.

(iii) Compute the dpm per 100 cm^2.

G. After direct and transferable survey results have been recorded on Form 2C.1A, compare dpm/100 cm^2 results to the applicable site release criteria from Attachment 1. In the comment section of the form, note all items that did not meet site criteria and the disposition of the item. An example entry might be: "Items 1, 3, 7 did not meet criteria and were not released (red tags attached)". If R_{max} values exceed site release criteria, the item can not be released. Longer survey times or lower backgrounds may be required.

H. The recipient of the released item(s) must be identified on Form 2C.1A, therefore only one recipient per form can be used.

2C.1.7 TAGGING EQUIPMENT/MATERIALS

A. Green Tags

(1) After surveys are performed and the survey results for the item are below the site release criteria specified in Attachment 1, items will be tagged with a green "Radiological Material Release Tag" (Attachment 3). The green tag must be attached to the item in a conspicuous place or accompany the item, unless the item meets the requirements specified in Section 2C.1.7A(4) below. Information on the green tag will include the following:

(a) Date survey was performed
(b) Survey number
(c) Name of person releasing the item
(d) A description of the item to be released
(e) Site release criteria in dpm/100 cm^2
(f) Contamination type (i.e., Natural Uranium, Depleted Uranium, Natural Thorium, Radium-226, or list other)
(g) Any remarks concerning release of the item (i.e., actual survey results)

(2) Items released shall also be accompanied by the original Form 2C.1A(s). No item shall be considered releasable without a green tag and Form 2C.1A unless it meets the conditions in section 2C.1.7A(4).

(3) In the event that the surveyed item is to be shipped to another site, a copy of Form 2C.1A shall accompany the shipment. Vehicles are not required to have this form attached unless the vehicle is to remain at the site for later removal. In the event a vehicle is to be picked up at a later date and is parked in a non-controlled area, a copy of Form 2C.1A and the green tag shall be placed in a conspicuous place in the cab or passenger area of the vehicle.

(4) For materials and equipment that are rented or subcontractor-owned and are surveyed immediately prior to offsite release, a green tag is not required and should not leave the site with the item. Form 2C.1A should also not leave site with the item, but will be maintained in the site files. A green tag is not required for materials that may be disposed of as uncontaminated trash.

(5) Small items, (hand tools, etc.) which have been surveyed and meet site release criteria may be placed in a clean carton or box with a copy of Form 2C.1A and a green tag attached to the container prior to release.

B. Red Tags

(1) After surveys are performed, equipment or materials that do not meet site release criteria will have a red "Contaminated Material Tag" (Attachment 3) attached. Red tagged items indicate the need for decontamination and resurvey, if practicable, to be performed on the item prior to it's release. The red tag must accompany the item, and if possible be attached in a conspicuous place. The following information will be recorded on the red tag:

(a) Date survey was performed
(b) Survey number
(c) Name of person surveying the item
(d) A description of the item surveyed
(e) Fixed and Transferable survey results in dpm/100 cm^2
(f) Contamination type (i.e., Natural Uranium, Depleted Uranium, Natural Thorium, Radium-226, or list other)
(g) Any remarks concerning why the item

can not be released

(2) Equipment/materials which cannot be decontaminated shall be confiscated, stored in a secured area, and remain at the site unless they are to be shipped in accordance with the requirements in section 2C.1.7B(3).

(3) In some cases, items which are "contaminated", i.e., surface contamination levels exceed those of Attachment 1, may be transferred to another site or other authorized recipient. However, prior to any shipment of a contaminated item, the following steps shall be taken:

   (a) Determine the feasibility of decontaminating the item. In general, if an item can be decontaminated in an economical and timely manner, then it should not be shipped as a contaminated item. If the cost and/or time delay are unacceptable, then the item can be shipped following the directions given here and in Reference (b). Efforts should be made to minimize both fixed and transferable contamination to an "As Low As Reasonably Achievable" (ALARA) level as determined by the Project Office in .

   (b) Advise the EDi Site Health Physics Specialist that a request for shipment of a contaminated item has been received. The RSS should have all pertinent information about the item(s) including approximate contamination levels prior to this contact. The EDi Health Physics Specialist will advise the Safety and Health Supervisor, or his designee, that a request for transfer has been made.

   (c) Attach a completed Red tag to the item, or in the case of a vehicle in a conspicuous place in the cab, prior to transferring the item offsite. If an item has internal parts which can not be surveyed, it shall be clearly noted on Form 2C.1A and the Reg Tag as potentially contaminated.

   (d) Refer to Reference (e) concerning contaminated item shipments.

(e) Once all requirements in reference (e) have been satisfied, the Project Office (Safety, Health, and Waste Management personnel) shall approve the contaminated item transfers from site to site. The original Form 2C.1A, as well as any other pertinent shipping documentation, shall accompany the shipment.

(f) Once approval has been obtained, the RSS shall contact the RSS Site Superintendent who is to receive the contaminated item. During this contact, all facts about the transfer shall be discussed including contamination levels, mode of shipment and expected delivery date. No contaminated item shall be shipped until the receiving site has been fully advised. Note: special emphasis shall be placed on not transferring items to sites where contamination types differ, e.g. a uranium contaminated site to a radium contaminated site.

2C.1.8 QUALITY CONTROL

A. Perform a duplicate count for one in every twenty surveys performed (including fixed and transferable surveys).

B. The duplicate reading will be recorded on the same survey form with the original measurement and identified as a duplicate reading (D).

C. The duplicate reading must be within ±20% of the original count. If not, the counting instrument must be returned to the EDi Service/Calibration Center for repair and/or recalibration.

Attachments:

(1) DOE Order 5400.5, Table 1, Acceptable Surface Contamination Levels

(2) EDi Form 2C.1A, Equipment and Materials Release Form

(3) Radiological Material Release Tag (Green) and Contaminated Material Tag (Red)

Table 1. Acceptable Surface Contamination Levels

NUCLIDE[1]/	REMOVABLE[2,4]	TOTAL[2,3] (FIXED PLUS REMOVABLE)
U-nat, U-235, U-238 and associated decay products	1,000 dpm α/100 cm^2	5,000 dpm α/100 cm^2
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	20 dpm/100 cm^2	100 dpm/100 cm^2
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	200 dpm/100 cm^2	1,000 dpm/100 cm^2
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and other noted above	1,000 dpm β-γ/100 cm^2	5,000 dpm β-γ/100 cm^2

(REF. 10CFR 835, APPENDIX D)

1/ 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 100cm^2 is less than three times the guide values. 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 $1/n\ s_1 > G$, where s_1 is the dis/min-100 cm^2 determined from measurements of section 1; 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 wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe 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-226, Ra-228, Ac-227, Th-228, Th-230, and Pa-231 alpha emitters, it is not necessary to use wiping 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.

EDi

Health Physics Operational Procedures Manual

Title: Direct Surface Contamination Survey

Procedure Number: 3A.2

Revision: 2

Date: October 1, 1996

Approved: ____________________ 10/1/96
Project Manager/Vice President, EDi — Date

Approved: Stanley A Waligora Jr 10/1/96
CHP/President, EDi — Date

3A.2.1 PURPOSE

The purpose of this procedure is to provide instruction on performing and recording the results of direct surface contamination surveys.

3A.2.2 SCOPE

This procedure describes how to perform direct surface contamination surveys and the proper calculation and reporting of the resulting survey data.

3A.2.3 EQUIPMENT AND MATERIALS

(a) Maps and/or Drawings

(b) Form 3A.2 - Direct Surface Contamination Survey, Attachment 1

(c) Portable Ratemeter/Scaler

(d) Alpha Scintillation Detector

(e) Beta/Gamma Pancake GM Detector (7 mg/cm^2 mylar shielded)

(f) Hewlett-Packard Calculator (or equivalent)

3A.2.4 DIRECT ALPHA MEASUREMENTS

(a) Determine background count rate, and source check alpha scintillation detector/portable scaler. Place the alpha scintillation detector near (on contact or just above) the surface at the selected survey point or location. Exercise care in positioning the detector near the surface when transferable contamination is present, and to prevent puncture of the aluminized window.

(b) Take a measurement using a predetermined counting duration. The counting duration shall be at least one-half minute. All results shall be converted to counts per minute.

(c) Record the location and count rate on Form 3A.2, and perform calculations as described in (d) and (e) as follows:

(d) Determine the activity per unit area (dpm/100cm^2):

EXAMPLE

Net cpm: 100

Efficiency (%): 15.0

Detector Window Area (cm^2): 59

Or detector window ratio to scale: 0.59

To determine dpm/100cm^2:

$$\text{dpm/100cm}^2 = \frac{100}{(0.59)(0.15)} = 1130\ \text{dpm/100cm}^2$$

NOTE: Use ratio to scale equivalents for efficiency and area (cm^2)

(e) Calculate the Minimum Detectable Activity (MDA) according to Appendix A-1.

3A.2.5 DIRECT BETA-GAMMA MEASUREMENTS

(a) Determine background count rate, and source check GM detector/portable scaler. Place the GM detector on or near the surface at the selected survey point or location. The detector should be positioned within 1 centimeter of the surface being surveyed.

(b) Take a measurement using a predetermined counting duration. The counting duration shall be at least one-half minute. All results shall be converted to counts per minute.

(c) Record the location and count rate on Form 3A.2 and perform calculations as described in (d) and (e) below.

(d) Determine the activity per unit area (dpm/100cm^2):

EXAMPLE

Net cpm: 500

Efficiency (%): 15.0

Detector Window Area (cm^2): 15.5

NOTE: Use ratio to scale equivalents for efficiency and area (cm^2)

To determine dpm/100cm^2:

$$\text{dpm}/100\text{cm}^2 = \frac{500}{(0.15)(0.155)} = 21{,}505\ \text{dpm}/100\text{cm}^2$$

(e) Calculate the Minimum Detector Activity (MDA) and standard deviation if required according to Appendix A-1.

NOTE: The above relation is based on the assumption that most of the detector's response is due to beta radiation. The presence of significant gamma radiation could result in an erroneous estimate of beta activity. One quick method to check this potential is to shield beta emissions with a piece of 1/4" thick plastic (plexiglass or equivalent). A simple comparison of count rate response, shielded vs. unshielded, will provide a proportional ratio of gamma activity vs. beta-gamma activity. The following assumptions may be determined.

Unshielded = Beta + Gamma
Shielded = Gamma
Unshielded - Shielded = Beta

This type of data can provide valuable information when dealing with contamination such as U-238 --> Pa-234, high energy beta and x-ray emitters. Furthermore, in cases where gamma emission are predominant, this may eliminate the possibility of beta emitting radionuclides as the contaminant source.

3A.2.6 ADDITIONAL SURVEY MEASUREMENTS

Quality Control

(a) Obtain a duplicate count for approximately one in every twenty measurements for both alpha and beta-gamma direct readings. The location will be chosen by a random number generator. (See Appendix A-2)

(b) Record any observed hotspot measurements on the same form with the direct surface measurements and identify the readings as hot spot (HS). Sketch hot spot location on grid drawing of area being surveyed.

Attachments:

(1) EDi Form 3A.2, Direct Surface Contamination Survey

Colonie Interim Storage Site
(CISS)
Formerly Utilized Site Remedial Action Program
Health Physics Operational Procedures Manual

Title: Transferable Surface Contamination Survey
Procedure Number: 3A.3
Revision: 3
Date: December 21, 1998

Approved: ______________________________ 12/22/98
Project Manager, Vice President, EDi Date

Approved: ______________________________ 12/22/98
CHP Quality Assurance, EDi Date

3A.3.1 PURPOSE

The purpose of this procedure is to provide instruction for measuring and documenting the results of transferable surface contamination surveys.

3A.3.2 SCOPE

This procedure describes the method for performing transferable surface contamination surveys, calculations of activity levels, and reporting methods.

3A.3.3 EQUIPMENT AND MATERIALS

(a) Maps and/or Drawings

(b) Form 3A.3 - Transferable Surface Contamination Survey, Attachment 1

(c) Alpha Scintillation Counter

(d) Portable Ratemeter/Scaler

(e) Beta/Gamma Pancake GM Detector (7 mg/cm^2 Mylar shielded)

(f) SH-4A Sample Holder

(g) Paper/Cloth Smears and Envelopes (Smear diameter - 40 mm)

(h) Hewlett-Packard Calculator (or equivalent)

3A.3.4 TRANSFERABLE RADIOACTIVITY MEASUREMENTS

Transferable surface contamination surveys shall be taken on floors, walls, equipment, and on representative items in the survey area. All direct (fixed) contamination measurements exceeding the transferable release limits shall be surveyed for transferable surface contamination.

Transferable contamination shall be measured using a paper or cloth smear.

(a) Use approximately 40 mm (1.57 inch) cloth or paper smears.

(b) Swipe a 10 x 10 cm (3.9 x 3.9 inch) area as required.

(c) Each smear shall represent an area of 100 cm^2 at the survey location.

(d) Place the smear in an envelope which is labeled with the survey location, survey date, and the initials of the technician performing the survey.

(e) Count smear with appropriate counting equipment to determine transferable contamination.

(f) Record smear sample locations, and count data from following instructions on Form 3A.3.

<u>Alpha Counting</u>

(1) Determine background count rate and source check alpha counter.

(2) Using tweezers, remove smear from envelope and position smear on sample tray in drawer of the alpha counter.

(3) Close sample tray drawer and count sample for one minute.

(4) Remove smear from sample tray drawer (using tweezers) and place in envelope from step (2) above. The site Health Physics manager/supervisor will determine when smears can be discarded.

(5) Record the net count rate on Form 3A.3.

Net Count Rate (cpm) = Gross Sample cpm - Background cpm

Calculate dpm/100cm^2 for sample as follows:

$$\frac{\text{net count rate (cpm)}}{\text{efficiency of alpha counter}} = \text{dpm}/100\text{cm}^2$$

(6) Calculate the Minimum Detectable Activity (MDA) according to the Appendix A-1.

<u>Beta/Gamma Counting</u>

(1) Determine background count rate, and source check GM detector/portable scaler setup using the SH-4A sample holder.

(2) Using tweezers, remove smear from envelope, and position smear on sample tray drawer of the SH-4A sample holder.

(3) Close sample tray drawer, and count sample for one minute.

(4) Remove smear from sample tray drawer using tweezers, and place in envelope it was removed from in step (2). The site Health Physics manager/supervisor will determine when smears can be discarded.

(5) Record the net count rate on Form 3A.3.

Net Count Rate (cpm) = Gross Sample cpm - Background cpm

Calculate dpm/100cm^2 for sample as follows:

$$\frac{\text{net count (cpm)}}{\text{efficiency of beta detector}} = \text{dpm}/100\text{cm}^2$$

Calculate the Minimum Detectable Activity (MDA) according to Appendix 3.1.

3A.3.5 QUALITY CONTROL

Duplicate counts will be performed on 20% of all samples and recorded on Form 3A.3, Attachment 1.

3A.3.6 HOT SPOT SURVEY

(a) Each monitoring grid block will have a location, identified by the direct beta-gamma scan survey, possessing the highest count rate. If this count rate exceeds the direct measurements previously performed, a smear will be collected at this location.

Attachments

(1) EDi Form 3A.3, Transferable Surface Contamination Survey (Smear)

EDi

Health Physics Operational Procedures Manual

Title: Vehicle Surveys

Procedure Number: 3A.4

Revision: 2

Date: August 15, 1996

Approved: ____________________ 8/15/96
Project Manager/Vice President, EDi Date

Approved: ____________________ 8/15/96
CHP/President, EDi Date

3A.4.1 PURPOSE

The purpose of this procedure is to provide instruction for performing vehicle surveys to meet U.S. Department of Transportation (DOT) and other regulations for the offsite transfer of radioactive materials and contaminated items.

3A.4.2 SCOPE

This procedure applies specifically to survey requirements for vehicles transporting radioactive material or contaminated items onto or across public roads. The surveys described in this procedure do not constitute a release for unrestricted use.

3A.4.3 REFERENCES

(a) EM 385-1-80, Radiation Protection Manual, USACE, May 30, 1997

(b) U.S. Department of Transportation Regulations 49 CFR 173.441-443

(c) U.S. Department of Energy Order 5480.6, "Radiological Control Manual", June, 1992

(d) U.S. Department of Energy Order 5400.5, "Radiation Protection of the Public and the Environment", 2-8-90

(e) EDi Health Physics Operational Procedures Manual, Section 5

(f) EDi Health Physics Operational Procedures Manual Procedure 3A.2, "Direct Surface Contamination Survey", Revision 2, 10/1/96 (or latest version)

(g) EDi Health Physics Operational Procedures Manual Procedure 3A.3, "Transferable Surface Contamination Survey", Revision 2, 10/1/95 (or latest version)

(h) EDi Health Physics Operational Procedures Manual Procedure 2C.1, "Release of Equipment and Materials", Revision 5, 7/24/96 (or latest version).

(i) EDi Health Physics Operational Procedures Manual Procedure 5A.2, "Operation of the PGM Pancake Geiger-Mueller Detector", Revision 3, 5/26/96 (or latest version)

3A.4.4 EQUIPMENT AND MATERIALS

(a) Form 3A.4, "Vehicle Survey Form" (Attachment 1)

(b) Ion chamber or other dose equivalent ratemeter

(c) Beta-Gamma Detector

(d) Alpha Detector

(e) Alpha Scintillation Counter

(f) SH-4A Holder

(g) Scaler/ratemeter

(h) Cloth smear papers

(i) Form 3A.4B (Attachment 3)

3A.4.5 DEFINITIONS

(a) Consignee - Receiver of a shipment.

(b) Consignor - shipper of a shipment.

(c) Contaminated Items - equipment or material, which are contaminated with radioactivity greater than USACE site release criteria.

(d) Controlled Area - an area in which access/egress is controlled to prevent the spread of contamination or the risk of personnel exposure to radioactive and/or hazardous materials.

(e) Conveyance - any vehicle which could be used to transport equipment or materials.

(f) Exclusive-use - also referred to as "sole use" means "the sole use of a conveyance by a single consignor and for which all initial, intermediate, and final loading and unloading are carried out in accordance with the direction of the consignor or consignee. Any loading or unloading must be performed by personnel having radiological training and resources appropriate for safe handling of the consignment. Specific instructions for maintenance of exclusive use shipment controls must be issued in writing and included with the shipping paper information provided to the carrier by the consignor."

(g) Package - the packaging together with its radioactive contents as presented for transport.

(h) Radioactive Material - DOT considers material to be regulated as radioactive if its specific activity is >2,000 pCi/g of total radioactivity. Other government agencies use lower concentrations to determine which materials are to be regulated, therefore when determining survey requirements for vehicles leaving sites, both DOT and other applicable regulations must be considered.

3A.4.6 DISCUSSION

A. Vehicles used to transport radioactive materials or contaminated items to or from the sites are subject to requirements set forth in U.S. DOT 49 CFR. This applies to vehicles traveling onto or across public roads, air, railways, waterways, etc.

B. All shipments of radioactive materials or contaminated items (above applicable limits) leaving a site will be manifested. Shipments will be accompanied by Form 3A.4 (Attachment 1), as well as any other survey documentation deemed appropriate.

C. Whenever a vehicle is transporting bulk radioactive material (i.e., dump trucks) the vehicle itself is considered a "package" and must meet DOT packaging requirements (Reference (a)).

D. It is the responsibility of the Radiological Support Subcontractor (RSS) to perform and record all vehicle surveys. The RSS will determine the number of survey points required to make a representative assessment of a vehicle.

E. This procedure does not apply to non-exclusive use shipments of radioactive packages from a site (i.e., Federal Express).

3A.4.7 DOSE RATE SURVEYS

A. In accordance with DOT regulations, dose rate surveys will be performed on all conveyances transporting radioactive material or contaminated items from a site onto or across public roads to ensure that radiation levels on the vehicle do not exceed the limits specified in Attachment 4.

B. Dose rate surveys may be recorded in either µrem/hr or mrem/hr with the proper units denoted on Form 3A.4 (Attachment 1) or in the comment section of Form 2C.1A (Reference (h), whichever is applicable.

C. Using a calibrated dose rate survey instrument (Reference (d)), each side of the vehicle on contact with the surface will be surveyed and the highest reading recorded in µrem/hr or mrem/hr. Surveys will include the top and underside of the vehicle.

D. If the on contact reading for all sides of the vehicle is ≤ 10 mrem/hr (10,000 µrem/hr), the "@ 2 meter" reading will not be required. For flatbed trailers, surveys will be conducted using the vertical planes and horizontal (for the top) of the trailer as described in 49 CFR 173.441(b)(2) (Reference (a)).

E. Dose rate measurements will be recorded on the bottom of Form 3A.4. On the top view truck drawing (a more detailed drawing may be used and attached) readings corresponding to location numbers will be recorded. An example (Attachment 2) demonstrates how to correctly complete this form. If the @ 2 meter readings are not required as noted above, "N/A" will be recorded beside each location number.

F. If any measurement exceeds the limits denoted in Attachment 4, EDi survey personnel will immediately notify the Site Superintendent that the vehicle can not depart the site until further determinations can be made.

3A.4.8 CONTAMINATION SURVEYS

All survey documentation will be sent to the EDi Project Office.

A. Incoming Surveys

Any vehicle that enters a controlled area on a site, or that will be used to transport radioactive materials or contaminated items, will have an incoming vehicle survey performed on it regardless of conveyance unless it meets the conditions of Section 3A.4.9. The limits used for this survey will be specific to the site from Attachment 4. Incoming survey results will be documented on Form 2C.1A (Reference (h)).

B. All conveyances will have a release survey performed on it prior to it's leaving a controlled area unless it meets the conditions of Section 3A.4.9. Results of this survey must be below site-specific limits specified in Attachment 5. Release surveys will be documented on Form 2C.1A.

C. Conveyance Surveys

DOT only requires transferable contamination and dose rate surveys for vehicles transporting radioactive materials or contaminated items. Therefore, direct contamination surveys will not be performed unless the vehicle has entered a controlled area. If direct contamination surveys are requested, the results will be documented on Form 3A.2 (Reference (f)). All survey documentation will accompany shipping manifests.

(1) Transferable Surveys

If a vehicle has not entered a controlled area but is transporting regulated material or contaminated items off a site surveys will be performed in accordance with DOT requirements. These surveys will be documented on Form 3A.4.

(a) Smear surveys will be performed in accordance with requirements outlined in Reference (g).

(b) The RSS will analyze smear papers for gross alpha and beta/gamma contamination according to EDi procedures (References (f) and (g)) as soon as possible, record results on Form 3A.4, and report any results that exceed limits to the Site Superintendent.

(c) A detailed description of the survey location will be entered onto Form 3A.4. A sketch of the vehicle may be attached which more clearly defines all survey locations, whenever possible.

(d) DOT limits for transferable contamination will be used. The alpha/beta transferable contamination limit will be the same for all sites. Hot spot averaging does not apply to DOT contamination limits.

(e) Special attention should be taken on likely contaminated locations (i.e., tailgate on dump trucks, tires, floor of cab).

(f) Per SSHO direction, vehicles that have not entered a controlled area, may depart a site prior to smear survey results being reported. These results will be reported when practicable.

(g) If any contamination limit in Attachment 4 is exceeded, the vehicle will be decontaminated and resurveyed. The RSS will not release any vehicle until it is decontaminated to levels below these limits.

3A.4.9 OTHER VEHICLE SURVEYS

A. Vehicle Access Control Surveys

(1) Direct surveys only on vehicles exiting a controlled area (not transporting radioactive materials or contaminated items) may be performed at sites that have adequate historical data to ensure that transferable contamination control is not a problem. Performing vehicle access control surveys in this manner will expedite ingress and egress of vehicles onto sites that meet special requirements.

(2) For Uranium sites, a single gross alpha/beta-gamma measurement with a cross-calibrated pgm pancake detector may be used (Reference (i)).

(3) Survey limits will conform to those specified in Attachment 4 or 5, whichever is lower.

(4) A Vehicle Access Control Register (Attachment 3) will be established which documents information pertinent to these surveys. Information documented includes license number, time in and out, and gross contamination levels detected.

(5) Periodic checks for transferable contamination will be performed to ensure that conditions have remained the same at the site. The results of these surveys will be documented on Form 3A.3 (Reference (g)).

(6) All survey data will be sent to the EDi Project Office. The RSS will maintain copies of these forms in the site filing system.

3A.4.10 DOCUMENTATION

A. Conveyance survey data will be recorded on Form 3A.4.

B. On sites which use vehicle access control registers, information will be recorded on Form 3A.4B. Periodic transferable contamination surveys will be recorded on Form 3A.3.

C. The shipment number will be recorded on all survey documentation on outgoing shipments to facilitate tracking.

D. Original survey documentation will always accompany a shipment, and copies will be maintained in site files by the RSS.

Attachments:

(1) Form 3A.4, Vehicle Survey Form

(2) Form 3A.4, Vehicle Survey Form, Example

(3) Form 3A.4B, Vehicle Access Control Register

(4) DOT Survey Limits

(5) 10 CFR 20, Surface Contamination Guidelines

10 CF 20

Figure IV-1
Surface Contamination Guidelines

Radionuclides[2]	Allowable Total Residual Surface Contamination (dpm/100 cm^2)[1] Average[3,4]	Maximum[4,5]	Removable[4,6]
Transuranics, I-125, I-129, Ra-226, Ac-227, Ra-228, Th-228, Th-230, Pa-231	100*	300*	20*
Th-Nat, Sr-90, I-126, I-131 I-133, Ra-223, Ra-224, U-232, Th-232	1000	3000	200
U-Nat, U-235, U-238, and associated decay products, alpha emitters	5000	15000	1000
Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above[7]	5000	15000	1000

---

[1] 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 measured by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[2] Where surface contamination by both alpha and beta-gamma emitting radionuclides exist, the limits established for alpha and beta-gamma emitting radionuclides should apply independently.

[3] Measurements of average contamination should not be averaged over an area of more than 1 m^2. For objects of less surface area, the average should be derived for each such object.

[4] The average and maximum dose rates associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/h and 1.0 mrad/h, respectively, at 1 cm.

[5] The maximum contamination level applies to an area of not more than 100 cm^2.

The amount of removable material per 100 cm^2 of surface area should be determined by wiping an area of that size with dry filter or soft absorbent paper, applying moderate pressure, and measuring the amount of radioactive material on the wiping with an appropriate instrument of known efficiency. 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. It is not necessary to use wiping 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.

[7] This category of radionuclides includes mixed fission products, including the Sr-90 which has been separated from the other fission products or mixtures where the Sr-90 has been enriched.

DOT SURVEY LIMITS

For Non-DOE conveyances in which radioactive materials or contaminated items are transported by public roads, rail,... DOT 49 CFR regulations will be followed. Typical shipments are EXCLUSIVE USE!

DOSE RATES	NON-EXCLUSIVE USE	EXCLUSIVE USE
	Limits	Limits
At any external surface of a package	200 mrem/hr	200 mrem/hr or 1000 mrem/hr IF[1]:
At 2 meter from the external surface of a package	10 mrem/hr	N/A
At any point on outer surface of vehicle (including top and underside)[2]	N/A	200 mrem/hr
At any point 2 meters from outer surfaces of vehicle	N/A	10 mrem/hr
Normally occupied space (i.e., cab)	N/A	2 mrem/hr[3,4]

---

[1] The 1000 mrem/hr limit applies to closed transport vehicles only (i.e., does not apply to flatbed trailers, etc.).

[2] For flatbed trailers, the vertical or horizontal (for the top) planes of the trailer will be used when performing dose rate surveys.

[3] For non- vehicle operators, the dose rate in the cab may exceed 2 mrem/hr if the operator is a radiological worker and is part of a certified dosimetry program.

[4] Whenever a vehicle is operated by an employee monitored through the TLD personnel monitoring program, normally occupied spaces can not exceed 1.8 mrem/hr.

Contamination Limits	Non-Exclusive Use
Alpha	220 dpm/100 cm^2
Beta-Gamma	2,200 dpm/100 cm^2

Colonie Interim Storage Site
(CISS)
Formerly Utilized Sites Remedial Action Program
Health Physics Operational Procedures Manual

Title: Walkover Gamma-Ray Scan
Procedure Number: 3B.4
Revision: 3
Date: December 21, 1998

Approved: ______________________ 12/22/98
Project Manager, Vice President, EDi — Date

Approved: ______________________ 12/22/98
CHP Quality Assurance, EDi — Date

3B.4.1 PURPOSE

The purpose of this procedure is to describe the methodology used in field walkover gamma-ray surveys to identify localized or gross contamination potentials for characterization or remedial action projects.

3B.4.2 SCOPE

This procedure includes a description of the techniques and instruments used to assess areas where contamination may exist. This procedure also includes the documentation requirements of walkover gamma-ray scanning.

3B.4.3 REFERENCES

(a) EDi Health Physics Operational Procedures Manual, Procedure 3C.2, Revision 2, "Determination of Background".

(b) EDi Health Physics Operational Procedures Manual, Procedure 4A.1, Revision 2, "Systematic and Bias Surface Soil Sampling".

(c) EDi Health Physics Operational Procedures Manual, Procedure 3B.2, Revision 2, "Near Surface Gamma-Ray Radiation Survey".

3B.4.4 EQUIPMENT AND MATERIALS

(a) Portable Ratemeter/Scaler

(b) Ratemeter

(c) Gamma Scintillation Detector

(d) FIDLER (if required)

(e) Headphones

(f) Form 3B.4, Walkover Gamma Scan Data Sheet, Attachment 1

3B.4.5 PROCEDURE

(a) Initial measurements shall be conducted prior to any site grid work or detailed walkover surveys to establish maximum exposure rates. Floor cracks, fissures, cold joints, drains, and other areas of interest must be documented on Form 3B.4A (Attachment 1). These areas provide a migratory pathway for radionuclides, therefore thorough surveys of such areas of interest must be performed along with the appropriate documentation of these surveys. Once this has been completed, systematic walkover gamma scans may begin.

(b) Determine the appropriate instrument to be used for the survey.

(c) Background determination will be performed monthly at a remote location from the site as per requirements in Procedure 3C.2, Revision 2. Remote background data will be documented on Form 3C.2. Remote background data will be reported on all survey information.

(d) Response check all instrumentation. On site background data will be used when response checking instruments only. Document all instrument information including background data on Form 3B.4A (Attachment 1). Check headphones with the instruments to be used to assure audio response. This check shall include placement of a gamma source near the detector to confirm increased audio response.

(e) Begin the survey after all the above steps have been completed. The detector shall be held as close to the ground as possible without touching rocks or hard objects (do not drag detector on ground).

(f) The area shall be surveyed in a systematic manner using a survey pattern covering the entire area.

(g) Using the audio response of the instrument, locate areas above background. Periodically observe the meter to obtain an estimate of the average levels measured per grid block.

(h) Traverse through the grided area from one end to the other as many times as necessary until the entire area has been scanned. Record all data from the survey on Form 3B.4A (Attachment 1) or a blank grid map as provided by the Project Office.

(i) For pre-remedial action surveys, the use of pin flags or paint may be used to mark boundaries or area of contamination. Such boundaries or contaminated areas shall be documented on data provided from the survey.

(j) For elevated areas noted during post remedial action or characterization surveys, further investigation by the collection of bias soil samples may be required (see Procedure 4A.1). Additionally, the use of the cone shield survey to better define localized areas should be considered (see Procedure 3B.2).

3B.4.6 DOCUMENTATION

Remote background data will be documented on Form 3C.2.

Attachments

(1) EDi Form 3B.4A, Walkover Gamma Scan Data Sheet (Large Area)

EDi

Health Physics Operational Procedures Manual

Title: Subsurface Gamma Radiation Logging

Procedure Number: 3B.5

Revision: 2

Date: October 1, 1995

Approved: ________________ 10/1/95
Project Manager/Vice President, EDi Date

Approved: ________________ 10/1/95
CHP/President, EDi Date

3B.5.1 PURPOSE

The purpose of this procedure is to describe the methods used to define subsurface contamination over land areas.

3B.5.2 SCOPE

This procedure provides directions of how subsurface gamma-ray logging is conducted to determine subsurface contamination parameters. This subsurface gamma-ray profile may be used to determine factors such as contamination depth, type, sampling location and quantity.

3B.5.3 EQUIPMENT AND MATERIALS

(a) Portable Ratemeter/Scaler

(b) Lead Shielded Gamma Scintillation Detector

(c) Unshielded Gamma Scintillation Detector

(d) Canberra-10 Multi Channel Analyzer (MCA) (if required)

(e) Measuring Tape, Forms, etc.

(f) Tripod support for Down Hole Probe (optional)

3B.5.4 INSTRUCTIONS

(a) Response and background check instrumentation as required for use. Document background data and detector conversion on Form 3B.5, Subsurface Gamma-Ray Radiation Survey.

(b) Prior to subsurface measurements, the BHP and cable should be marked in depth increments (usually feet), starting from the NaI(Tl) crystal as zero.

(c) Once the above has been completed, subsurface measurements may begin. Site technicians may decide if a PVC pipe is required. This consideration will include such factors as water, hole stability, etc. Begin subsurface measurements starting from the top of the hole and continue by increments to the bottom of the hole as prescribed by the site plan or Site Supervisor.

(d) Document measurements after each increment on Form 3B.5. For Quality Control checks, acquire duplicate measurements from every fifth borehole location. Documentation on Form 3B.5 shall include all pertinent information about the borehole.

Attachments

(1) EDi Form 3B.5, Subsurface Gamma-Ray Radiation Log

REFERENCE NUMBER: ____________________ FORM 3B.5A

SUBSURFACE GAMMA-RAY RADIATION LOG

SURVEY #: ____________________
SITE: ____________________ JOB NUMBER: ______ SURVEYORS: ____________________
AREA: ____________________ RECORDER: ____________________
DATE: ____________________ COUNT TIME: ______ MINUTE(S) DEPTH (UNITS)= ______

W(-X)		E(+X)
S(-Y)	COORDINATES	N(-Y)

	Hole # & Coord.		Hole # & Coord.		Hole # & Coord.		Hole # & Coord.
Depth		Depth		Depth		Depth	

SCALER MODEL: ____________________ SERIAL NUMBER: ____________________
DETECTOR(SHIELDED): ____________________ SERIAL NUMBER: ____________________
SCALER MODEL: ____________________ SERIAL NUMBER: ____________________
DETECTOR(UNSHIELDED): ____________________ SERIAL NUMBER: ____________________

COMMENTS: ____

NOTE: COMMENTS MUST BE MADE FOR SPECIFIC GRID LOCATIONS. GIVE COORDINATES OF THE LOCATIONS TO WHICH EACH COMMENT APPLIES.

EDi

Health Physics Operational Procedures Manual

Title: Surface Gamma-Ray Radiation Survey - FIDLER

Procedure Number: 3B.6

Revision: 2

Date: October 1, 1997

Approved: ________________ 10/1/97
Project Manager/Vice President, EDi Date

Approved: ________________ 10/1/97
CHP/President, EDi Date

3B.6.1 PURPOSE

The purpose of this procedure is to describe the methodology for surface gamma-ray measurements using the FIDLER (Field Instrument for the Detection of Low Energy Radiation) probe in open land areas to estimate uranium-238 concentrations in surface soils.

3B.6.2 SCOPE

This procedure includes a description of the methods used to perform surface gamma-ray measurements and the proper documentation of the resulting survey data.

3B.6.3 EQUIPMENT AND MATERIALS

(a) FIDLER Probe

(b) Portable Ratemeter/Scaler

(c) Maps and/or Drawings

(d) Form 3B.2, Near Surface Gamma-Ray Radiation Survey, Attachment 1

(e) Clipboard and Pen

(f) Hewlett-Packard Calculator (or equivalent)

(g) Am-241 Check Source

3B.6.4 INSTRUCTIONS

(a) Defining Areas

(1) The area to be surveyed shall be divided into grid sections described by mutually perpendicular lines spaced 2-3 meters by 10-12.5 feet apart (or as otherwise defined by the survey work plan).

(2) Grid points shall be identified by a north-south/east-west coordinate system that will enable a future duplication of measurements and delineation of contaminated areas.

(3) Determine background count rate, and source check the FIDLER probe/portable ratemeter-scaler as per instructions in Section 5 of this manual.

(4) Assure that FIDLER probe is secured in a protective housing.

(5) Surface scans shall be conducted using the same methodology as described in Section 3B.4, Walkover Gamma-Ray Scan, paragraph 3B.4.4.

(6) Surface gamma-ray measurements shall be made at the intersection of grid lines.

(7) Using care not to disturb the soil, remove gravel or any sharp obstruction from the surface before placing the FIDLER on the ground (for protection of the thin Be window).

(8) Place FIDLER probe housing on the surface at a grid intersection. Perform a gamma-ray measurement at this grid point with a count time of at least one-half minute.

(9) Record the reading on Form 3B.2, Near Surface Gamma-Ray Radiation Survey, along with the grid coordinate.

(b) Quality Control

(1) Perform a duplicate count for one in every twenty (20) measurements.

(2) The duplicate measurement will be performed after the completion of all measurements in a specific area (i.e., open yard of a vicinity property).

(3) The duplicate measurement will be recorded on the same form with the original measurement and identified as a duplicate (D).

(c) Evaluation of Data

Using the correlation factor cpm to pCi/g established in Procedure 5D.1, determine the approximate uranium concentrations in soil. The correlation factor will allow for the establishment of control limits to guide excavation monitoring and to document the soil concentrations (after excavation) during remedial action activities.

The correlation factor will also allow for the determination of approximate uranium concentrations in surface soil during characterization activities.

Attachments:

(1) EDi Form 3B.2, Near Surface Gamma-Ray Radiation Survey

Health Physics Operational Procedures Manual

Title: Beta-Gamma Dose Rate Survey

Procedure Number: 3C.1

Revision: 2

Date: October 1, 1996

Approved: ______________________ 10/1/96
Project Manager/Vice President, EDi Date

Approved: ______________________ 10/1/96
CHP/President, EDi Date

3C.1.1 PURPOSE

The purpose of this procedure is to describe the methods for conducting direct beta-gamma exposure rate surveys with various detectors.

3C.1.2 SCOPE

This procedure describes techniques for measuring proportional beta-gamma radiation from surface contaminated areas. Included also, are documentation and data interpretation instructions.

3C.1.3 EQUIPMENT AND MATERIALS

(a) Portable Ratemeter/Scaler

(b) Pancake-Geometry GM Detector

(c) Ion Chamber Thin Window Detector for high range surveys.

(d) Form 3C.1, Beta-Gamma Dose Rate Survey, Attachment 1

(e) Measuring Tape, etc.

3C.1.4 INSTRUCTIONS

(1) Conduct investigations of the site's previous history to try and establish the types of contamination present. This may assist in determining how and where the survey should be conducted, specifically the type of instruments required.

(2) Beta-gamma dose rate surveys to be conducted in areas of contamination shall be made at locations as determined by the characterization plan. These surveys may be systematic or bias dependent upon parameters/requirements established in the site specific instruction guide.

(3) Response and background check all instrumentation. Document all instrument information, background cpm, and instrument conversions on Form 3C.1.

(4) Conduct a brief walkover gamma and cursory beta survey to determine peak exposure potentials prior to long term occupation in contaminated areas.

(5) After completion of all the above, a detailed beta-gamma exposure rate survey may begin. Place the appropriate detector on contact with surface to be surveyed. Determine cpm beta+gamma at the survey point(s). Document reading on Form 3C.1 for cpm beta+gamma. For gamma only, place a piece of 1/4" plastic under the detector, or close the beta window shield on the RO-2 and determine the cpm response at the same survey location. Document this measurement cpm on Form 3C.1 in the block gamma, cpm.

(6) Calculate the beta-gamma proportional exposure rates as below:

Beta mR/hr = cpm beta+gamma - cpm gamma/conversion

Gamma mR/hr = cpm gamma/conversion

> Subtract background count rates from all measurements prior to determination of exposure rates on Form 3C.1.

(7) Quality control measurements shall be conducted at the twentieth (20) survey location by a duplicate measurement, and shall be indicated on the form by the letter (D).

Attachments:

(1) EDi Form 3C.1, Beta-Gamma Dose Rate Survey

EDi

Health Physics Operational Procedures Manual

Title: Subsurface Soil Sampling (Radiological)

Procedure Number: 4A.2

Revision: 3

Date: April 24, 1998

Approved:______________________________ 4/24/98
Project Manager, Vice President, EDi Date

Approved:______________________________ 4/24/98
CHP/President, EDi Date

4A.2.1 PURPOSE

The purpose of this procedure is to establish radiological sampling techniques for collecting subsurface soil samples during remedial action, characterization or other activities.

4A.2.2 SCOPE

This procedure describes subsurface soil sampling techniques, applicable forms, sample labels, decontamination of sampling equipment and identification of sampling locations. Additional guidance is provided for requirements as specified within EPA documents.

4A.2.3 REFERENCES

(a) "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods SW-846" - Third Edition, Proposed Update Package, 1989.

(b) "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods" SW-846, Third Edition Revised, November, 1990 (updates).

(c) "A Compendium Of Superfund Field Operations Methods" EPA 540 P-87 001, December 1987, Section 4.

(d) EDi Health Physics Operational Procedures Manual, Procedure 4A.1, Revision 3, "Systematic and Bias Soil Sampling (Radiological)".

4A.2.4 GENERAL EQUIPMENT AND MATERIALS

(a) Sample Containers (500 ml Nalgene jars, etc.).

(b) Sampling Equipment as required.

(c) Labels, etc.

(d) Form 4A.1, Field Sample Collection Form, Attachment 1.

(e) Measuring Tape.

(f) Chain of Custody Seal, Attachment 2.

(g) Alconox (or standard brand phosphate-free detergent), DI Water, Spray Bottles, 5 Gallon Plastic Buckets (3), and Soft Bristle Brushes (3).

(h) Radiological Field Sample Collection Logbook(s).

4A.2.5 INSTRUCTIONS

Sample collection for radiological analysis parameters require that samples be collected consistent with guidance as specified within EPA documents. This includes sampling technique, sampling equipment decontamination, and documentation.

(a) The frequency and number of subsurface soil samples shall be determined by the site characterization plan or by written guidance provided by the Project Office. The number of samples collected will depend on site specific information such as elevated gamma readings and direction from Environmental Health & Safety personnel to assure the property is adequately covered.

Field sampling plans or written instruction are required for all sampling events. The EDi Project Office will provide necessary guidance documents.

(b) Prior to starting of sampling, tools and equipment shall be cleaned as specified below:

Sampling tools shall be washed using a solution of Alconox and water. A soft bristle brush shall be used to remove any visible material from sampling tools and equipment. Sampling tools shall be rinsed with deionized (DI) water and allowed to air dry. After drying, tools shall be covered with aluminum foil or wrapped in plastic to preclude their contamination until used.

(c) Prior to sampling, a bound, page-numbered sample log book shall be established, and during sampling shall be completed to include the following information:

(1) Purpose of sampling (e.g., characterization, remedial action, etc.).

(2) Coordinates of sampling point, and depth of sampling.

(3) Name of sampling technician(s).

(4) Sample matrix (e.g., soil, water, etc.).

(5) Number of samples and volume taken.

(6) Description of sampling point and sampling methodology.

(7) Date and time of collection.

(8) Sample identification number(s).

(9) Sample distribution and how transported (e.g., name of laboratory, UPS, Federal Express.

(10) References such as maps or photographs of the sampling site.

(11) Field Observations such as weather conditions, wind direction, wind speed, and relative humidity must be entered into the sample log book even when work is conducted inside a building or structure.

(12) Any measurements made (e.g., pH, soil density, flammability, explosivity, etc.).

(13) Signature of personnel who sample or make any observations.

(14) Method used for decontamination of sampling equipment.

(15) For composite samples, method of compositing.

Note: All entries into the sample log book must be done in black ink.

Other considerations included within EPA guidance are:

* Producer of waste and address, if different than location.

* Type of process (if known) producing wastes.

* Suspected waste composition, including concentrations.

All information shall be included in the field sampling log book to adequately reconstruct the sampling event. Custody seals (see Attachment 2) shall be placed on sample containers by technicians taking samples prior to turning these samples over to other technicians for shipment. Custody seals shall be dated and signed by technicians collecting the sample.

A sample is considered to be under a person's custody if (1) it is in a person's physical possession, (2) in view of the person after he has taken possession, (3) secured by that person so that no one can tamper with the sample, or (4) secured by that person in an area which is restricted to authorized personnel.

4A.2.6 SAMPLING TECHNIQUES

Subsurface soil samples can be obtained using hand augers, split spoons, shelby tubes, power augers or other various techniques dependent upon soil conditions and site characteristics.

(a) HAND AUGER SAMPLES

Various types of hand augers are available for sampling applications. Hand augers are typically made of a short cutting barrel with extension handles. The hand auger is limited in use because soil must be of small particle size to avoid clogging the intake area. Hand augers will not work well in soil where rock or debris exceed one inch (2.5 cm) in diameter. Handaugers will have 2, 3, or 4 cutting edges on the bottom of the cutting barrel where soil is forced up into the barrel during drilling operations.

(1) ADDITIONAL REQUIRED EQUIPMENT AND MATERIALS

- (I) Hand Auger
- (ii) Sample Extraction Tools

(2) INSTRUCTIONS

- (I) Assemble the hand auger and mark depth increments on the auger handle. Note: if samples are required from specific depths it may be advantageous to drill with a power drill to just above the sampling point.
- (ii) Drill to depth of sample removing excess soil from hole. Note: Place contaminated soil in a stainless steel bowl or pan for homogenization.
- (iii) Drill and obtain samples from auger barrel as required for sampling plan.

(iv) Decontaminate hand auger after each sampling effort as outlined in Section 4A.2.5 (b).

(b) SPLIT SPOON SAMPLES

Split spoon samples are most likely the best method for obtaining subsurface soil samples when soil conditions are rocky or wet. Split spoon samplers vary in size. Typical split spoons are 1.5 to 3 inch (4 - 8 cm) inner diameter. Samples are pushed up into the spoon when the spoon is driven/hammered into the ground. Spoons have a steel or plastic basket which works as a check valve to keep sample material from falling out during removal of the spoon from the hole. Split spoons have threaded ends where caps, used to hold the sampler parts together, are removed after sampling. The spoon is then split in half to obtain the enclosed sample.

(1) ADDITIONAL REQUIRED EQUIPMENT AND MATERIALS

(I) Split Spoon Samplers with Extension Rods

(ii) Sledge Hammer, Hydraulic Jack, Pipe Wrenches, and Base Wood.

(2) INSTRUCTIONS

(I) Assemble split spoon sampler with steel or plastic basket (radiological only) in place.

NOTE: Typical spoons are made with cap ends as a matched set (i.e., end caps only fit the spoon for which they were made as a set).

(ii) Assemble extension rods as required, and drive the spoon to the depth as specified in the sampling plan.

(iii) After spoon has passed through the required sampling depth, remove the spoon from the hole.

(iv) Place spoon on a clean piece of plastic, and remove the threaded end caps.

(v) Open the spoon by prying the spoon apart. Measure the amount of material present inside the spoon and note the percent (%) recovery. Typical spoon lengths are 24 inches long (61 cm). Example 24 inches of sample = 100% recovery, 12 inches of sample = 50% recovery, etc.

(vi) Loosely reassemble the split spoon for decontamination. It is important to keep the matched ends with the manufactured set.

(vii) Continue sampling as required.

(3) NOTES:

(I) Should technicians be required to drive split spoons, an impact rod must be constructed. This rod may be made from a piece of drill steel which has the split spoon thread. A section of the drill steel is cut off to a length of one foot and screwed into the spoon threads. This will prevent the split spoon from being damaged by hammer impact.

(ii) When technicians are required to drive split spoons with a sledge hammer, it will be difficult to remove the spoon from the hole. One method used is to place a pipe wrench on the steel extending from the hole at a point high enough to place a hydraulic jack under the pipe wrench, and jack the spoons out.

(c) SHELBY TUBE SAMPLES

A shelby tube is a hollow pipe which is pushed into the ground which forces material up into the tube. Shelby tubes range in size, but most commonly used are the 30 inches long (76 cm) by 3 inches (8 cm) inner diameter. Shelby tubes are not suitable if soil is rocky or extremely wet. Note that it is very difficult to push shelby tubes without the assistance of a drilling rig. However, in some cases shelby tubes may be pushed by heavy equipment such as a backhoe to acquire a good sample.

(1) ADDITIONAL REQUIRED EQUIPMENT AND MATERIALS

(I) Shelby Tubes with End Caps

(ii) Sample Extraction Tool (if required)

(2) INSTRUCTIONS

The drilling contractor will auger to the required sampling depth. The contractor will push and extract the shelby tube sample. Plastic caps are placed over the ends of the sampling tube by the contractor and the tube is then turned over to a EDi technician for identification, extraction (if required) and shipment.

(I) Estimate the percent (%) recovery as in the split spoon sampling procedure. If the sample enclosed in the shelby tube is to be extracted, a extraction tool will be required.

(ii) Record all pertinent data on a metal sampling label. Clean the exterior of the tube, and attach completed sampling label to the tube.

(iii) Duct tape or paraffin seal the end caps of the shelby tube if sample is to be sent intact. If sample is to be extracted, remove end caps and place the tube into the extractor. Extract sample increments as required, homogenize sample in a stainless steel bowl or pan, place in Nalgene jars, and correctly label. Ship the samples to the laboratory for analysis.

(d) POWER AUGURING

It is possible to acquire information samples during and after auguring boreholes. This method should be used for information samples only. The sample obtained from the sampling method described below will, in general, be biased by soil mixing and subsequent dilution. However, the open borehole will provide access to acquire samples as explained in Section E (Other Techniques of this procedure).

(1) ADDITIONAL REQUIRED EQUIPMENT AND MATERIALS

(I) Power Auger with Auger Flights

(ii) Sampling Tools

(2) INSTRUCTIONS

(I) Assemble power auger for drilling. As with any power equipment check the oil level prior to using the equipment. Routine beta-gamma surveys of soils may assist in bias sampling.

(ii) Screw the auger in to the required depth, and remove the auger with a relatively representative soil stuck to the auger. It is important to minimize soil extraction from the hole by auger rotation.

(iii) Obtain sample from auger and decontaminate the auger as required in Section 4A.2.5 (b).

(iv) Repeat the above steps as required to obtain additional samples.

(e) OTHER TECHNIQUES

Other techniques include any method by which subsurface soil samples can be obtained. The methods described below may assist field technicians in collecting samples when other sampling tools are not available.

(1) ADDITIONAL REQUIRED EQUIPMENT AND MATERIALS

(I) Post Hole Digger

(2) INSTRUCTIONS

(I) TECHNIQUE #1

Post hole digger samples can be obtained from two sources. Source #1 is to use the post hole digger to dig a hole acquiring samples at required depths as the hole is dug. Source #2 is used after power auguring. This method utilizes the open borehole drilled by a rig or other source. The post hole digger is used on the side of the hole to collect samples at required depths. This technique is easier because of the pre-opened hole.

(ii) TECHNIQUE #2

Side wall samples can be obtained from an open borehole. Fabrication of a sampling tool is required to obtain these types of samples. Typical side wall samplers consist of a can or cup attached to a pipe or piece of wood. Samples are obtained from existing boreholes by scraping the side of the borehole at the required depths.

(iii) TECHNIQUE #3

Test pit sampling can be done with the assistance of a backhoe. Holes are dug to the required depth and samples are the cut from the side of the hole. As in any open hole, be sure that adequate shoring, sloping, or shielding is in place prior to any work inside the hole. <u>USE CAUTION!</u>

(iv) TECHNIQUE #4

Hollow nail pipe samplers are sections of pipe 3 or 4 inch diameter, connected together with couplings at 1 foot increments. This pipe is pushed into the ground with a backhoe and then removed. The pipe is then taken apart to obtain the samples needed at the required depths. This method requires the use of heavy equipment to push and extract the hollow nail pipe.

4A.2.7 DOCUMENTATION

(a) FIELD SAMPLE COLLECTION FORM

Each subsurface soil sample collected shall be assigned a sequential number and recorded in the field sample collection log book. Sample information shall then be documented on Form 4A.1, Field Sample Collection Form. Documentation on the Field Sample Collection Form shall contain the following information:

(1) SITE WBS NUMBER
(2) SITE NAME
(3) ACTIVITY SUPPORT (JOB) NUMBER!
(4) SAMPLER(S) NAME
(5) SAMPLE IDENTIFICATION NUMBER
(6) SAMPLE GRID POINTS
(7) SAMPLE TYPE
(8) TIME SAMPLE WAS COLLECTED
(9) DATE SAMPLE WAS COLLECTED
(10) SAMPLE PRESERVATIVE USED
(11) PURPOSE
(12) DEPTH (IN CENTIMETERS OR FEET)
(13) ANALYSES REQUIRED
(14) REMARKS
(15) CHAIN OF CUSTODY INFORMATION
(16) RECORDED BY
(17) DATE/TIME FORM WAS COMPLETED
(18) NUMBER OF SAMPLES IN EACH SHIPPING CONTAINER
(19) TOTAL NUMBER OF SAMPLES IN SHIPMENT
(20) TOTAL NUMBER OF BOXES IN SHIPMENT

Record in the field sample collection log book the names of the individuals who collected the samples. Document all facts about the sample on the Field Sample Collection Form and enclose the original Field Sample Collection Form with samples to be shipped to the laboratory.

To ensure that each sample has been properly handled, a Chain of Custody procedure must be followed. For Chain of Custody reporting, enter the following information in the appropriate box of the Field Collection Form:

(I) Reason the sample is being released from the site (i.e., shipment, archival, analysis, etc...).

(ii) Person physically relinquishing the sample to the carrier (consignor).

(iii) Person or consignor (i.e., Federal Express).

(iv) Date and approximate time the sample was released to the consignor (time the sample leaves the site or is delivered to the consignor).

(v) Personnel at the laboratory (or location which receives the sample) will acknowledge receipt of the sample on the next line of the Chain of Custody box by their signature in the "received by" column, and by entering the date and time the sample was received.

A copy of the Field Sample Collection Form shall be sent to the Project Office by the EDi Site Supervisor (or his designee). A copy of the Field Sample Collection Form is retained for on site records.

Upon receipt of samples in the laboratory, receiving personnel shall acknowledge this shipment by completion of appropriate information in the Chain of Custody section of the Field Sample Collection Form. The laboratory will also note within the remarks section of this form if custody seals have been violated. In addition to completing the Chain of Custody section of the Field Sample Collection Form, the laboratory stamps the form with a received date stamp, and on the back of the form with a sample receiving information stamp. The sample receiving information stamp requires: (1) condition of the shipping container, (2) condition of samples, (3) presence or absence of custody seals, (4) presence or absence of Chain of Custody and air bill, (5) notes by inspector of shipment, (6) person performing inspection of the shipment, and (7) the date. See Attachment 4 of Procedure 4A.1, Revision 3.

Attachments:

(1) EDi Form 4A.1, Field Sample Collection Form

(2) Chain of Custody Seal

Procedure 4A.1

Attachment 1

Revision 2

FIELD SAMPLE COLLECTION FORM
SITE ACTIVITY SAMPLES

Page of

Site WBS

Site Name

Activity Support (Job) #

Sampler(s)

Sample ID Sample Grid Point	Sample Type (1)	Sample Time	Date of Sample	Preserved With	Purpose (2)	Depth cm [ ] ft [ ]	Analysis Required	Remarks

SAMPLE TYPE (1)		Purpose (2)	
Surface Soil	SS	Rad Character	RC
Bias Soil	BS	Verification	VR
Profile Soil	PS	Quality Control	QC
Sediment Silt	SD	Hot Spot	HS
Other	OR	Resample	RS
Vegetation	VE	Background	BG
Ground Water	GW	Routine	RT
Surface Water	SW	Special	SP

"This package conforms to the conditions and limitations specified in 49 CFR 173.421 for excepted radioactive material, limited quantity, n.o.s., UN 2910"

CHAIN OF CUSTODY

REASON	RELNQ BY	REC'D BY	DATE	TIME

Recorded By

Date/Time

No. of Samples in this box ☐

Total No. of samples in this shipment ☐

Total No. of Boxes in this shipment ☐

Shipper:

Ship to:

Colonie Interim Storage Site
(CISS)
Formerly Utilized Sites Remedial Action Program
Health Physics Operational Manual

Title: Airborne Radioactive Particulate Monitoring
Procedure Number: 4B.2
Revision: 3
Date: December 21, 1998

Approved: ______________________ 12/22/98
Project Manager, Vice President, EDi — Date

Approved: ______________________ 12/22/98
CHP Quality Assurance, EDi — Date

4B.2.1 PURPOSE

The purpose of this procedure is to provide guidance for proper sampling techniques, action levels, and equipment needed to determine airborne radioactive particulate concentrations.

4B.2.2 SCOPE

This procedure concerns the selection of filters and sampling equipment, the location of air sampling equipment, and the actions to be taken if applicable limits are exceeded for occupational and environmental monitoring for airborne radioactively contaminated particles.

4B.2.3 REFERENCES

(a) 10 CFR 20, Standards for Protection against Radiation

(b) EM 385-1-80, Radiation Protection Manual

(c) EDi Health Physics Operational Procedures Manual Section 5C, "Air Samplers"

(d) EDi Health Physics Operational Procedures Manual Procedure 1B.3, DAC-Hour Exposure Record, Revision 2, 10/1/96

(e) EDi Computer Data Reduction Manual Procedure CP5B.7, "EXCEL Calculation Spreadsheet for Results of Air Particulate Sampling", Revision 1, 6/19/94

(f) EDi Health Physics Operational Procedures Manual Procedure 5B.7, "Operation of the SAC-4 Scintillation Alpha Counter", Revision 2, 10/1/97

(g) EDi Health Physics Operational Procedures Manual Procedure 1B.2, "Bioassay Program", Revision 3, 5/7/95

(h) EM 385-1-1, Safety and Health Requirements Manual

(i) U.S. Environmental Protection Agency 40 CFR Part 61, Subpart H

(j) EDi Health Physics Operational Procedures Manual Section 4C, "Gaseous Sampling Techniques"

(k) EDi Health Physics Operational Procedures Manual Procedure 2A.2, "Access Requirements for Controlled Areas and Other Radiation Areas", Revision 2, 10/1/96

(l) EDi Health Physics Operational Procedures Manual Procedure 2B.1, "Personal Protective Equipment", Revision 2, 10/1/95

(m) EDi Computer Data Reduction Manual Procedure CP1B.3, "EXCEL Calculation Spreadsheet to Calculate DAC-Hour Exposure Records for Workers

4B.2.4 DEFINITIONS

(a) Air Sampling - is the collection of air or airborne contaminants in a suitable container or on an appropriate media for the purpose of contaminant identification and quantification.

(b) Air Surveillance - is the use of direct reading and air sampling instruments to identify and quantify airborne contaminants for the purpose of personnel and environmental protection.

(c) Airborne Radioactivity - is contamination that is dispersed in the air in the form of a dust, vapor, or gas.

(d) Breathing Zone - is any location within 6 - 9 inch diameter from a worker's nose and mouth.

(e) Derived Air Concentration (DAC) - is determined by dividing the quantity of a single radionuclide if inhaled or ingested in one year by the volume of air breathed by an average worker during that working year period.

(f) Derived Concentration Guides (DCG) - are limits to control exposures from radioactivity in air and water and are based on a committed effective dose equivalent to the public of 50 mrem per year (10CFR20 Appendix B) for the radionuclide of concern.

(g) Particulates - are all particles, solid or liquid, which are suspended in air, and may be inhaled.

(h) Restricted Work Area - is any area in which access is controlled to prevent or reduce exposures to hazardous materials.

(i) Working Level (WL) - is any combination of short-lived radon daughters in one liter of air without regard to the degree of equilibrium that will result in the ultimate emission of 1.3E5 MeV of alpha energy. 1 WL = 100 pCi/l at 100% equilibrium.

4B.2.5 EQUIPMENT & MATERIALS

(a) 25mm or 47mm Filter Holders

(b) High Efficiency Filters

(c) Eberline RAS-1 Air Sampler, or equivalent

(d) MSA Lapel or SKC Sampler, or equivalent

(e) Bubble Tube Calibration Kit, or equivalent

(f) Alpha Scintillation Counter, or equivalent

(g) KURZ Flow Calibration Kit (RAS-1 Sampler), or equivalent

(h) Filter Envelopes

(I) Form 5B.7A2, Air Particulate Sample Reporting Log (Attachment 1)

4B.2.6 INTRODUCTION

A. Airborne particles in general are classified into two categories, RESPIRABLE and NONRESPIRABLE. Those which are deposited in the lung are considered to be respirable. Particles which are deposited in the nasal and throat cavities are deemed to be non-respirable. Both respirable and non-respirable radioactive contamination pose an internal dose potential. The derived air concentration (DAC), for limiting radiation exposures through inhalation of radionuclides by workers, assumes total airborne contamination and makes no assumptions for non-respirable fractions in the breathing/work area. The total airborne radionuclide particulate concentration in the work area, shall be used to determine compliance with the DAC limits. Therefore, this procedure shall address sampling for total airborne contamination only.

B. Airborne particulate monitoring for radioactive contaminants is performed to determine the potential for exposure to workers and/or the public or environment from activities conducted on sites. Any activity that can affect ambient airborne radioactive concentrations must be monitored with appropriate air sampling equipment. The results of this monitoring, may also be used to determine the need for engineering controls and to evaluate the effectiveness of implemented engineering controls. All effort should be made to keep exposures "as low as reasonably achievable"(ALARA).

C. The Radiological Support Subcontractor (RSS) in coordination with the Site Safety and Health Officer (SSHO) will determine the need and frequency of air surveillance based upon site activities and site history. Any activity that can affect ambient airborne radioactive concentrations must be monitored with appropriate air sampling equipment.

D. A limit of 10% of the DAC before respiratory protection is required (see Section 4B.1.11) for site workers.

E. Workers who have been exposed to greater than 10% of the DAC will be bioassayed and an airborne contamination exposure report will be completed by the RSS (see Section 4B.1.12). In addition, the RSS and/or SSHO are responsible for implementing the proper corrective actions and notifying the Project Office.

F. Airborne particulate measurements shall not be used exclusively for determinations of internal exposure, shall be used to determine when additional bioassay samples or internal dose assessments are to be required to quantify and qualify internal dose equivalents.

G. Examples of conditions which may require comprehensive air surveillance are:

(1) Site excavation activities

(2) Activities that generate airborne particulate contamination that could exceed 10% of the applicable DAC values (i.e., dry soils)

(3) Any activity in which public exposure may occur

(4) grass/brush cutting

(5) scabbling concrete

(6) Decontaminating equipment

4B.2.7 SAMPLING TYPES

A. There are three basic sample types used for performing airborne assessments to workers and the public:

(1) Personnel Samples

(a) Personnel sampling may be used to determine the radioactive particulate concentration an individual is exposed to by placing a lapel sampling device within his/her breathing zone.

(b) The lapel sampler is flow checked and calibrated pre- and post-sampling each day.

(c) All information concerning the air sample will be recorded on Attachment 1, and used to calculate air particulate concentrations.

(d) For sites where U-238 is the primary isotope of interest, Radon-222 (Rn-222) concentrations in air will be measured to determine worker exposure. The short-lived daughter products of Rn-222, particularly Po-218 and Po-214, are highly energetic alpha particle emitters that are of great concern for dose to lung tissue. By counting the alpha activity from the Rn-222 daughter products collected on the filter, exposure to Rn-222 can be determined. The DAC for Rn-222 is in Attachment 3.

(e) For sites where Thorium is the primary isotope of interest, Radon-220 (Thoron) Daughter concentrations in air will be determined. Filters used to collect Thoron daughter samples are allowed to decay for 5 hours so that the Rn-222 daughters will decay and the Rn-

220 daughters, particularly Bi-212, can grown into transient equilibrium with Pb-210 (see Reference (k)).

(2) Short-term Samples

(a) Short-term grab samples may be required to determine the maximum exposure potentials in special areas for determination of the effectiveness of engineering controls or for determining the working condition exposure potentials. This may be accomplished by using a high volume air sampler (i.e., Eberline RAS-1) to monitor a work activity during peak airborne contamination potential. The appropriate respiratory protection equipment will be used assuming that airborne concentrations exceed 10% of the appropriate DAC limit until proven otherwise.

(3) Area Samples

(a) General area sampling may be used to evaluate airborne conditions in rooms, buildings, restricted work areas, etc. Ideally, this type of sampling will provide area average concentrations of airborne contamination for general working or occupational functions within the area. Area samples are limited in value for internal exposure assessment if the area being sampled is subject to point source dust generation. During work conditions that create uniform airborne contamination, the use of area samplers will provide sufficient estimates of worker exposure.

(b) Area samplers may be used to determine personnel exposures for sites with very restrictive DAC's where personnel lapel

sampling can not provide statistically acceptable minimum detectable activity (MDA) values due to the lack of volume obtained with lapel samplers. In addition, area samplers may be used instead of personnel samplers when collection times are too short to pull adequate volume.

(c) Area sampler results exceeding the DCG limit for the limiting radionuclide will be reported immediately by the RSS to the SSHO. DCG values will be used as the governing limit for area samples unless the proximity of the area to the site boundary would result in offsite releases exceeding NESHAPS limits (see below). If area sample results exceed the applicable DCG, the RSS will notify the SSHO that dust generating work must be stopped, or that further guidance is needed.

(4) Perimeter Monitoring

Perimeter monitoring is performed to determine if offsite releases exceed the NESHAPS limits specified in Attachment 3. Perimeter monitors should be placed uniformly at the boundary of the fenced or restricted area with emphasis placed on the predominantly downwind direction. The RSS is responsible for monitoring the wind direction to ensure that the downwind direction is being adequately sampled. If the perimeter sampler is located at the boundary of a site and the NESHAPS limit for the limiting radionuclide is exceeded, the RSS will immediately stop dust generating work and notify the SSHO for further guidance.

4B.2.8 SAMPLING INSTRUCTIONS

A. Proper operation and documentation of personnel and area or perimeter samplers will be followed in accordance with the appropriate requirements.

B. At the end and periodically throughout the sampling period, air sampler flow rates must be visually checked to ensure that volumes have not been affected by pump problems, pinched tubing, etc.

C. Sample filter medium shall be glass fiber and/or cellulose membrane and are typically 25mm in diameter for personnel samplers, and 47mm for area or perimeter samplers.

D. Occupational Sampling shall be performed by placement of a lapel sampler in an individual's breathing zone that has a calibrated flow rate of not less than 2 liters/minute or using area samplers (see Section 4B.1.7A(3)(b)).

E. Sampling duration shall be long enough to ensure that the sample volume exceeds 8E5 ml of air. Samples shall be counted as long as required to report results which is less than the DAC and preferably less than 10% of the DAC to demonstrate compliance with the limits.

F. Area and perimeter sampling shall be conducted by placing a high volume air sampler (i.e., Eberline RAS-1) around the perimeter, and/or in the downwind direction, of a work area. Lapel samplers can also be used for area sampling; however, because of low sample volumes, longer sampling time and/or longer count time will be required. The volume of air required is greater than 8E5 ml.

4B.2.9 EQUIPMENT

A. Selection of airborne sampling equipment shall be based on the types of contamination present. The method used to determine naturally occurring radionuclides present in the work place or at specific sites shall be conducted in areas where the potential of any exposure greater than 10% of the DAC (see Attachment 3) exists.

B. Breathing Zones (e.g., SKC Air Sampler) air pumps are typically worn at the waist area of the individual being sampled. The air pump uses a rechargeable battery, and is designed to have minimal impact on an individual's activities. In addition, the air pump may be programmable.

C. The RSS is responsible for maintaining monitoring equipment in good working condition and ensuring that each unit is properly calibrated.

D. Occupational sampling for Radon-222 and Radon-220 (Thoron) and their daughter products shall also be conducted in areas where the potential of any exposure greater than 10% of the DAC (see

Attachment 3) exists. Sampling shall, however, be conducted with field instrumentation (Pylon) to determine area concentrations. These results may be used to estimate internal exposure information and will be documented on the appropriate forms.

4B.2.10 SAMPLE COUNTING

A. Filters are counted using a alpha scintillation detector for gross alpha activity for a minimum of 50 minutes. Longer count times may be required to achieve MDAs less than 10% of the DAC for sites with very restrictive limits (i.e., Th-232 sites).

B. Filters must be allowed to decay for a minimum of three days to allow for radon and thoron daughters to decay and reach equilibrium, unless otherwise specified. In time critical situations, filters can be counted after shorter decay periods. A filter efficiency shall be determine to account for self-absorption of glass fiber filter media. This will be conducted on a site-specific basis.

4B.2.11 ACTION LEVELS

A. The RSS shall perform radiological air sampling and analysis to determine the concentrations of airborne radionuclides and to establish an ALARA program for protection of employees who may be exposed while working in restricted work areas.

B. An area shall be posted as an airborne radioactivity area when the airborne radioactivity exceeds 10% of the DAC for the most restrictive radionuclide present (Attachment 3). The RSS is responsible for informing the SSHO that an area exceeds this administrative limit so that it can be properly posted and any applicable reporting is initiated.

C. For areas with airborne radioactive concentrations greater than the 10% DAC limit, a signed and approved Hazardous Work Permit (HWP) must be posted with the respiratory protection requirements for entry into the area.

D. When releases at the perimeter exceed the NESHAPS limits, which is 10% of the DCG for the most restrictive radionuclide present. The RSS will inform the SSHO that dust generating work must be stopped.

E. The action level to use for personnel sampling is 10% of the DAC for the most restrictive radionuclide present (Attachment 3). The most conservative lung retention class limit is used. For example, the appropriate DAC limit for Th-232 would be 5E-13, and the administrative limit which is 10% of that value would be 5E-14.

F. To determine worker exposures, DAC-Hour calculations will be performed in accordance with the requirements.

4B.2.12 DOCUMENTATION

A. Airborne particulate sample results will be calculated using the EXCEL program AIRPARTA.WR1 or by hand and documented on Form 5B.7A2 (Attachment 1). All air sampling data will be transmitted to the Project Office.

B. If any air particulate sample results in a concentration greater than 10% of the applicable DAC taking into account any protection factors that may be appropriate, an airborne contamination exposure report, Form 1B.3A2 (Attachment 3), will be completed for all personnel exposed. The time an individual is exposed to these concentrations will be determined using the controlled area access register.

C. Airborne contamination exposures will be calculated using the EXCEL spreadsheet AIRDACA.WR1 or by hand and documented on Form 1B.3A2. Form 1B.3A2 must be transmitted by the RSS to the Project Office.

D. The RSS will document in the daily site manager's log whenever action levels are exceeded, the conditions surrounding the event, as well as any discussions or decisions pertaining to work stoppage.

ATTACHMENTS

Attachment 1	Form 5B.7A2
Attachment 2	Action Levels
Attachment 3	Form 1B.3A2

ATTACHMENT 2

ACTION LEVELS

	Derived Air Concentration			DCG	NESHAPS*
	D (mCi/ml)	W (mCi/ml)	Y (mCi/ml)	(mCi/ml)	(mCi/ml)
Ra-226	----	3E-10 (3E-11)	----	1E-12	1E-13
Th-230	----	3E-12 **(3E-13)**	7E-12 (7E-13)	4E-14	4E-15
Th-232	----	5E-13 **(5E-14)**	1E-12 (1E-13)	7E-15	7E-16
U-235	6E-10 (6E-11)	3E-10 **(3E-11)**	----	1E-13	1E-14
U-238	6E-10 (6E-11)	3E-10 **(3E-11)**	----	1E-13	1E-14

* NESHAPS limits for offsite release are 10% DCG

* For Derived Air Concentrations, the lung retention classes are denoted by "D", "W", and "Y". The most restrictive class will be used to determine the action level.

* The administrative limit, 10% of the DAC, appears in parentheses, and the most restrictive limit for each of the lung retention classes appear in bold.

Air Particulate S eporting Log

		Counter #1		Counter #2		Counter #3	
Reference Number	139AP00	Detector Model		Detector Model		Detector Model	
WBS Number	139	Serial Number		Serial Number		Serial Number	
Date Counted		Cal Due Date		Cal Due Date		Cal Due Date	
Limiting Isotope	U-238	Efficiency		Efficiency		Efficiency	
DAC	2E-11	BKG CPM		BKG CPM		BKG CPM	
Filter Media	GLASS FIBER 25 mm	BKG Ct Time		BKG Ct Time		BKG Ct Time	
Filter Collection Eff.	0.9998	Sample Ct Time		Sample Ct Time		Sample Ct Time	

Sample #	HWP #	Person	SSN #	Total Hrs.	PF	Detect. #	ON Date/Time	OFF Date/Time	TIME (mins)	FLOWRATE (lpm)	GROSS CPM	LC Qual	ACTIVITY (µCi/ml)	STDEV (µCi/ml)	Lc (µCi/ml)	DAC (hrs)

Data Entered By and Date: ______________________________

Reviewed By and Date (RSSS):____________________________

Reviewed By and Date (RCM):_______________________

FORM 5B.7A2

Air Monitoring Reporting Log

		Counter #1		Counter #2		Counter #3	V13
Reference Number		Detector Model		Detector Model		Detector Model	
WBS Number		Serial Number		Serial Number		Serial Number	
Date Counted		Cal Due Date		Cal Due Date		Cal Due Date	
Limiting Isotope	U238	Efficiency		Efficiency		Efficiency	
10CFR20	6E-14	BKG CPM		BKG CPM		BKG CPM	
Filter Media	GLASS FIBER 47 mm	BKG Ct Time		BKG Ct Time		BKG Ct Time	
Filter Coll. Eff.	0.9998	Sample Ct Time		Sample Ct Time		Sample Ct Time	

Comments: * Data provided in this column represents the percent of total gross alpha activity counted and reported as a percentage of the weekly target concentration. Actual limits are based on an effective dose equivalent of 50 mR/yr. This number does not represent an infraction if greater than 100%.

Sample #	Location	Detect. #	ON Date/Time	OFF Date/Time	TIME (mins)	FLOWRATE (lpm)	GROSS CPM	LC Qual	ACTIVITY (µCi/ml)	STDEV (µCi/ml)	Lc (µCi/ml)	%10CFR20*

Data Entered By and Date:____________________

Reviewed By and Date (RCM):____________________

Reviewed By and Date (RSSS):____________________

FORM 1B.3A2

EDi

Health Physics Operational Procedures Manual

Title: Operation of the Eberline AC-3 and Ludlum 43-5 Alpha Scintillation Detectors

Procedure Number: 5A.1

Revision: 3

Date: August 10, 1996

Approved:________________________________ 8/10/96
Project Manager/Vice President, EDi Date

Approved:________________________________ 8/10/96
CHP/President, EDi Date

5A.1.1 PURPOSE

The purpose of this procedure is to ensure the proper use of the Eberline AC-3 and Ludlum 43-5 alpha scintillation detectors in the field based on field source checks and background determination.

5A.1.2 SCOPE

This procedure describes the operation of the Eberline AC-3 and Ludlum 43-5 alpha scintillation detectors when coupled to an Eberline Portable Ratemeter/Scaler or equivalent.

5A.1.3 REFERENCES

(a) Eberline Instrument Corporation Technical Manual for the AC-3 Alpha Detector

(b) Ludlum Instruments Technical Manual for the Model 43-5 Alpha Detector.

(c) American National Standard Institute, "Radiation Protection Instrumentation Test and Calibration", ANSI N323-1978, 9/13/77

(d) DOE/EH 0256T, Radiological Control Manual, June 1992

(e) EDi Calibration Procedure EA 4.10, Revision 1

5A.1.4 EQUIPMENT AND MATERIALS

(a) Eberline AC-3 Alpha Detector

(b) Portable Ratemeter/Scaler or equivalent

(c) Th-230 Alpha Source Jigs (standard and check sources)

(d) Weekly Field Source Check Log, Form 5E.2, (Attachment 1)

(e) Ludlum 43-5 Alpha Detector with Adapter Connector

5A.1.5 DESCRIPTION

A. The Eberline AC-3 and Ludlum 43-5 are alpha scintillation detectors used to measure alpha emitting contaminants on personnel, equipment, or surfaces. The large surface area and low background achieved with these detectors allow sensitive measurements of alpha contamination levels to be made.

B. There are two versions of the AC-3 detector which differ only in the window assembly. The AC-3-7 designates a maximum open area window for alpha surveys. The AC-3-8 designates a rugged window for surveying rough or irregular surfaces.

C. The pertinent features and characteristics of each alpha scintillation detector are:

(1) Eberline AC-3

(a) Active probe face area 59 cm^2.

(b) Operating voltage: depends on photomultiplier tube characteristics, cable length, and input impedance of the readout instrument. Voltage is determined in accordance with requirements specified in Reference (e).

(c) Connector: waterproof connector (CJ-1), cable and mating connector (CP-1).

(d) Efficiency measured using 1.0 inch diameter Th-230 alpha source assuming a 4 pi geometry:

AC-3-7 window-nominally, 15%
AC-3-8 window-nominally, 10%

(e) Temperature range: -40°C to +60°C.

(2) Ludlum 43-5

(a) Active probe face area 50 cm^2.

(b) Operating voltage: much lower than for the Eberline AC-3. Voltage is determined in accordance requirements specified in Reference (e).

(c) C Connector with adapter.

(d) Efficiency measured using 1.0 inch diameter Th-230 alpha source assuming a 4 pi geometry is 11-12% (window-nominally).

(e) Temperature range: -40°C to +60°C.

5A.1.6 DAILY FIELD RESPONSE CHECKS

A. Daily field response checks are performed on alpha scintillation detectors at the beginning and end of each work shift (if used).

B. All results of routine daily field checks shall be entered on Form 5E.2.

C. Daily field response checks are to be performed as follows:

(1) Take a 5 minute background count. Transuranic sites will require lower backgrounds (i.e., ≤5 cpm) whereas Uranium sites can accept higher backgrounds (i.e., ≤10 cpm). The background count rate will be recorded in Column (B) of Form 5E.2.

(2) Take two - 1 minute alpha source counts using a Th-230 plaque. If a milled Th-230 jig is available, take three - 1 minute alpha source counts one each at the top, center and bottom positions on the detector face. Average the readings and record all readings in Column (A) of Form 5E.2.

(3) The calibrated efficiency found on the detector's calibration label will be recorded in Column © of Form 5E.2. This number will be recorded in decimal form (i.e., 18% will be recorded as 0.18).

(4) The daily calculated efficiency (Column (D)) will be calculated and recorded using the following equation:

$$\frac{\text{Source cpm} - \text{Bkg cpm}}{\text{Source Activity dpm}} = (D)$$

(5) To determine if the detector is operating within specifications. Calculate ±20% (reference (c)) of the calibrated efficiency (Column (C)). Record these values on the bottom of Form 5E.2.

(6) If the Column (D) value is within ±20% range recorded on Form 5E.2, the detector is operating within specifications and may be used for data collection.

(7) If the Column (D) value is not within ±20% range recorded on Form 5E.2, recheck the source geometry. If the detector can not be brought within the ±20% range, return it to the EDi Instrument Service Center for repair and recalibration. Data obtained with an instrument not operating within specifications is invalid. Contact the EDi Project Office for further guidance.

5A.1.7 OPERATION

A. Surfaces being surveyed shall be dry.

B. Remove the plastic face cover from the detector. Extra care should be taken not to damage the Mylar facing.

C. The probe should be held as close as possible to the surface being surveyed without actually touching the surface (approximately 1/4").

D. Fixed point measurements shall have a minimum count time of 0.5 minutes, unless the isotope of interest is Ra-226 in which case a minimum count time of 1 minute is required.

E. Survey scanning speed shall not exceed two inches per second. If count rate increases during surveying, pause 5 - 10 seconds over the area to provide adequate instrument response time.

F. Caution should be taken not to contaminate the detector when there is obvious surface contamination present.

G. Always replace the plastic face cover on the detector face and turn instrument off when not in use.

Attachment:

(1) Form 5E.2, Weekly Field Source Check Log

EDi

Health Physics Operational Procedures Manual

Title: Operation of the Eberline HP-210, HP-260 and Bicron PGM Pancake Geiger-Mueller Detector

Procedure Number: 5A.2

Revision: 3

Date: May 26, 1996

Approved:______________________________ 5/26/96
Project Manager/Vice President, EDi Date

Approved:______________________________ 5/26/96
CHP/President, EDi Date

5A.2.1 PURPOSE

The purpose of this procedure is to ensure the proper operation of the Eberline HP-210, HP-260, and Ludlum 44-9, 44-90 PGM detectors when coupled with a portable ratemeter or scaler.

5A.2.2 SCOPE

This procedure describes the operation of the Eberline HP-210, HP-260, and Ludlum 44-9, 44-90 PGM detectors used to detect alpha, and beta-gamma radiation.

5A.2.3 REFERENCES

(a) Eberline Instrument Corporation Technical Manual, HP-210 and HP-260 Detectors.

(b) Ludlum Corporation Technical Manual, PGM Detector.

(c) EDi Health Physics Operational Procedures Manual Procedure 5E.2, "Field Source Check Response and Documentation"

(d) EDi Health Physics Operational Procedures Manual Procedure 5E.3," Radioactive Source Inventory, Service Schedule, and Leak Testing"

(e) EDi Health Physics Operational Procedures Manual Procedure 3A.2, "Direct Surface Contamination Survey"

(f) EDi Health Physics Operational Procedures Manual Procedure 3A.3, "Transferable Surface Contamination Survey"

(g) EDi Instrument Operation Standard Procedures Manual Procedure EA 4.46, "Calibration of the Eberline HP-210 Pancake-Geometry Geiger Probe for Alpha Response"

5A.2.4 EQUIPMENT AND MATERIALS

(a) Eberline HP-210, HP-260 or Ludlum PGM Detector

(b) Portable Ratemeter or Scaler

(c) SrY-90 Beta Sources (standard and check sources)

(d) Th-230 Alpha Check Source

(e) SH-4A Source Holder

(f) Weekly Field Source Check Log, Form 5E.2, Attachment 1.

5A.2.5 DESCRIPTION

The Eberline HP-210, HP-260 and Ludlum PGM detectors are rugged, pancake-geometry Geiger-Mueller tubes designed for field use in detecting alpha, and beta-gamma radiation. The mylared HP-210, HP-260 and Ludlum PGM all utilize a G-M tube with a thin window protected by a sturdy wire screen which allows detection of beta particles with energies greater than 40 KeV. The use of mylar on the HP-210 shields alpha particles and precludes the detection of alpha activity by this detector, however with the mylar removed, this detector can be used for alpha particle detection as well as beta-gamma detection. The non-mylared HP-260 and Ludlum PGM are used for initial screening of alpha and beta-gamma radiation only. The detectors described in this procedure may be used only to perform gross screening for alpha activity, if site conditions warrant their use. Because alpha and beta-gamma activity can not be distinguished using these detectors, their use for alpha detection is conservative.

The HP-210, HP-260 and Ludlum PGM specifications are:

(a) Active detector face area 15.5 cm^2

(b) Mica window thickness of 1.4 to 2.0 mg/cm^2

(c) 7 mg/cm^2 mylar between mica window and wire screen (HP-210 only)

(d) Operating voltage: 900 ± 50V

(e) Connector: BNC series coaxial (HP-210, HP-260) and MHV (PGM)

(f) Operating temperature range: -30°C to + 75°C

(g) Sensitivity through window:

Alpha:	approximately 10-11% 4 pi nominal efficiency on contact for 4.7 MeV alpha particles
Gamma:	approximately 3600 cpm/mR/hr using a Cs-137 source

Beta: approximately 20% of 4 pi emission for SrY-90 in a SH-4A holder

5A.2.6 DAILY FIELD RESPONSE CHECKS

A. BETA-GAMMA RESPONSE USING SrY-90

(a) Background Determination

(1) To achieve a consistent geometry with source checking, place the detector in the SH-4A holder (with a clean empty planchet in the holder).

(2) Take a 1 minute background count with the scaler or ratemeter to determine detector background response. Record background counts in Column (B) of EDi Form 5E.2.

Note: Longer background determinations may be conducted if required for statistical reasons.

(3) If count rate is greater than 55 cpm in a low background area, decontaminate the detector or move to a lower background area. If background cpm remain above 55 cpm, an "out-of-service" tag will be placed on the detector denoting the problem on the tag. An entry will be made on Form 5E.2 that the detector was not used for data collection. If the detector is found not to be performing within specifications at the end of a work shift, data collected with it for that day will not be used. The detector will be returned to the EDi Instrument Service Center for recalibration or repair.

(b) Source Response Check

(1) Place the SrY-90 beta source in a clean planchet in the SH-4A holder, take a 1 minute count. Source geometry and source type can cause variance. Use the same SH-4A geometry and the same beta source for each check.

Note: If SH-4 holder is not available, place detector approximately 3/8" above the surface of the SrY-90 source.

(2) The calibrated Efficiency/Response recorded on the detector's calibration sticker will be recorded in decimal form in Column © of Form 5E.2. To convert the % efficiency to decimal form, divide the % value by 100 (i.e., 18% to 0.18).

(3) Calculate the Daily Calculated Efficiency (Column (D)) of Form 5E.2 by determining the net response cpm ((A) - (B)) then dividing by the source activity (in dpm). Record as the decimal form.

(4) To determine if the detector is responding within specifications (i.e., ±20%), multiply the value in Column © by 0.20. Add and subtract this value to Column © and record on the + and - lines, respectively, at the bottom of Form 5E.2.

(5) If the value in Column (D) is within the ±20% range, the detector is responding within specifications.

(6) If the value in Column (D) is not within the ±20% range, investigate, recheck geometry and instrument settings (according to appropriate instrument procedures in Section 5.0 of the EDi Health Physics Operational Procedures Manual). If the instrument is determined to be malfunctioning, an "out-of-service" tag will be placed on the detector denoting the problem on the tag. An entry will be made on Form 5E.2 that the detector was not used for data

collection. If the detector is found not to be performing within specifications at the end of a work shift, data collected with it for that day will not be used. The detector will be returned to the EDi Instrument Service Center for recalibration or repair.

B. ALPHA RESPONSE USING Th-230 SOURCE

(a) Background determinations for alpha activity will not be performed using these detectors because the contributions from beta-gamma activity can not be distinguished from that of alpha. Because these detectors are used for gross screening for alpha activity a background of 0 will be assumed.

(b) In Column (B) of Form 5E.2 record 0 for background cpm.

(c) Form 5E.2 can be used for an individual detector for response checks to either alpha or beta-gamma radiation (note: a separate form may be used for the same detector for alpha and beta-gamma response checks, if desired). The entries for source, serial no., activity, and calibrated efficiency/response will be different for alpha and beta-gamma.

(d) Source Response Check

(1) Place the Th-230 alpha source on a clean surface in a low background area. Because calibrated efficiencies are based on contact with the alpha source, the detector must be placed in direct contact with the source. Take a 1 minute count. Source geometry and source type can cause variance. Use the same geometry and the same alpha source for each check.

(2) The calibrated Efficiency/Response recorded on the detector's calibration sticker will be recorded in decimal form in Column © of Form 5E.2. To convert the % efficiency to decimal form, divide the % value by 100 (i.e., 18% to 0.18).

(3) Calculate the Daily Calculated Efficiency (Column (D)) of Form 5E.2 by determining the net response cpm ((A) - (B)) then dividing by the source activity (in dpm). Record as the decimal form.

(4) To determine if the detector is responding within specifications (i.e., ±20%), multiply the value in Column © by 0.20. Add and subtract this value to Column © and record on the + and - lines, respectively, at the bottom of Form 5E.2.

(5) If the value in Column (D) is within the ±20% range, the detector is responding within specifications.

(6) If the value in Column (D) is not within the ±20% range, investigate, recheck geometry and instrument settings. If the instrument is determined to be malfunctioning, an "out-of-service" tag will be placed on the detector denoting the problem on the tag. An entry will be made on Form 5E.2 that the detector was not used for data collection. If the detector is found not to be performing within specifications at the end of a work shift, it may not be used for gross screening until it is returned to the EDi Instrument Service Center for recalibration or repair. Because the detector was not used for data collection, surveys will not be repeated.

5A.2.7 OPERATION

A. The HP-210 detector, fitted with a 7 mg/cm^2 mylar sheet placed between the mica window and wire screen, is used for beta-gamma radiation detection only. With the mylar removed, this detector can also be used to perform gross screening for alpha radiation.

B. The EDi Instrument Service Center will provide alpha efficiencies for detectors only on request.

C. The HP-210, HP-260, or Ludlum PGM may be used as a hand-held detector for direct surface measurements. The HP-210 may be used as a sample counter when used with a Model SH-4A sample holder assembly. The HP-260 and PGM detectors do not have a mylar window, and therefore are alpha sensitive so they can only be used for gross screening.

(a) When using these detectors to measure direct surface contamination, the requirements set forth in EDi Procedure 3A.2, "Direct Surface Contamination Survey" (reference (e)) must be met.

(b) When using these detectors as a sample or smear counter, the requirements set forth in EDi Procedure 3A.3, "Transferable Surface

Contamination Survey" (reference (f)) must be met.

D. A beta dose to count rate conversion factor can be estimated using the HP-210, HP-260, or Ludlum PGM detectors. To estimate the beta dose-count rate conversion factor:

(a) Make the decay correction for the SrY-90 beta source, if necessary, as specified on Form 5E.3A, Reference (d).

(b) Calculate the surface beta dose of the source using the following equation:

$$\text{mrad/hr} = 9.43 \times 10^{-5} \times \text{corrected source activity (dpm)}$$

(For example if the corrected activity of the source is 13160 dpm, then the surface beta dose will be:

$$\text{mrad/hr} = 9.43 \times 10^{-5} \times 13160 \text{ dpm} = 1.24 \text{ mrad/hr}$$

(c) The beta dose-count rate conversion factor is calculated by dividing the net cpm by the mrad/hr of the source.

(d) Typically, all detectors will have a cpm/mrad conversion posted on the detector.

Attachment:

(1) EDi Form 5E.2, Weekly Field Source Check Log

Colonie Interim Storage Site
(CISS)
Formerly Utilized Sites Remedial Action Program
Health Physics Operational Procedures Manual

Title: Operation of the SPA-3 and Ludlum 44-10 Gamma Scintillation Detectors
Procedure Number: 5A.5
Revision: 3
Date: December 21, 1998

Approved: ______________________________ 12/22/98
Project Manager, Vice President, EDi Date

Approved: ______________________________ 12/22/98
CHF Quality Assurance, EDi Date

5A.5.1 PURPOSE

The purpose of this procedure is to ensure the proper field check and response of the Eberline SPA-3 and Ludlum 44-10 Gamma Scintillation Detectors when coupled to a portable ratemeter/scaler (or equivalent).

5A.5.2 SCOPE

The Eberline SPA-3 and the Ludlum 44-10 Gamma Scintillation Detectors are rugged and semi-waterproof detector assemblies used to detect low-levels of gamma radiation in the uR/hr. range. These detectors are primarily used to perform surface surveys on land. This procedure describes the proper use of these detectors when making such measurements.

5A.5.3 REFERENCES

(a) Eberline Instrument Corporation Technical Manual, SPA-3 Gamma Scintillation Detector.

(b) Ludlum Corporation Technical Manual, 44-10 Gamma Scintillation Detector.

(c) EDi Procedures Manual, Section 5.0, Instrument Operation Procedures.

5A.5.4 EQUIPMENT AND MATERIALS

(a) Gamma Scintillation Detector

(b) Ludlum 44-10 Gamma Scintillation Detector

(c) PRS-1 Ratemeter/Scaler or equivalent

(d) Cs-137 Gamma Check Source

(e) Fixed geometry jig

(f) Weekly Field Source Check Log, Form 5E.2, (Attachment 1)

5A.5.5 DESCRIPTION

The SPA-3 and 44-10 detector's assembly contains a 2-inch diameter, 2-inch long NaI(Tl) crystal, a 2-inch ten stage photomultiplier tube, tube socket with a dynode resistor string, and a magnetic shield.

(a) Detector specifications are:

  (1) Detector: 2 inch diameter x 2-inch long cylindrical NaI(Tl) crystal

  (2) Connector: Mates with CP-1 (SPA-3)
  Mates with MHV (44-10)

  (3) Sensitivity:

    (A) Approximately 1200k cpm per mR/hr with Cs-137
    (B) Approximately 500k cpm per mR/hr with Co-60

5A.5.6 FIELD OPERATION

(a) Inspect and clean the exterior of the detector and connector.

(b) To perform the daily response check, place the detector in an area where background radiation levels are minimal. Place the detector in the jig. The jig is designed to hold either the SPA-3 or 44-10 detector in a fixed geometry. Set the selector switch for a one-minute count time. Take three one-minute background measurements, and record the average cpm in Column (B) on the Weekly Field Source Check Form, Form 5E.2.

(c) Place the Cs-137 check source in the jig. Insert the detector upright into the jig, thus exposing it to the source. As noted above, the jig is designed to hold the detector in a fixed geometry to achieve reproducible counting results. Set the selector switch for a one-minute count. Take 1 one-minute measurement. Record as source check (cpm) in Column (A) of Form 5E.2.

(d) An efficiency value is not required for the SPA-3 or 44-10, therefore the cpm response to Cs-137 is to be compared to the cpm response documented on the source and will be used to determine if the detector is responding within specifications. Record the calibrated response cpm from the calibration sticker in Column (C) of Form 5E.2.

(e) To determine if the detector is within ± 20% of the source's calibrated response cpm, multiply the cpm value in Column (C) by 0.20. Add and subtract this value to the calibrated response cpm (C) and record on the + and - lines, respectively, at the bottom of Form 5E.2.

(f) Calculate the net response cpm for the detector, (A) - (B), then compare to the ± 20% values on Form 5E.2. If the net response cpm is within the ± 20% window, the detector is responding within specifications. If the net response cpm is not within the ± 20% window, investigate and recheck the geometry and instrument settings. If the instrument is determined to be malfunctioning, return it to the Project Office for repair and recalibration.

(g) The column labeled "Daily Calculated Efficiency (D)" does not apply to the SPA-3 or44-10. Record N/A in Column (D).

(h) Attachment 2 is an example of a properly completed Form 5E.2. The first and second lines indicate that the detector was functioning within specifications. The third line shows that the detector is no longer within specifications and that it was returned to the EDi Project Office for repair. It is helpful to make a notation in the daily site log whenever an instrument is removed from service.

Attachments:

(1) EDi Form 5E.2, Weekly Field Source Check Log

(2) EDi Form 5E.2, Example

WEEKLY FIELD SC CE CHECK LOG

Site Name: CFS Week Ending: ______

Scaler/Ratemeter: ______ S/N: ______ Cal Date: ______ Cal. Due: ______

Detector: ______ S/N: ______ Cal Date: ______ Cal. Due: ______

Date Time	Source	Serial No.	Source Activity	Source Check cpm (A)	Bkg. Cpm (B)	Calibrated Eff./ Response (C)	Daily Calculated Eff. (D)	HV	Batt.	Spkr.	Disp.	OK By

± 20% of Calibrated Value:
+ Value ______
- Value

Daily Calculated Efficiency:

$$\frac{(A) - (B)}{\text{Activity}} = (D)$$

Remarks:

Colonie Interim Storage Site
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Formerly Utilized Site Remedial Action Program
Health Physics Operational Procedures Manual

Title: Operation of the Eberline MS-3 Mini Scaler
Procedure Number: 5B.3
Revision: 3
Date: December 21, 1998

Approved: ________________________________ 12/22/98
Project Manager, Vice President, EDi Date

Approved: ________________________________ 12/22/98
CHP Quality Assurance, EDi Date

5B.3.1 PURPOSE

The purpose of this procedure is to ensure proper use of the Eberline MS-3 Mini Scaler.

5B.3.2 SCOPE

This section describes the procedure for operating the Eberline MS-3 Mini Scale, which is designed for use with most Eberline Scintillation, G-M or proportional detectors.

5B.3.3 REFERENCES

Eberline Instrument Corporation Technical Manual for MS-3 Mini Scaler.

5B.3.4 EQUIPMENT AND MATERIALS

(a) Eberline MS-3 Mini Scaler

(b) Eberline HP-210 Pancake GM Detector

(c) Eberline AC-3 Alpha Scintillation Detector

(d) Eberline SPA-1 Alpha Scintillation Detector

(e) Weekly Field Source Check Log, Form 5E.2, Attachment 1

(f) Appropriate Alpha & Beta Check Sources

5B.3.5 DESCRIPTION

The MS-3 Mini Scaler consists of a variable high voltage power supply, a charge sensitive input amplifier, and a six-decade scaler and timer. All circuits are solid-state with integrated circuits to enhance reliability.

The MS-3 Mini Scaler is designed for use with most scintillation, G-M or proportional detectors.

The scaler section uses light-emitting diode readouts. Battery operation is available by use of an external battery that can be plugged into a rear panel connector.

(a) High voltage: Regulated and adjustable by front panel control from 200 V to approximately 2400V maximum, it can supply a 100 megahom load up to 1700V. A ten-turn potentiometer allows repeatable predetermined voltage setting. The power supply is a plug-in module for ease of maintenance.

(b) Scaler: Six-decade light emitting diode readout. Counting light stays lit when in counting mode. Decade counters and counting gates are plug-in type for ease of maintenance.

(c) Timer: Preset times from 0.1 minute to 50 minutes in a 1, 2, 5 sequence referenced to line frequency yielding an accuracy typically better than 0.05 percent. The timer has an oscillator for use with a battery.

5B.3.6 SPECIFICATIONS

(a) Reset-Start: Resets scaler and timer to zero and starts a timed count.

(b) Timed-Stop-Manual Switch: Selects counting mode: Timed position automatically stops count after preset time. Manual position counts continuously. Stop position does not count.

(c) Temperature: 32°F to 140°F (0° to 60°C). High voltage changes less than ±3%.

(d) Detector: MHV series coaxial connector.

(e) Power: Line 115 or 230 ± 10 percent VAC, switch selectable. Any battery 7.5V minimum, 14V maximum at 1.0 a load.

5B.3.7 INSTRUCTIONS

(a) The instrument should be checked for physical damage prior to use.

(b) Connect power cord to the power source or connect to the battery power through BATTERY connector.

(c) Turn POWER switch ON and allow 5 minutes for instrument to stabilize.

(d) Connect the detector.

(e) Adjust high voltage as required for the detector being used.

5B.3.8 OPERATION CHECK

(a) Set TIMED-STOP-MAN switch to MAN. Count light should come on.

(b) Set TIMED-STOP-MAN switch to TIMED.

(c) Set COUNT TIME IN MINUTES switches to 1 and X.1. Press RESET-START switch. Units should stop counting after 6 seconds. Count light should go off.

(d) Run 50 minute background count on detector being used, and record on Weekly Field Source Check Log, Form 5E.2.

(e) Insert source in detector holder and count for five minutes. Verify counts obtained with data listed on detector for efficiency.

(f) Record the results on the Weekly Field Source Check Log, Form 5E.2.

Attachments

(1) Form 5E.2, Weekly Field Source Check Log

Colonie Interim Storage Site
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Formerly Utilized Site Remedial Action Program
Health Physics Operational Procedures Manual

Title: Operation of the Eberline SAC-4 Scintillation Alpha Counter
Procedure Number: 5B.7
Revision: 3
Date: December 21, 1998

Approved: ______________________ 12/22/98
Project Manager, Vice President, EDi Date

Approved: ______________________ 12/22/98
CHE Quality Assurance, EDi Date

5B.7.1 PURPOSE

The purpose of this procedure is to ensure the proper use and operation of the Eberline SAC-4 Scintillation Alpha Counter.

5B.7.2 SCOPE

This procedure provides a general description, pertinent characteristics, and describes the operation of the Eberline SAC-4 Scintillation Alpha Counter. This instrument is intended for use in counting air particulate sample filters, planchets containing evaporated water samples, and smears taken on surfaces.

5B.7.3 REFERENCES

(a) Eberline Instrument Corporation, Technical Manual for SAC-4.

(b) Health Physics Operational Procedure Manual, Procedure Number 5E.2.

5B.7.4 EQUIPMENT AND MATERIALS

(a) Eberline SAC-4 Scintillation Alpha Counter

(b) Th-230 Alpha Check Source

(c) Air Particulate Sample Reporting Log, Form 5B.7A, Attachment 1

(d) Operational Control Samples, Form 5B.7B, Attachment 2

(e) Weekly Field Source Check Log, Form 5E.2, Attachment 3

(f) Laboratory Instructions

5B.7.5 DESCRIPTION

The Model SAC-4 Scintillation Alpha Counter is a complete system consisting of a two-inch detector, high voltage power supply, charge sensitive input amplifier, timer, and six-decade readout. All circuits are solid state, except the detector, with extensive use of integrated circuits to enhance reliability. Specifications are as follows:

(a) Scintillation Phosphor: ZnS(Ag) powdered on a plastic light pipe.

(b) Photomultiplier Tube: 2-inch-diameter ten-stage end window.

(c) High Voltage: Regulated, adjustable by a rear panel control to approximately 1500V.

(d) Timer: Preset times from 0.1 minute to 50 minutes in a 1, 2, 5 sequence referenced to line frequency yielding an accuracy typically better than 0.05 percent.

(e) Power: 115/230 ± 10 Vac, switch selectable, 60 Hz, 1/4A, 3-wire, 50 Hz operation optional.

(f) Temperature: $32^{o}F$ to $+140^{o}F$ ($0^{o}C$ to $+60^{o}C$) with less than ±50V plateau shift.

5B.7.6 CHARACTERISTICS

(a) Efficiency: 80% of 2 pi minimum from a one-inch diameter Pu-239 alpha source.

(b) Background is less than 0.3 counts per minute.

(c) Plateau: At least 200V long with a slope of less than 1 percent per 100V.

5B.7.7 OPERATION

(a) Instrument should be allowed to stabilize for one hour prior to operation.

(b) Reset timer and Scaler to zero.

(c) Set lower time scale to position 5 and the time multiplier to the X10 position and start counter for a fifty-minute background count. Determine counts per minute (cpm) background. Background should be less than 1.0 cpm. If above 1.0 cpm. remove 2-inch planchet and decontaminate sample tray. Repeat if necessary until background is less than 1.0 cpm.

(d) Place the Th-230 alpha source in the 2-inch planchet and insert in the sample tray (source should have a strength of 200 - 1,000 dpm).

(e) Obtain a 5-minute count with Th-230 alpha source. Calculate the average cpm for the result.

(f) Calculate efficiency as follows:

$$\text{Efficiency} = \frac{\text{Source count rate (cpm) - Bkg. (cpm)}}{\text{source strength (dpm)}}$$

Record the efficiency as a decimal,
(typical values are 0.35 - 0.50 cpm/dpm)

(g) Record the results on the Weekly Field Source Check Log, Form 5E.2

(h) Also record the instrument response daily on the SAC-4 control chart as described in Procedure 5E.2.

5B.7.8 SAMPLE COUNTING (AIR SAMPLES AND SWIPES)

CAUTION: At some sites, there is a possibility that samples could be grossly contaminated (greater than 2000 cpm). Scan each sample with a portable alpha probe before counting in SAC-4. If sample count rate (cpm) is greater than 2000 cpm, contact the EDi Site Manager for evaluation and/or further instructions.

(a) Place the sample in the 2-inch planchet and insert in the sample tray.

(b) Select the desired counting time.

(c) Reset timer and Scaler to zero.

(d) Initiate counting.

(e) Document results on the appropriate form as required by the analysis.

Attachments

(1) Air Particulate Sample Reporting Log, Form 5B.7A
(2) Operational Control Samples, Form 5B.7B
(3) Weekly Field Source Check Log, Form 5E.2

Colonie Interim Storage Site
(CISS)
Formerly Utilized Sites Remedial Action Program
Health Physics Operational Procedures Manual

Title: Operation of the Ludlum 2929 Dual Channel Scaler with Ludlum 43-10-1
Procedure Number: 5B.13
Revision: 0
Date: December 15, 1998

Approved: ______________________ 12/22/98
Project Manager, Vice President, EDi Date

Approved: ______________________ 12/22/98
CHF Quality Assurance, EDi Date

5B.13.1 PURPOSE

The purpose of this procedure is to ensure the proper use and operation of the Ludlum 2929 Dual Channel Scaler when used in conjunction with Ludlum Model 43-10-1 scintillator.

5B.13.2 SCOPE

This procedure provides general description, pertinent characteristics, and describes the operation of the Ludlum 2929 Dual Channel Scaler with Ludlum 43-10-1. This instrument is intended for use in counting smears.

5B.13.3 REFERENCES

Ludlum Instruction Manual for Ludlum Model 2929.

Health Physics Operational Procedure Manual, Procedure Number 5E.2.

5B.13.4 EQUIPMENT AND MATERIALS

(a) Ludlum 2929 Dual Channel Scaler connected to Ludlum 43-10-1

(b) Th-230 Alpha Check Source/SrY90 Beta-Gamma Check Source

c) Weekly Field Source Check Log, Form 5E.2, Attachment 1

5B.13.5 DESCRIPTION

The Ludlum Model 2929 Dual Channel Scaler is designed for use with “Phoswich” and/or proportional detectors. A pulse height analyzer is employed to provide information to the two independent counters.

The Model 2929 is powered by 110 v AC, has a built-in detector high voltage power supply with front panel readout, has adjustable count time periods ranging from 0.1 to 990 minutes and has a click per event audio for each of the two channels. Specifications are as follows:

Power: 9 watts at 110v 50-60 Hz single phase.

Input Sensitivity: Beta-Gamma lower threshold is adjustable from 2mV to 10mV, Beta-Gamma upper threshold is adjustable from 25mV to 100mV, Alpha threshold is adjustable from 150mV to 500mV.

High Voltage: Fully adjustable from 0-2250±100 volts with capability of supporting 100 megohm loads to 1500 volts.

Audio: “click per event” type with volume control for each of the two channels.

Count Time: 0-99 minutes with multiplier of 0.1, 1.0 and 10; external position for use with an external clock source.

Model 43-10-1 is a windowless alpha sample changer for counting filters or smears. The sample changer can be used with any of the Ludlum scaler instruments or other equivalent counting instruments.

Scaler Input Sensitivity: 2mV to 500mV

Photomultiplier tube: 2” diameter, 14-pin tube base, 10 pin dynode structure

Scintillation material: ZnS disc; plastic 0.01” thick.

Efficiency: 70% (2pi) for Pu-239

5B.13.6 OPERATION

(a) Place “clean”, empty planchet into sample holder well (sample slide).

(b) Place sample slide in locked position for a short time before taking count to allow room light to decay out of scintillation material.

(c) Set background count time to 50 minutes. Start background count. Record results on Weekly Field Source Check Log, Form 5E.2. Background should be less than 1.0 cpm. If above 1.0 cpm, remove planchet and decontaminate sample slide. Repeat, if necessary, until background is below 1.0 cpm.

(d) Place TH-230 source in sample slide. Place sample slide in locked position. Count a TH-230 source for 5 minutes.

(e) Calculate efficiency as follows:

$$\frac{\text{Source Count Rate (cpm)} - \text{Background (cpm)}}{\text{Source Strength (dpm)}}$$

(f) Document results in accordance with procedure 5E.2. Repeat step (d) with the SrY90 source.

(g) Also record the instrument response daily on the Ludlum 2929 Control Chart as described in Procedure 5E.2.

5B.13.7 *SAMPLING COUNTING*

Caution: At some sites, there is a possibility that samples could be grossly contaminated (greater than 2000 cpm). Scan each sample with a portable alpha probe before counting in Ludlum 2929. If a sample count rate is greater than 2000 cpm, contact the EDi Site Manager for evaluation and/or further instructions.

(a) Place the sample in a clean planchet. Place planchet inside sample slide. Place sample slide in locked position.

(b) Select desired counting time.

(c) Initiate counting.

(d) Document results on appropriate form as required by the analysis.

Attachments

(1) EDi Weekly Field Source Check Log, Form 5E.2

Colonie Interim Storage Site
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Formerly Utilized Sites Remedial Action Program
Health Physics Operational Procedures Manual

Title: Operation of the Ludlum 2221 Portable Scaler Ratemeter
Procedure Number: 5B.14
Revision: 0
Date: December 16, 1998

Approved: ______________________ 12/22/98
Project Manager, Vice President, EDi Date

Approved: ______________________ 12/22/98
CHF Quality Assurance, EDi Date

5B.14.1 PURPOSE

The purpose of this procedure is to ensure the proper use and operation of the Ludlum Model 2221 Portable Scaler Ratemeter.

5B.14.2 SCOPE

This procedure provides general description, pertinent characteristics, and describes the operation of the Ludlum Model 2221 Portable Scaler Ratemeter. This instrument may be used with a wide variety of scintillation or proportional detectors to measure alpha, beta, or gamma radiation.

5B.14.3 REFERENCES

Ludlum Model 2221 Portable Scaler Ratemeter Instruction Manual

Health Physics Operational Procedure Manual, Procedure Number 5E.2

5B.14.4 EQUIPMENT AND MATERIALS

(a) Ludlum Model 2221 Portable Scaler Ratemeter

(b) Desired detector and cable (AC-3, HP-210, SPA-3, Fidler, etc.)

(c) Weekly Field Source Check Log, Form 5E.2, Attachment 1

(d) Appropriate check source

5B.14.5 DESCRIPTION

The Ludlum Model 2221 Scaler Ratemeter is a self-contained counting instrument designed for operation with scintillation, proportional or G-M detectors. Power is derived from four D size batteries. The Unit

Unit is complete with a voltage-sensitive pre-amplifier, linear amplifier, electronic timer, detector, high voltage power supply and detector overload detection circuitry.

A single channel analyzer is also featured in this unit for use in gamma spectrum analysis. The analyzer may be switched on or off, allowing gross or window counting.

The unit has a combination four-decade linear and log ratemeter and a six digit local readout for the scaler and digital ratemeter. Potentiometers are supplied for threshold, window and high-voltage controls.

Specifications are as follows:

High Voltage: 200 to 2410 volts with digital readout.

Battery Compartment: Four each D cell batteries.

Battery Life: Approximately 250 hours with Duracell batteries (MN1300, size D, alkaline batteries).

Sensitivity: Voltage-sensitivity and adjustable from 1.5 mV to 100mV; factory calibrated to 10mV 100 on the THR display scales.

Range: Four decade log ratemeter ranging from 50 to 500k cpm; four decade linear ratemeter 500 cpm meter dial with range multipliers of X1K, X100, X10, X1 producing an overall range of 0-500k cpm.

Operating Temperature: 5-122°F (-15 to 50°C)

5B.14.6 OPERATION

(a) Record the Ludlum Model 2221 number along with the detector and source identification on the Weekly Field Source Check Log, Form 5E.2.

(b) Press the High Voltage button located on the left side in the box labeled TEST. The High Voltage potentiometer is located at the bottom left of the unit underneath the calibration plate. Set High Voltage by turning potentiometer slowly clockwise to increase or counter clockwise to decrease setting.

(c) Check threshold parameters and adjust accordingly (Alpha probes 100 and Beta-Gamma probes 350). If adjustment is indicated, adjust by turning the threshold potentiometer located to the left of the HV potentiometer underneath the calibration plate. Replace the calibration plate and perform battery check. Record on Weekly Field Source Check Log, Form 5E.2.

(d) Perform a source check with the detector attached, following the operating procedures for that particular detector.

(e) Record all pertinent information on the Weekly Field Source Check Log, Form 5E.2.

Attachment

(1) EDi Weekly Field Source Check Log, Form 5E.2

[illegible]

WEEKLY FIELD SC[illegible]CE CHECK LOG

Site Name: CFS
Week Ending:

Scaler/Ratemeter:
S/N:
Cal Date:
Cal. Due:

Detector:
S/N:
Cal Date:
Cal. Due:

Date Time	Source	Serial No.	Source Activity	Source Check cpm (A)	Bkg. Cpm (B)	Calibrated Eff./ Response (C)	Daily Calculated Eff. (D)	HV	Batt.	Spkr.	Disp.	OK By

± 20% of Calibrated Value:
+ Value
- Value

Daily Calculated Efficiency:

$$\frac{(A) - (B)}{\text{Activity}} = (D)$$

Remarks:

Formerly Utilized Sites Remedial Action Program

Health Physics Operational Procedures Manual

Title: Preparation of Soil Samples for Gamma Spectrometry

Procedure Number: 5B.15

Revision: 1

Date: January 14, 1999

RECEIVED
JAN 18 1999
EDI

Approved: ____________________ 1/18/99
Project Manager, Vice President, EDi — Date

Approved: Stanley J Waligora Jr 1/22/99
CHP/President, EDi — Date

5B.15.1 PURPOSE

The purpose of this procedure is to ensure the proper method is used for the preparation of soil samples to be counted on-site in the HPGe System.

5B.15.2 SCOPE

This procedure outlines the method used for the preparation of soil samples to be counted on-site in the HPGe system.

5B.15.3 REFERENCES

US Department of Health and Human Services; The Industrial Environment; Its Evaluation and Control

Patty's Industrial Hygiene and Toxicology, Fourth Edition, Section 3.4.3, Paragraph 1

Fundamentals of Industrial Hygiene, Fourth Edition, Table 19-B Capture, Control, Face and Slot Velocities for Hood Design

EDi Health Physics Operational Procedures Manual Procedure 2C.1

5B.15.4 EQUIPMENT AND MATERIAL

(a) Calibrated air flow velometer
(b) Paint cans (1-quart size with lids)
(c) Soil Sample Log Book
(d) TVA-1000
(e) Sharpies/Pens
(f) Aluminum tins
(g) Paint scraper or equivalent
(h) Drying oven
(i) Paint shaker
(j) Calibrated balance
(k) Electrical tape
(l) Petri dishes
(m) PPE
(n) Plastic bags
(o) Alpha/Beta Gamma instrumentation

5B.15.5 OPERATION

(a) Assure that the drying oven has been on for several hours and that the temperature has stabilized at 100° ± 5°C. Don PPE in accordance with HWP. Insure Lab Hood flow and face opening to be 150 linear feet per minute.

(b) Retrieve the one-quart paint can containing the soil sample. Record the sample identification and the date collected. Place the sample in the laboratory hood. (If there is any possibility that the soil might be contaminated with organics, open the paint can lid and measure the hood space with a suitable organic vapor detector. If the organic vapors are detected, re-seal the can and return it to sample storage. The analysis possibilities will be negotiated with the client.)

(c) Use a Sharpie pen to write the sample I.D. onto the pan. Place a disposable aluminum pan into the hood. Open the paint can lid and transfer the entire sample into the aluminum pan. Use a paint scraper to remove the soil from the paint can (a tongue depressor may be substituted for the paint scraper). Use the paint scraper to break up larger clods of soil to aid in drying and to avoid "bricking" of soil by drying.

(d) Dry overnight or for an equivalent period. Remove the aluminum pan from the drying oven. Allow cooling until conveniently handled.

(e) Don PPE in accordance with HWP.

(f) Transfer the sample back to its original paint can, using the paint scraper to assist in the transfer. Seal the lid and clamp into the paint can shaker. Assure the can is properly sealed and clamped. Two paint can samples should be shaken simultaneously. Shake paint can for five minutes. Open the can to see if any larger "clumps" exist (>5mm). If larger clumps exist, use a paint can scraper to break them up and re-shake the can for another five minutes.

(g) If necessary, repeat the two steps above. If the soil matrix still includes a fraction in excess of 5mm, estimate and record the percentage of the sample that exceeds 5mm. Record the size of the largest constituents.

(h) Pre-weigh an empty petri dish and place upon a prophylactic paper towel within the hood. Carefully transfer the soil sample from the paint can into the petri dish using a paint can scraper. The petri dish will hold only a fraction of the total sample. Transfer the soil into the petri dish. The overall consistency and texture in the petri dish should be equivalent to that in the paint can.

(i) Carefully fill the petri dish until the soil level is nearly level with the top. Place the cover onto the petri dish. Use a tissue to remove any surface dust. Seal the petri dish lid peripherally with black electrician's tape. Minimize stretching of the tape to allow a stable (non-shrinking) seal. Use a "sharpie" to write the sample ID on the petri dish. Smear sample container in accordance with EDi Equipment and Material Release Procedure 2c.1.

(j) Remove one glove and transfer the sealed petri dish (gloved hand) into small clear plastic bags. Remove the other glove and seal the bag. Weigh the prepared sample and record the weight to the nearest gram. The sample may proceed directly to gamma spectrometry analysis unless radium-226 is a radionuclide of concern. If radium-226 is to be accurately determined, then delay at least two weeks before proceeding with gamma spectrometry.

(k) Decon and release in accordance with EDi Equipment and Materials Release Procedure 2c.1 all tools utilized for soil prep between each sample preparation.

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Health Physics Operational Procedures Manual

Title: Operation of the Ludlum Model 177 Radiation Monitor
Procedure Number: 5B.16
Revision: 0
Date: December 17, 1998

Approved: ______________________ 12/22/98
Project Manager, Vice President, EDi — Date

Approved: ______________________ 12/22/98
Chief Quality Assurance, EDi — Date

5B.16.1 PURPOSE

The purpose of this procedure is to describe the operation and field checks of the Ludlum Model 177 Radiation Monitor.

5B.16.2 SCOPE

This procedure describes the functions and use of the Ludlum 177, which is a portable count ratemeter intended primarily for use with a Geiger-Mueller (GM) detector operating at 900 ± 50V.

5B.16.3 REFERENCES

Eberline Instrument Corporation RM-14 Technical Manual.

5B.16.4 EQUIPMENT AND MATERIALS

(a) Eberline HP-210 Pancake G-M Detector, or equivalent

(b) Ludlum Model 177 Radiation Monitor

(c) Appropriate Check Sources

(d) Weekly Field Source Check Log, Form 5E.2, Attachment 1

5B.16.5 DESCRIPTION

The Ludlum 177 Radiation Monitor is an alarming count rate meter powered by a rechargeable Gelled-cell battery which is trickle charged when the unit is plugged into an electrical supply system. The instrument may be used to monitor personnel and equipment for contamination. The instrument may also be used to monitor background radiation.

Characteristics are:

(a) Range: Four ranges of X1 through X1K counts per minute full scale.

(b) Response time: fast – 2.2 seconds, slow - 22 seconds measured to 90 percent of final reading.

(c) Alarm Point: adjustable from 0 to 150 percent full scale.

(d) Alarm indication: red light on front of panel and approximately 1 kHz tone on speaker independent of volume control.

(e) Audio: Unimorph speaker with volume control located on front panel. One click for each event counted.

(f) Volume: varies speaker clicks from maximum loudness to zero.

(g) High voltage: Variable from 400-1500 volts.

(h) Battery: lifetime between charges is 50 hours.

5B.16.6 INSTRUCTION

(a) Ensure the Ludlum 177 has a valid calibration sticker and inspect the instrument for physical damage.

NOTE: If the calibration sticker has expired or the instrument is in need of repair, send it to EDi Instrument Service Center.

(b) Equipment out of calibration or showing evidence of physical abuse shall not be used.

(c) With the instrument turned off, check the meter for a zero indication. If the meter indicates a reading above or below zero, the instrument should be adjusted by a qualified instrument technician.

(d) Plug the instrument into a 105-125 Vac, 50-60 Hz power source. (The AC ON indicator should light.)

NOTE: Whether or not in use, keep the Ludlum 177 plugged into an AC line. Battery operation is for emergency use only, and should not be used whenever line power is available.

(e) Connect detector to Ludlum 177.

(f) Turn the selector switch to BATT. (Meter should read upscale to BATT OK.)

NOTE: If the meter indicates the battery is in need of charging, leave the instrument on AC power until charged. Do not use battery power until the proper charge is indicated by a BATT OK reading.

(g) Turn the selector switch to the designated range (X1, X10, X100).

(h) Ensure response is on FAST or SLOW as desired.

(i) Set VOLUME depending on noise level of working area. "Clicks" of background radiation should be clearly audible.

(j) The meter reading must be multiplied by the selector switch scale setting to obtain CPM. Example:

METER READING	SELECTOR SETTING	CPM
100	X1	100
100	X10	1,000
100	X100	10,000

(k) Push the RESET button. The meter reading should drop to zero rapidly, then climb back to the source reading when the RESET button is released.

(l) Turn the ALARM SET DIAL of the Ludlum 177 counterclockwise until the alarm occurs. ALARM light should light and audible alarm should be heard through the speaker. Push the RESET button. The alarm condition should go away until reading exceeds alarm set point.

(m) Turn the ALARM SET DIAL back to desired position.

Attachment

(1) Form 5E.2, Weekly Field Source Check Log.

Colonie Interim Storage Site
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Health Physics Operational Procedures Manual

Title: Operation of the Ludlum 12S Micro R Meter
Procedure Number: 5B.17
Revision: 0
Date: December 17, 1998

Approved: ______________________________ 12/22/98
Project Manager, Vice President, EDi — Date

Approved: ______________________________ 12/22/98
CHF Quality Assurance, EDi — Date

5B.17.1 PURPOSE

The purpose of this procedure is to ensure proper operation of the Ludlum 12S Micro R meter.

5B.17.2 SCOPE

This procedure describes the standard method for the proper operation of the Ludlum 12S Micro R meter used to detect gamma radiation from radioactive isotopes.

5B.17.3 REFERENCES

Ludlum Operations Manual for the Ludlum 12S Micro R Meter

5B.17.4 EQUIPMENT AND MATERIAL

(a) Ludlum 12S Micro R Meter
(b) Cs-137 Gamma Standard Source 0 Cs-7A
(c) Weekly Field Source Check Log Form 5E.2

5B.17.5 DESCRIPTION

The Ludlum Mode 12S Micro R meter utilizes an internally mounted 1" x 1" NaI (TI) scintillator which offers optimum performance in counting low level gamma radiation. The instrument is designed to be completely self contained and utilizes two "D" size batteries for power.

Four range scales are provided to select the most desirable range in the 0 to 3,000 Micro R/hr spectrum. The meter face has one scale, 0-3 micro R/hr with X1, X10, X100 and X1000 range multipliers.

5B17.6 SPECIFICATIONS

Power: Two standard "D" size batteries.
Input Sensitivity: Adjustable from 30-100mV.
Audio: Built-in unimorph speaker with an on/off switch.
High Voltage: Externally adjustable from 400-1500 volts.
Response: Four to twenty-two seconds for 90% of final meter reading.

5B17.7 OPERATION

(a) Record Ludlum 12S serial number and information for the Cs-137 check source on the Weekly Field Source Check Log, Form 5E.2.

(b) Turn the switch to BAT and check to see that the meter indicates within the BAT OK range.

(c) Using the Cs-137 check source, record response on the Weekly Field source Check Log.

(d) A series of measurements should be made with an average response to the source determined. If the response varies more than ± 2 sigma, then the instrument should be sent to the EDi Instrument Service Center for repair and re-calibration.

Attachment

(1) Weekly Field Source Check Log, Form 5E.2.

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WEEKLY FIELD SOURCE CHECK LOG

Site Name ______________ Week Ending __________ Background Location ____________________

Scaler/Ratemeter __________ Serial No. _______ Cal. Date _______ Cal. Due __________

Detector ______________ Serial No. _______ Cal. Date _______ Cal. Due __________

Date Time	Source	Serial No.	Source Activity	Source Check CPM (A)	BKG CPM (B)	Calibrated Efficiency/ Response (C)	Daily Calculated Efficiency % (D)	HV	Bat	Spkr	Disp	OK BY

± 20% of Calibrated Value:

+ Value __________

- Value __________

Daily Calculated Efficiency:

$\frac{(A) - (B)}{\text{Activity}} = (D)$

Remarks:

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Formerly Utilized Sites Remedial Action Program

Health Physics Operational Procedures Manual

Title: Operation of the HPGe Gamma Spectrometry System

Procedure Number: 5B.18

Revision: 0

Date: December 23, 1998

Approved: ______________________ 12/23/98
Project Manager, Vice President, EDi Date

Approved: ______________________ 12/23/98
CHP/President, EDi Date

5B.18.1 PURPOSE

The purpose of this procedure is to describe methods used to analyze prepared soil samples by high resolution HPGe gamma spectrometry.

5B.18.2 SCOPE

This procedure covers the setup, use, and quality control measures to analyze prepared soil samples for concentrations of gamma emitting radionuclides and/or gamma emitting daughter nuclides.

5B.18.3 REFERENCES

(a) A66-B32 Gamma Vision for Windows Software User's manual

(b) EG&G ORTEC Solid-State Photon Detector Operators Manual

(c) In-situ Spectroscopy M-1-B32 M-1 for windows Operator Program Manual

(d) Soil-based uranium disequilibrium and mixed uranium-thorium series radionuclide reference materials

(e) EDi Procedure for soil sample preparation

5B18.4 EQUIPMENT AND MATERIALS

(a) EG&G ORTEC Gamma Spectrometry System
  - HPGe Detector
  - DART
  - Laptop Computer
  - Printer
  - LN2 Dewar
  - Battery/Power Supplies

(b) Soil Standards

(c) Face Shield

(d) Protective Gloves

5B.18.5 PROCEDURES

5B.18.6 PREPARATION

(a) Assure that the detector dewar has adequate liquid nitrogen.

(b) Ensure that the batteries/power supplies are adequate for all systems components.

(c) Initiate the detector system as follows:

- Disconnect the HPGe detector from the 30L dewar in accordance with the posted instruction.
- Place the detector downward into the lead counting shield and connect the cables:

  Blue to Blue
  Green to Green
  Orange to Orange

- Connect the gray lead wire from the HPGe detector to the P/A connector at the rear of the DART.

(d) Turn on the system as follows:

- Turn on the printer
- Place the Sony AC adapter switch in the VTR position
- Turn on the DART

  Verify the DART turns on

- Verify that the PASS light goes on after a few seconds
- Verify that the μP status is blinking intermittently
- Turn on the computer and allow it to boot up

  Enter the password at the prompt

- Press Enter at the prompt and await completion of boot up

Energize the Detector:

- Double click on the Gamma Vision shortcut i9con
- Click on the Acquire Selection
- Click on the Adjust Controls
- Click on High Voltage
- Turn on the High Voltage
- Verify the green light goes on and that the box changes from "off" to "on"
- Verify the red DART bias light is on solid
- Verify HV control is set to 3,500 volts and that the actual HV is approximately 3,500 volts.
- Click "OK"
- Check/Adjust amplifier
- Click on Acquire
- Click on Adjust Controls
- Click on Amplifier if not already on that section
- The amplifier gain should be **exactly 0.5649**; if not, adjust accordingly
- Click "OK"

5B.18.7 BASIC STEPS FOR GAMMA SPECTROMETRY ANALYSIS

(a) Place the soil sample on the stand inside the lead counting shield and lower the detector/dewier in place.

(b) Double click on the Gamma Vision shortcut icon. (To clear memory of any prior spectra, click on Acquire and then click on "CLEAR".

(c) Click on Acquire.

(d) Check that the correct .SWF file is being used then click "OK"

(e) Check the preset **live** time is set for 3600.00 seconds. If not, set this to 3600.00 seconds, and then click "OK".

(f) Enter the appropriate title for the sample description then click "OK".

(g) Check that the sample volume is 0.1000 Kg then click "OK".

(h) The detector will now commence a spectral count for a live time of 3600 seconds.

(i) After the 3600-second count is complete, click on the Analyze option.

(j) Click on the Entire spectrum in memory option.

(k) Gamma Vision will now analyze the spectrum using the WAN-32 method.

(l) After the spectrum has been analyzed, the report will automatically be displayed.

(m) Print the report of analysis and save the spectrum as a diskette (Attachment A is a sample report of a calibration standard).

5B.18.8 QUALITY CONTROL

At the beginning of each analytical day, acquire a background spectrum as follows:

(a) Click on Acquire

(b) Drag the mouse to QA

(c) Click on Measure Background

(d) Ensure the detector is free of any samples, and press "OK" - "Start" to continue

At the beginning of each analytical day, acquire the soil standard spectrum in the lead counting shield as in 5B.18.7 above.

Compare the reported radionuclide concentration. Compare results of at least three (3) radionuclides of the standard. Results must be within ninety-five percent confidence of the reference standard concentrations.

Attachments:

(1) Sample Report - Calibration Standard

(2) Sample Data Forms

Colonie Interim Storage Site
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Formerly Utilized Site Remedial Action Program
Health Physics Operational Procedures Manual

Title: Use of the MSA Monitaire MDL-S Lapel Air Sampler
Procedure Number: 5C.2
Revision: 3
Date: December 21, 1998

Approved: ______________________ 12/22/98
Project Manager, Vice President, EDi Date

Approved: ______________________ 12/22/98
CHF Quality Assurance, EDi Date

5C.2.1 PURPOSE

The purpose of this procedure is to ensure that proper technique is used for breathing zone air particulate measurements which may be required to document actual airborne radionuclide levels.

5C.2.2 SCOPE

This procedure describes the use and operation of the MSA Monitaire MDL-S, Lapel Air Sampler.

5C.2.3 EQUIPMENT AND MATERIALS

(a) Glass Fiber Filter Paper (2.5 cm diameter)

(b) Ball Point Pen and Paper

(c) MSA Monitaire MDL-S, Lapel Air Sampler

(d) Sample Head, Gelman No. 1107, 25 mm, Delrin

(e) Flexible Plastic Hose (1/4 inch ID)

(f) MSA Model A Pump Calibrator or equivalent

(g) Air Particulate Sample Collection Form 4B.2, Attachment 1

5C.2.4 DESCRIPTION

The MSA Monitaire MDL-S uses a rechargeable battery operated diaphragm pump with a sample flow indication controlled with sample and bypass valves. The battery charger will provide a full charge (in 16 hours) to the pump battery.

5C.2.5 OPERATION

(a) Inspect pump and filter apparatus.

(b) Connect the sample head to the inlet fitting using 3 ft. of 1/4 inch ID tubing.

(c) Turn sample valve stem (the large stem) clockwise to the closed position.

(d) Open the bypass stem (the smaller stem) counterclockwise one turn from its closed position. This allows optimum sample bypass resulting in minimum battery drain.

(e) Adjust the sample flow to the desired rate by turning the sample stem counterclockwise until the desired sample flow is observed on the rotameter.

NOTE: Changing the bypass valve setting will change the flow through the sample filter.

(f) Verify flow rate by using an MSA Model A Pump Calibrator. An equivalent flow rate calibrator may be used if the MSA unit is not available.

(g) Batteries shall be recharged after every eight to ten hours of run time or after each use.

CAUTION: Use only the chargers designated for use with the Monitaire Sampler. Use of other chargers may damage the pump battery.

(h) Record all pertinent information on the Air Particulate Sample Collection Form, Form 4B.2. See Procedure 4B.2.

Attachment

(1) EDi Air Particulate Sample Collection Form 4B.2

Colonie Interim Storage Site
(CISS)
Formerly Utilized Site Remedial Action Program
Health Physics Operational Procedures Manual

Title: Operation of the Eberline RAS-1 Low Volume Air Sampler
Procedure Number: 5C.4
Revision: 3
Date: December 21, 1998

Approved: ______________________________ 12/22/98
Project Manager, Vice President, EDi Date

Approved: ______________________________ 12/22/98
Chief Quality Assurance, EDi Date

5C.4.1 PURPOSE

The purpose of this procedure is to provide adequate information concerning the proper use of the RAS-1 (Regulated Air Sampler).

5C.4.2 SCOPE

This procedure provides a description of the RAS-1, its operational characteristics and instructions for proper operation.

5C.4.3 REFERENCES

Eberline Instrument Corporation Technical Manual for RAS-1.

5C.4.4 DESCRIPTION

(a) The Model RAS-1 is a compact, portable air particulate sampler containing an oil free vacuum pump, motor, airflow regulator, flowmeter, vacuum-gauge, and filter holder.

The airflow regulator is designed to maintain a constant pressure drop across an in-line orifice by controlling a variable bypass valve into the pump. The orifice is adjustable, permitting flow rate adjustment from near zero to the maximum pump flow capacity. This flow control system permits the pump to operate at a minimum pressure drop at all times, which provides cooler pump operation and to extend its lifetime.

(b) Pump Type: Oil Free Carbon Vane.

(c) Motor: 1/4 HP, 115V, 60 Hz, 5A.

(d) Vacuum: 26 inches Hg at Sea Level.

(e) Filter Holder: Model FH-2, 47mm.

(f) Flow Meter: 0-100 1/min (0-3.5 ft^3/min)

(g) Vacuum Gauge: 0-30 inches Hg

(h) Calibration: The unit is supplied with a three-point flow calibration using a mass flowmeter.

5C.4.5 EQUIPMENT AND MATERIALS

(a) Eberline RAS-1 Air Sampler

(b) Air Particulate Sampling: Glass Fiber Filter, 47 mm, 0.45 micron Gelman No. 61631.

(c) Radon Daughter Sampling: Membrane Filter, 47mm, 0.45 micron Gelman GN-6.

(d) Air Particulate Sample Collection Form 4B.2, Attachment 1

5C.4.6 OPERATION

(a) Ensure the RAS-1 has a valid calibration sticker.

(b) Selection of sample location is described in Procedure 4B.

(c) Provide 110-115 VAC, 60 Hz power to the RAS-1 from area power grid, if available, or use power supplied from portable electric generators as an alternate power supply.

(d) Place filter paper in filter holder.

(e) Start pump motor and check flow meter. The regulator is normally set to provide a flow rate of approximately 50 LPM. Check calibration on tag on pump handle for proper flow meter setting for a 50 LPM flow rate.

(f) If flow rate is not adjusted to the predetermined rate adjust the floweret by turning the brass screw on the side of the regulator housing. (An arrow on top of the regulator indicates its location). Turn brass screw clockwise to decrease and counterclockwise to increase the flow rate. Do not set flow rate greater than 60 LPM as regulator will not operate properly with older pumps.

CAUTION: Do not attempt to control air flow with an external valve or close off the air bypass line.

(g) Following any adjustment of flow rate, and NIST Traceable Calibrated Kurz air flow calibrator must be used to verify the flow rate (Refer to airflow calibration Procedure).

(h) During extended sampling periods check the RAS-1 motor and pump for proper operation and overheating when air sample filters are changed.

(i) Record all pertinent information on the Air Particulate Sample Collection Form, Form 4B.2.

Attachment

(1) EDi Air Particulate Sample Collection Form 4B.2

Colonie Interim Storage Site
(CISS)
Formerly Utilized Site Remedial Action Program
Health Physics Operational Procedures Manual

Title: Use of the FIDLER Detector to Monitor Ground Deposits of Low Energy Gamma Radiation
Procedure Number: 5D.1
Revision: 3
Date: December 21, 1998

Approved: ______________________ 12/22/98
Project Manager, Vice President, EDi — Date

Approved: ______________________ 12/22/98
Chief Quality Assurance, EDi — Date

5D.1.1 PURPOSE

The purpose of this procedure is to ensure the proper operation of the Field Instrument for the Detection of Low Energy Radiation (FIDLER) when coupled with a portable ratemeter/scaler.

5D.1.2 SCOPE

This procedure describes the methods by which a FIDLER detector is used to monitor ground surface deposits of uranium.

5D.1.3 REFERENCES

(a) EDi Health Physics Operational Procedures Manual Section 5.

(b) EDi Health Physics Operational Procedures Manual Procedure 3B.4, "Walkover Gamma-Ray Scan", Revision 2, 4/17/91 (or latest version).

(c) EDi Health Physics Operational Procedures Manual Procedure 3B.6, "Surface Gamma-Ray Radiation Survey-FIDLER", Revision 1, 10/1/89 (or latest version).

5D.1.4 EQUIPMENT AND MATERIALS

(a) Portable Ratemeter/Scaler or equivalent

(b) FIDLER Detector (Bicron or Teledyne)

(c) Am-241 Check Source

(d) Cables

(e) Weekly Field Source Check Log, Form 5E.2, Attachment 1.

(f) FIDLER Protective Housing

(g) Earphones

5D.1.5 DESCRIPTION

The Field Instrument for the Detection of Low Energy Radiation (FIDLER) was developed in the 1960's as a portable instrument to monitor ground surfaces contaminated with americium. A five-inch diameter thin sodium iodide [NaI(Tl)] crystal serves as the detector. It is optically coupled to a quartz light pipe and installed in a standard five inch probe housing which has an entrance window of beryllium. The principal use of this detector is for detection of photons with energies less than 75 KeV. Uranium is primarily an alpha emitter; however, the radiation from its daughter products include low energy photons, principally L X-rays from thorium. There are two low energy photons from Th-234, which can be detected by the FIDLER. These are 63 KeV (3.5 percent abundant) and 93 KeV (4 percent abundant).

5D.1.6 DAILY RESPONSE CHECKS

A. FIDLER response checks and background measurements will be made twice daily whenever the detector is in use. These checks will be performed prior to use and at the end of the work shift.

(a) Background Determination

(1) Place the detector in a low background area. If a jig has been fabricated for performing source checks, remove the check source and place the detector in the jig for background determination. If a jig has not been fabricated, use a consistent geometry for background measurements as with source response checks.

(2) Take three one-minute background measurements. Record the average background cpm in Column (B) of Form 5E.2.

(b) Source Response Checks

(1) Establish a fixed source to detector geometry such that the source to detector distance is between 2.750 and 2.875 inches. The source must be placed at the center of the detector face. To best accomplish a consistent reproducible geometry, a jig can be fabricated to meet these requirements.

(2) Take three one-minute counts with the Am-241 check source in its check position. Record the average results in Column (A) of the Weekly Field Source Check Log, Form 5E.2.

(3) Source geometry and source type can cause variance. Use the same geometry and source for each check.

(4) The calibrated Efficiency/Response recorded on the FIDLER's calibration sticker will be recorded in decimal form in Column (C) of Form 5E.2. To convert the % efficiency to decimal form, divide the % value by 100 (i.e., 18% to 0.18).

(5) Calculate the Daily Calculated Efficiency (Column (D)) of Form 5E.2 by calculating the net response cpm ((A) - (B)) then dividing by the source activity (in dpm). Record as the decimal form.

(6) To determine if the FIDLER is responding within specifications (i.e., ±20%), multiply the value in Column (C) by 0.20. Add and subtract this value to the Column (C) value and record on the + and - lines, respectively, at the bottom of Form 5E.2.

(7) If the value in Column (D) is within the ±20% range, the FIDLER is responding within specifications. If the value in Column (D) is not within the ±20% range, investigate, recheck geometry and instrument settings. If the instrument is determined to be malfunctioning, return it to the EDi Instrument Service Center for recalibration or repair.

(8) If a FIDLER is not functioning within specifications at the end of the work shift, data collected for the day with that instrument will not be used. All surveys performed with a malfunctioning instrument must be repeated.

(9) In the event that a FIDLER is taken out of service, make a notation on Form 5E.2 that it was not used for data collection, and place an "out-of-service" tag on the instrument. Denote the problem with the instrument on the out-of-service tag. Also, make a notation in the site logbook of the circumstances surrounding it's removal from service.

5D.1.7 OPERATION

A. The FIDLER must be placed in a protective housing prior to use in the field. The thin beryllium window can be easily damaged, and care must be taken not to drop the detector or strike it against hard objects (i.e., rocks, concrete,...).

B. Surface gamma measurements (reference (c)) and walkover gamma scans (reference (b)) will be made using the FIDLER. Proper operation of this detector for these purposes must follow the requirements set forth in these respective procedures.

C. Response factors for soil contamination levels will be established by the EDi Project Office specific to site conditions, and will be provided to the site.

D. Earphones for audio response will be used to facilitate location of areas of contamination greater than background.

Attachments:

(1) EDi Weekly Field Source Check Log, Form 5E.2

Colonie Interim Storage Site
(CISS)
Formerly Utilized Site Remedial Action Program
Health Physics Operational Procedures Manual

Title: Operation of the Eberline RO-2 Ionization Chamber
Procedure Number: 5D.2
Revision: 3
Date: December 21, 1998

Approved: ______________________ 12/22/98
Project Manager, Vice President, EDi Date

Approved: ______________________ 12/22/98
CHF Quality Assurance, EDi Date

5D.2.1 PURPOSE

The purpose of this procedure is to ensure proper operation of the Eberline RO-2 Ionization Chamber.

5D.2.2 SCOPE

This procedure describes the standard method for the proper operation of the Eberline RO-2 Ion Chamber used to detect beta, gamma, and x-ray radiation.

5D.2.3 REFERENCES

Eberline Instrument Corporation, Technical Manual for RO-2.

5D.2.4 EQUIPMENT AND MATERIALS

(a) Eberline RO-2 Ionization Chamber

(b) Cs-137 Gamma Standard Source, CS-7A

(c) Weekly Field Source Check Log, Form 5E.2, Attachment 1

5D.2.5 DESCRIPTION

The RO-2 is a portable air ionization chamber instrument used to detect beta, gamma, and x-ray radiation with four linear ranges of operation from 5 to 5000 mR/h full scale. The ionization chamber is vented to atmospheric pressure and is specifically designed to have a flat energy response from 12 KeV to 7 MeV. Each instrument is factory calibrated to gamma radiation. A single rotary switch turns the instrument off, checks the batteries, checks the zero setting, and selects the range of operation. Additional features are:

(a) Detectors: A 3 inch air filled ionization chamber vented to atmospheric pressure. The sliding beta shield is 400 mg/cm^2 phenolic on the bottom of the case with a positive friction lock. The window is 7 mg/cm^2 mylar.

(b) Energy Response: Photon exposure response is within ±20 percent of the Cs-137 gamma response from 12 KeV to 7 MeV.

(c) Ranges: Four Linear Ranges: 0-5, 0-50, 0-5000 mR/h.

(d) Response Time: 5 seconds, 0-90 percent of final reading.

(e) Batteries: Three NEDA 1604, 9 V batteries.

EDi

Health Physics Operational Procedures Manual

Title: Field Source Check Response and Documentation

Procedure Number: 5E.2

Revision: 2

Date: October 1, 1995

Approved: ______________________________ 10/1/95
Project Manager/Vice President, EDi — Date

Approved: ______________________________ 10/1/95
CHP/President, EDi — Date

5E.2.1 PURPOSE

The purpose of this procedure is to ensure the proper performance of field instrument response checks, the completion of the response check data forms, and the use of control charts.

5E.2.2 SCOPE

This procedure describes the methodology and the documentation of field instrument response checks, the organization of the response check data forms and the proper use of control charts.

5E.2.3 EQUIPMENT AND MATERIALS

(a) Weekly Field Source Check Log, Form 5E.2, Attachment 1

(b) Control Charts

5E.2.4 REFERENCES

(a) Health Physics Operational Procedures Manual, Section 5.0, Instrument Operation Procedures

(b) 3-Ring Binder Type Notebook

(c) Th-230 Alpha Certified Source

(d) Scintillation Alpha Counter

5E.2.5 INSTRUCTIONS

The response of each radiation detection instrument or radiation counting system used for radiation protection purposes or remedial action efforts shall be tested by field personnel on a daily basis. To ensure quality data, a check shall be performed at the beginning and at the end of each shift. Both response checks shall be recorded on the Weekly Field Source Check Log, Form 5E.2.

All field personnel shall familiarize themselves with the Health Physics Procedures Manual Section 5.0 Instrument Operation Procedures. The type of source and geometry used should comply with the Instrument Operation Procedures. If the variance for control is not given in the procedures, then the efficiency and background for that particular instrument should not vary more than two sigma for stationary detectors and three sigma for portable detectors.

In addition, for all Alpha Scintillation Counters used in the field, a control chart graph shall be completed and used on a daily basis. A control chart consists of a graph showing time on the abscissa and count rate, or total counts, on the ordinate (vertical axis). Lines are drawn parallel to the time axis at values (corrected for decay if necessary) for the "true" count rate and the values of ±1 and ±2 standard deviations (See Appendix 5.1). The "true" count rate is the rate determined at the previous calibration.

5E.2.6 DOCUMENTATION

A record or file shall be kept of each instruments response check. The Weekly Field Source Check Log, Form 5E.2, shall be completed as follows:

NOTE: The purpose of this form is to maintain a continuous record of instrument performance and field measurement validity. Response checks shall be completed in the morning prior to work and after measurements have been completed for the day. All instrument source check response data shall be segregated by scaler, ratemeter, etc. An individual file shall be established to cover all aspects of the instrument including the Weekly Field Source Check Log Forms. If detectors or probes are changed, it is not necessary to start a new form. Note the date and time of this change and continue the form. If instruments are transferred to another site, forward a copy of all documentation including past response checks, calibration, etc. which should be maintained in file or log form or both. Always maintain a copy of these records on site for field measurement quality control documentation.

The form shall be filled out completely during instrument source response checks. Assign one sheet per scaler, ratemeter, etc.

(a) Complete all data on the top of the form. Note each form is a weekly form. A new form for each instrument should be started each Monday.

(b) Document time and date.

(c) Prior to response check, check high voltage and document value.

(d) Check batteries, speaker, and display and annotate form if okay.

(e) Document source type, serial number and source strength by activity dpm or 1R/hr.

(f) Document instrument response to source cpm (A), and background cpm (B).

(g) Document instrument conversion factor in efficiency or cpm/1R/hr - (C).

(h) When instrument has been source response checked back calculate the source strength by the instrument response as shown below.

Source Strength by Instrument =

$$\frac{\text{-A- Source Check, cpm - Background cpm -B-}}{\text{-C- Instrument Conversion Factor or Efficiency}}$$

The Edi control chart should be completed as follows:

Upon receipt of an unused Alpha Scintillation Counter, it will be necessary to establish initial control limits. The following is required to establish these initial parameters.

(1) Take 5 each five minute counts of a calibrated certified Th-230 45mm electroplated alpha certified source.

Calculate as below:

Th-230 Alpha Source = 2800 dpm

$$\text{Efficiency} = \frac{\text{cpm Th-230 source}}{\text{dpm Th-230 source}}$$

Count Time = 5 minutes

Count #1 = 5072 / 5 = 1014 cpm / 2800 dpm = 0.362 or 36.2% Eff.
Count #2 = 4993 / 5 = 999 cpm / 2800 dpm = 0.357 or 35.7% Eff.
Count #3 = 5199 / 5 = 1040 cpm / 2800 dpm = 0.371 or 37.1% Eff.
Count #4 = 5001 / 5 = 1000 cpm / 2800 dpm = 0.357 or 35.7% Eff.
Count #5 = 5108 / 5 = 1022 cpm / 2800 dpm = 0.365 or 36.5% Eff.

Mean (X) = 0.362 or 36.2% Eff.

Standard Deviation (one sigma) = ± 0.006 or ± 0.6% Eff.

S. Dev. = 0.006 x 1.96 = ± 0.012 or ± 1.2% Eff. (as the 95 percent confidence interval)

(2) Take 5 each 10 minute background counts and document the mean (X) and standard deviation as the 95% confidence interval.

Count Time = 10 minutes

Background count #1 = 2 counts / 10 = 0.2 cpm
Background count #2 = 1 count / 10 = 0.1 cpm
Background count #3 = 1 count / 10 = 0.1 cpm
Background count #4 = 3 counts / 10 = 0.3 cpm
Background count #5 = 1 count / 10 = 0.1 cpm
\------------------------
Mean (X) = 0.16 cpm

Standard Deviation (one sigma) = ± 0.09 cpm
S. Dev. (95% confidence) = 0.09 x 1.96 = ± 0.18 cpm

These values would be the initial control chart parameters to establish such documentation. (See attached example control chart.)

(3) When a month of measurements have been made, the acquired data can be used to establish the next month's control chart parameters. Should the instrument go out of control because of high background count rates, then clean the sample tray or counting area to try and remove the contamination. If this does not work, it may be necessary to clean or replace the ZnS (Ag) crystal. Return to the Instrument Service Center.

Document all source checks on the Weekly Field Source Check Log Form 5E.2 and maintain current control charts.

Attachment:

(1) EDi Weekly Field Source Check Log, Form 5E.2

EDi

Health Physics Operational Procedures Manual

Title: Radioactive Source Inventory, Service Schedule, and Leak Testing

Procedure Number: 5E.3

Revision: 3

Date: March 5, 1993

Approved: ______________________ 5/5/93
Project Manager/Vice Presient, Edi — Date

Approved: ______________________ 5/5/93
CHP/President, Edi — Date

5E.3.1 PURPOSE

The purpose of this procedure is to provide a methodology for the proper documentation of a radioactive source inventory, service schedule, and leak testing program at sites.

5E.3.2 SCOPE

This procedure describes a methodology for the management of radioactive sources in a field environment. The methodology includes an administrative procedure for source inventory control, periodic recalibration, and/or activity correction for decay and for identification of sources due for leak testing.

5E.3.3 REFERENCES

(a) U.S. DOE Notice 5400.9, "Sealed Radioactive Source Accountability"

(b) 10 CFR 20, Standards for Protection Against Radiation

5E.3.4 DEFINITIONS

(a) <u>Accountable Sealed Radioactive Source</u> - is a sealed source with an activity equal to or greater than those listed in Table 1 (Attachment 4).

(b) <u>Exempted Radioactive Materials</u> - are radioactive materials exempted from accountability under DOE Notice 5400.9, but are subject to the requirements of 10 CFR 20. Exempted radioactive materials include: materials in process, activated shielding materials, liquid and gaseous sources. Materials defined as consumer products (i.e., exit signs, smoke detectors, welding rods,...) are not subject to the requirements of 10 CFR 20.

(c) <u>Exempted Sealed Radioactive Source</u> - is a sealed source with a half-life of less than 30 days or an activity less than the values listed in Table 1.

(d) <u>Sealed Radioactive Source</u> - is radioactive material that is contained in a sealed capsule, sealed between layers of nonradioactive material, or firmly fixed to a nonradioactive surface by electroplating or other means. The confining barrier prevents dispersion of the radioactive material under normal and most accidental conditions related to use of the source.

(e) Source Custodian - is an individual that is responsible for physical control of the sealed source and for physical inventory of the sealed sources assigned to him/her. The source custodian must be trained as a radiation worker in accordance with references (a) and (b).

(f) Source Integrity Test - is a test to determine if a sealed radioactive source is leaking radioactive material. The test must be capable of detecting the presence of 0.005 µCi (5000 pCi) or less of radioactive material on the test sample.

5E.3.5 EQUIPMENT AND MATERIALS

(a) Site Source Inventory and Calibration Due Dates, Form 5E.3

(b) Sr/Y-90 Radioactive Decay Correction Data Sheet, Form 5E.3A

(c) Cs-137 Radioactive Decay Correction Data Sheet, Form 5E.3B

(d) Alcohol and chemwipes

(e) Cloth or paper swipes and envelopes

(f) Double ace plastic tape

(g) Source calibration file

(h) Appropriate radiation detection instrumentation

5E.3.6 INTRODUCTION

A. This procedure delineates the requirements for the proper inventory and maintenance of radioactive sources. The Site Supervisor is the designated source custodian on all sites, and as such is responsible for compliance with all procedural requirements concerning sources. The Site Supervisor will notify the Project Office in the event of any unusual occurrence concerning sources (i.e., loss, damage,...), will keep an updated inventory of sources, will exercise proper control of sources, and will perform leak testing as required.

B. EDi policy for inventory and control of sources applies to those sources with activities greater than those listed in Attachment 4. EDi will adhere to inventory requirements for all sources (regardless of activity), but will perform leak tests only on sources with activities greater than those listed in Attachment 4 for each specific radionuclide.

5E.3.7 RADIOACTIVE SOURCE MAINTENANCE

A. Service Schedule

The normal frequency for source re-calibration is once every three years unless the source is returned to the Radioactive Source Fabrication Group, due to damage such as scratches, leakage, etc.

B. Decay Corrections

(1) Radioactive sources with half-lives less than 100 years (i.e., Sr/Y-90, Cs-137), and activities greater than those listed in Table 1, shall have the activity corrected for decay every six months. A copy of the decay correction form will be forwarded to the EDi Service Center for entry into the source database.

(2) Radioactive sources with half lives greater than 100 years (i.e., Th-230, Ra-226, Am-241) shall have the activity corrected for decay at the time of re-calibration (every three years), as a minimum, by the Service Center. Form 5E.3A or 5E.3B (Attachment 2 and 3), whichever is appropriate, will be completed and filed with source inventory forms and copies of all pertinent source documentation will accompany the source when it is sent to a site.

C. Repair/Replacement

(1) Radioactive sources which have been damaged, exhibit transferable contamination, or indicate leakage will be removed from service and labeled accordingly. (2) Radioactive sources that have been declared defective shall be tagged with a label that contains the following information:

Source in need of repair/replacement

Reason: Leaking
Return Date: 12/31/86
Site: Wayne, NJ (WISS)
Leak Tested By: J. Doe

The source should be sent promptly to the Instrument Service Center.

D. Labeling

(1) All radioactive source containers will be clearly marked with the radiation trefoil symbol.

(2) A sticker will be attached to the source or source container upon the completion of the calibration. The sticker will include the following information:

(a) Calibration Date

(b) Source type (i.e., isotope)

(c) Activity (dpm,μCi, etc.)

(d) Serial Number

(3) The Site Supervisor, upon receipt of a source, will affix a label on the container with his/her name and site telephone number.

(4) Sealed sources not in storage containers shall have durable labels/tags attached that identifies the radionuclide, amount of activity, manufacturer, date of assay, and serial number.

E. Storage

(1) Storage rooms, cabinets, or drawers containing sealed sources must be locked and posted with "CAUTION RADIOACTIVE MATERIALS" signs. Also, the source custodian's name and telephone number will be posted at all storage areas.

(2) Storage containers must be fire retardant, free of flammable material, kept out of normally occupied areas if possible, and exposure rated biannually to ensure that dose rates on contact with the storage container do not exceed 0.5 mrem/hr. Results of the exposure rate survey will be documented on Form 5E.3.

(3) A transferable contamination survey will be performed on the inner surfaces of source storage containers using paper or cloth smears. Transferable activity must be less than the site release criteria. If the survey indicates transferable activity greater than the site release criteria, the container will be decontaminated and resurveyed. Results of this survey will be documented on Form 5E.3.

(4) Radioactive sources in storage, for periods longer than 6 months, need only to have their integrity determined when they are removed from storage and before being placed in use.

5E.3.8 RADIOACTIVE SOURCE INVENTORY

A. File Maintenance

(1) A file must be maintained which includes all radioactive sources present onsite, and shall be maintained by the Site Supervisor. The file must include current Certificates of Calibration, calibration due forms, decay correction forms, and any other pertinent documentation. A master list of sources will also be included in the file.

(2) All calibration data will be recorded into a database and maintained at the Instrument Service Center. The original copy of the calibration certificate will be filed at the Service Center, and a copy shall accompany the source.

(3) A copy of the source database printout for each site is sent from the Service Center to the site approximately monthly. The Site Supervisor is responsible for checking the printout to determine what sources are due for re-calibration, decay correction, or leak testing.

B. Documentation

(1) The information on Form 5E.3 must be completed for each source assigned to the site. This form must be reviewed on a routine basis to ensure that sources are serviced in accordance with the service schedule in section 5E.3.8 (A).

(2) The source documentation shall be kept in an organized manner so that specific sources can be easily referenced. A notebook with current source information will be established. Expired calibration sheets or preceding calibration data shall be archived in the source file. All current source documentation shall accompany a source whenever it is being shipped to another site or back to the Service Center. Archived source documentation will be transferred to the Service Center when the source leaves a site.

(3) Decay corrections will be performed in accordance with section 5E.3.8(B) of this procedure and documented on Forms 5E.3A (Sr/y-90) or 5E.3B (Cs-137), whichever is appropriate (Attachments 2 and 3).

5E.3.9 LEAK TESTING

A. Radioactive sources used at field sites may be of three general types:

(1) sealed metal container (Ra-226, Cs-137, Co-60, etc.),
(2) electroplated on a metal substrate (Th-230, Am-241, etc.), and
(3) check sources sealed in plastic holders (uranium ore) or laminated (Cs-137).

B. Leak testing will be conducted on any source at a site with an activity equal to or greater than those listed in Table 1.

C. Field staff members are trained to safely handle radioactive sources by not touching the active surfaces with their hands, and to use proper tools which will not damage the integrity of a source's seal.

D. The proper type of detector and the appropriate site release criteria used to leak test a source will depend on the type of radiation it emits. For example, for a Sr/Y-90 source, transferrable surveys for beta activity only will be performed.

E. Leak tests shall be performed on a six month cycle, (except for sources not in use and that are in storage) or whenever a source is shipped to another site, as follows:

(1) Using proper handling tools (nylon tipped tweezers for plated sources, long handle tongs for other sources), the source will be removed to a secondary shield or source container.

(2) A leak test will be performed by gently wiping the surface of the source, except for the active surface area of an electroplated source. The integrity of a source contained in a shield or device may be checked by wiping the area of the shield or device, where contamination is most likely to occur from a failure of the source integrity.

(3) For Ra-226 containers, it is only necessary to remove the cotton ball, and survey for alpha and/or beta-gamma activity in a low background area.

(4) If the results of steps (2) or (3) are within site criteria release limits for the respective activity, return the source to its container and indicate on Form 5E.3 in the leak test data section that the source surveys are within site criteria limits.

(5) If the results of steps (2) or (3) are not within site criteria release limits properly handle the source as not to contaminate hands, surfaces, etc. Repeat the survey as follows:

(a) Electroplated Sources

i. Gently wipe the back of the source with a paper or cloth swipe and count for the respective activity. Repeat the process for the active surface area and compare results. If the active surface area swipe indicates a transferable activity

greater than site criteria limits, it may represent a leaking source. Controlled handling techniques will be instituted so personnel, surfaces, etc. are not contaminated.

ii. Rinse the source with alcohol, wipe dry with chemwipe and let air dry for 10 minutes. Swipe both the surface and back of the source and recount. If the source is still contaminated, proceed to step 5E.3.9E(5)(a)iii. If the source passes the leak test, proceed to step 5E.3.9E(5)(a)iv.

iii. Again, rinse the source with alcohol, wipe with chemwipe and let air dry for 10 minutes. If the results of this test indicates transferable activity above site criteria limits, the source shall be removed from service and tagged as leaking. Wrap the source in double layers of plastic, place in a half gallon metal can or 500ml Nalgene jar, and return to the Service Center. Document the findings of this leak test on Form 5E.3 and transmit all appropriate documentation with the source.

iv. Sources which have been successfully decontaminated using the steps outlined above will be re-tested for contamination/leaks <u>one month</u> after the initial leak test. At the time of the initial leak test, a notation in the remarks section of the leak test data section of Form 5E.3 must be made indicating that a follow-up leak test will be performed. The results of the follow-up leak test will be recorded on a new Form 5E.3 and attached to the initial leak test form.

v. If the follow-up leak test indicates levels of transferable contamination greater than site criteria limits, the source must be immediately removed from service, tagged as leaking, properly packaged, and returned to the Service Center with all appropriate documentation.

(b) Sealed Sources

i. Sealed sources with activities > 2 mCi (Ra-226, Cs-137, etc.) must be handled with tongs to maintain a source to hand separation of at least 12 inches. If it is necessary to swipe a source based on the results of steps (2) and (3) above, grasp the source with tongs and wipe gently on a swipe paper (attached to a flat surface), count in the appropriate counter and determine the activity.

ii. If the results of this leak test indicate transferable activity greater than site criteria limits, rinse thoroughly with alcohol, let air dry for 10 minutes and repeat the swipe test. Controlled handling techniques will be instituted so personnel, surfaces, etc. are not contaminated. If transferable activity is still above site criteria limits, the source will be tagged as leaking, properly packaged, and returned to the Service Center with all appropriate documentation.

iii. Sources which have been successfully decontaminated using the steps outlined above will be re-tested for contamination/leaks <u>one month</u> after the initial leak test. At the time of the initial leak test, a notation in the remarks section of the leak test data section of Form 5E.3 must be made indicating that a follow-up leak test will be performed. The results of the follow-up leak test will be recorded on a new **Form 5E.3** and attached to the initial leak test form.

iv. If the follow-up leak test indicates levels of transferable contamination greater than site criteria limits, the source must be immediately removed from service, properly packaged, tagged as leaking, and returned to the Service Center with all appropriate documentation.

v. Sealed sources such a uranium ore and Cs-137 check sources may be handled briefly for purposes of decontamination and leak testing as noted above.

Attachments:

(1) EDi Site Source Inventory and Calibration Due Form, Form 5E.3

(2) Sr/Y-90 Radioactive Decay Correction Data Sheet, Form 5E.3A

(3) Cs-137 Radioactive Decay Correction Data Sheet, Form 5E.3B

(4) DOE Notice 5400.9, Values for Exemption of Sealed Sources From Inventory

MDC Calculation for 2929 (Smear Counter)[1]

AA11 = $\sqrt{\frac{1+T14}{T13}}$

T14= Time Sample (TS)
T13= Time Background (TB)

AA12= $\sqrt{T11 \times T14}$

T11= B_{cpm}
T14= Time Sample (TS)

AA13 = AA11 X AA12

AA13 = $\sqrt{\frac{1+TS}{TB}}$ X $\sqrt{Bcpm \times TS}$

MDC = $\frac{(AA13 \times 3.29)+3}{T10 \times T14}$

T10= Efficiency
T14= Time Sample (TS)

$$\text{MDC} = \frac{\left(\sqrt{\frac{1+TS}{TB}} \times \sqrt{Bcpm \times TS} \times 3.29\right)+3}{Efficiency \times TS}$$

MDC Calculation (Hand Held)[1]

$$AA5 = \sqrt{\frac{1+N14}{N13}}$$

N14 = Time Sample (TS)
N13 = Time Background (TB)

$$AA6 = \sqrt{N11 \times N14}$$

N11 = B $_{\text{cpm}}$
N14 = Time Sample (TS)

AA7 = AA5 X AA6

$$AA7 = \sqrt{\frac{1+N14}{N13}} \text{ x } \sqrt{N11 \times N14}$$

$$MDC = \frac{(AA7 \times 3.29)+3}{N10 \times N14 \times N12}$$

N10= Efficiency
N14= Time Sample (TS)
N12= Correction Factor (CF)

So:

$$MDC = \frac{\left(\sqrt{\frac{1+TS}{TB}} \times \sqrt{Bcpm \times TS} \times 3.29\right)+3}{Efficiency \times TS \times CorrFactor}$$

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[1] These formula's are in master survey forms with the radiological subcontractor on site. They have been used at FUSRAP Sites here and other locations since DOE / Bechtel time frame and continue to be used.

APPENDIX B

SHAW ENVIRONMENTAL AND INFRASTRUCTURE STANDARD OPERATING PROCEDURE

(Note: Only those SOPs specifically referenced in the SAP follow. A complete copy of SOPs are maintained at the project site and are available for review.)

STANDARD OPERATING PROCEDURE C.1
CALIBRATION AND USE OF A PHOTOIONIZATION DETECTOR (PID)

1.0 Scope and Application

The purpose of this Standard Operating Procedure (SOP) is to document the protocols for the calibration and use of a photoionization detector (HNU Model PI-101). The photoionization detector (PID) is used to detect, measure, and provide a direct reading of the concentration of ionizable trace gases, particularly organics, in a gaseous sample (e.g., atmosphere, soil gas). The PID contains an ultraviolet light source that emits photons with an energy level high enough to ionize organics, but not high enough to ionize the primary components of atmospheric air (e.g., oxygen, nitrogen). The current produced by the ions released during ionization is measured and the corresponding concentration is displayed directly in parts per million by volume (ppm). The repeatability of the meter reading is ± 1% of the full scale deflection (e.g., on the 0 - 20 ppm scale, the uncertainty is ± 0.2 ppm). Therefore, at low concentrations near the detection limit, the error could be quite large.

The PID will not detect gaseous compounds that have ionization potentials above the power level of the lamp used. For instance, with a 11.7 eV probe, the following substances are among those which will not be detected:

Methane	(12.98 eV)
Hydrogen Cyanide	(13.91 eV)
Carbon Dioxide	(13.79 eV)

For information on additional compounds, consult the HNU Systems Operator's Manual or other chemical reference books.

Use of this SOP will provide monitoring of organic vapors during field activities. The concentration measurements can be used to: establish levels of health and safety protection, trigger operational control measures, or guide the selection of sampling locations.

2.0 Materials

a. HNU Model PI-101 with 11.7 or 10.2 eV ultraviolet lamp probe
b. Tygon tubing
c. Flow regulator
d. Isobutylene Calibration Gas (e.g., 100 ppm)

3.0 Procedure

3.1 Calibration

3.1.1 Before attaching the probe, check the function switch on the control panel to ensure that it is in the off position. Attach the probe by plugging it into the interface on the top of the readout module.

3.1.2 Turn the function switch to the battery check position. The needle on the meter should read within or above the green region. If not, recharge the battery. If the red indicator light comes on, the battery needs recharging or service may be necessary.

3.1.3 To ZERO the instrument, turn the function switch to the standby position and rotate the zero adjustment knob until the meter reads zero. If the span adjustment setting is changed after the zero is set, the zero should be rechecked and adjusted. Allow the instrument to warm up for 3-5 minutes to ensure that the zero reading is stable. If necessary, readjust the zero.

3.1.4 Set the function switch to the 0-200 ppm range.

3.1.5 Attach a regulator to a disposable cylinder of isobutylene (100 ppm). Connect the regulator to the probe of the PID with a piece of clean Tygon tubing. Turn on the valve of the regulator.

3.1.6 Record the initial span control setting.

3.1.7 Adjust the instrument display to a reading of 82 ppm. By adjusting the display to 82 ppm, the instrument is calibrated to read total organic vapor ionized at 11.7 eV quantitated relative to benzene. If 75 ppm isobutylene calibration gas is used, adjust the instrument display to a reading of 61 ppm.

3.1.8 Record the final span control setting.

3.1.9 Close the valves on the calibration gas cylinder and regulator, and disconnect the cylinder and Tygon tubing from the PID instrument.

3.1.10 After the instrument has been calibrated, turn the function switch to the 0-20 ppm range and record the background reading.

3.1.11 Record the date, time, initial span setting, initial calibration gas concentration, adjusted span setting, final calibrated gas concentration, and ambient background concentration on the Equipment Calibration Log sheet.

3.1.12 It must be noted that the concentration readout is for benzene only, since the calibration gas is benzene or an equivalent. The instrument response to different compounds is relative to the calibration setting. The actual concentration of total contaminants can be higher or lower than the instrument readings. In addition, the response is not linear over the detection range (e.g., if the concentration increases by 10%, the meter will not necessarily rise by 10%).

3.2 Operation

3.2.1 Set the function switch to the appropriate range. If the concentration of gases or vapors is unknown, set the function switch to 0-20 ppm range. Adjust if necessary.

3.2.2 While taking care not to permit the PID to be exposed to excessive moisture, dirt, or contaminants, monitor the field sampling activities.

NOTE: Do not place the probe too close to the monitoring media (e.g., soil or liquids) because the inlet can become clogged.

3.2.3 When sampling activities are completed or at the end of the day, carefully clean the outside of the PID with a damp disposable towel to remove all visible dirt. Return the PID to a secure area and place on charge.

3.2.4 With the exception of the probe's inlet and exhaust, the PID can be wrapped in clear plastic to prevent it from becoming contaminated and to prevent water from getting inside in the event of precipitation. If the instrument becomes contaminated, make sure to take necessary steps to decontaminate it.

4.0 Maintenance

During periods of analyzer operation, dust and other foreign materials are drawn into the probe, forming deposits on the surface of the UV lamp and in the ion chamber. These deposits interfere with the ionization process and cause erroneous readings. The UV lamp and ion chamber should be cleaned if the meter readings are low, erratic, unstable, non-repeatable, drifting, or show moisture sensitivity. At a minimum, the cleaning should be performed on a monthly basis.

The following items cover basic field maintenance and servicing procedures for the HNU Model PI-101. In general, maintenance procedures not covered below are to be left to trained service personnel.

4.1 Disassemble the probe and remove the lamp and the ion chamber in a careful manner.

4.2 For a 9.5 or 10.2 eV lamp, clean the lamp by rubbing gently with lens tissue wetted with a detergent solution or HNU cleaning compound (PA101534). Wipe the lens dry with a new tissue.

4.3 For the 11.7 eV lamp, apply a freon or chlorinated organic solvent with a non-abrasive tissue and rub gently. **IMPORTANT**: Do not clean the lamp with water, water miscible solvents such as methanol or acetone, or the cleaning compound used for the 9.5 and 10.2 eV lamps.

4.4 Inspect the ion chamber for dust and deposits. If dusts or deposits are present, remove the outer Teflon® ring and the four screws holding the retaining ring. Gently move the retaining ring aside and remove the screen. Use a tissue or swab moistened with methanol to clean the assembly.

4.5 Reassemble the probe after ensuring no liquid is present. If the instrument still does not perform properly, replace the lamp or refer to the owner's manual.

5.0 Precautions

5.1 The HNU PI-101 is designed to sample air or vapors only. DO NOT allow any liquids or low boiling vapors to get into the probe or meter assembly.

5.2 High concentrations of any gas will cause erroneous readings. High humidity can cause the instrument readings to vary significantly from the actual concentration of gases or vapors present. This is true even though the PID cannot react to water vapor.

5.3 High humidity or exposure to concentrations of low boiling vapors will contaminate the ion chamber, causing a steady decrease in sensitivity. If the reading is zero or negative, there is condensation present on the lamp. Move the instrument to a drier area so that the air drawn into the probe will remove the condensation by evaporation.

5.4 Do not look at the light source from a distance closer than 6 inches with unprotected eyes. Observe only briefly. Continued exposure to ultraviolet light energy generated by the light source can be harmful to eyesight.

5.5 Place the instrument on charge after each use. The batteries are gel cells and it is not possible to overcharge them. Since the instrument has to be recalibrated every time it's turned off, it should be left in the standby mode after calibration, when not being used to take readings. The batteries should be recharged overnight by first plugging the miniphone jack from the charger into the instrument and then plugging the charger into the 120V mains. After charging is complete, the charger should be removed from the 120V line before being unplugged from the instrument.

5.6 Never interchange lamps with different eV ratings. Since the amplifier and other components of the HNU are designed for a specific eV lamp, a lamp with a different eV rating will cause the instrument not to operate properly.

5.7 Turn the function switch to the OFF position before performing any maintenance operations.

6.0 References

PID Manufactuers Manual.

7.0 Attachments

None.

STANDARD OPERATING PROCEDURE D.1
DECONTAMINATION OF SAMPLING EQUIPMENT AND OTHER SMALL EQUIPMENT ITEMS

1.0 Scope and Application

3.1.1 This Standard Operating Procedure (SOP) describes the procedures to be followed for decontaminating sampling equipment and other equipment items. All sampling equipment must be decontaminated following each use in order to prevent cross-contamination. In addition, equipment and other items leaving the site must be surveyed for radioactive contamination and be decontaminated, when contamination is detected. In most instances, the decontamination procedures will consist of scrubbing the equipment with a detergent solution, followed by a potable water rinse and a distilled water rinse. If the sampling equipment is to be used for collecting a soil or sediment sample for any type of organic analysis, the sampling equipment decontamination will include an *additional final rinse with methanol.* If sampling equipment is to be used for collecting a soil or sediment sample for metals compounds, the sampling equipment decontamination will include an additional *final rinse with 1:1 nitric acid.*

2.0 Materials

a. Plastic sheeting
b. Buckets
c. Potable water
d. Distilled water
e. Low-phosphate detergent (i.e., alconox)
f. Aluminum foil
g. Methanol
h. Nitric Acid

3.0 Procedure

3.1 Sampling Equipment

All sampling equipment will be decontaminated after each use in accordance with the following procedures.

3.1.2 Wash and brush the equipment with potable water and low-phosphate detergent (i.e., alconox).

3.1.3 If sampling equipment is to be used for collecting a soil or sediment sample which will be analyzed for metals compounds, rinse the equipment with 1:1 nitric acid.

3.1.4 Rinse off detergent with potable water.

3.1.5 Rinse equipment with distilled water.

3.1.6 If sampling equipment is to be used for collecting a soil or sediment sample which will be analyzed for organic compounds, rinse the equipment with methanol.

3.1.7 Allow equipment to air dry.

3.1.8 Wrap equipment in aluminum foil (shiny side out).

3.2 Small equipment items and other items leaving the site must meet "free release" requirements. If decontamination is required, then the following procedures shall be used.

3.2.1 Wash and brush the equipment with potable water and low-phosphate detergent (i.e., alconox).

3.2.2 Thoroughly rinse with potable water.

3.2.3 Allow equipment to air dry.

3.2.4 Resurvey equipment and decontaminate again, if necessary, in order to meet free release requirements.

4.0 Maintenance

Not Applicable.

5.0 Precautions

5.1 Once a piece of equipment has been decontaminated, be careful to keep it in such condition until needed.

5.2 Refer to the Health and Safety Plan for appropriate health and safety precautions.

6.0 References

USEPA, 1989. Region II CERCLA Quality Assurance Manual. Revision 1.

7.0 Attachments

None.

STANDARD OPERATING PROCEDURE D.3
DECONTAMINATION OF EXCAVATING EQUIPMENT, VEHICLES, AND RAIL CARS

1.0 Scope and Application

The purpose of this Standard Operating Procedure (SOP) is to describe the protocol for decontamination of excavating equipment (i.e., excavators, dump trucks, backhoes), rail cars, vehicles, and other large equipment items. Decontamination of rail cars will be performed if contamination is detected during a radiological survey. Decontamination of excavating equipment or vehicles will be performed if contamination is detected during a routine radiological survey, or a survey for unrestricted release.

2.0 Material

a. Health and Safety Plan
b. Alconox or equivalent laboratory grade detergent
c. Potable water
d. Scrub brushes
e. Portable pressure sprayer
f. Heavy gauge plastic sheeting
g. Field logbook

3.0 Procedures

3.1 Read the Health and Safety Plan and comply with applicable requirements and procedures.

3.2 Perform the following steps for the decontamination of large equipment when contamination is detected.

(a) Remove visible dirt and mud with a brush and/or scraper.

(b) Wash the external surfaces with soapy water and a high pressure sprayer. If necessary, use a scrub brush to wash the equipment until all visible dirt, grime, and grease have been removed.

(c) Rinse the equipment with potable water.

(d) Collect the decontamination fluids and associated sediments into a lined pit or a container and transport the wastewater to the on-site holding tanks.

3.3 Perform radiological survey of equipment to ensure that decontamination activities successfully reduced radioactivity to acceptable limits.

3.4 Document all decontamination activities in the field logbook.

4.0 Maintenance

Not Applicable.

5.0 Precautions

Perform decontamination procedures using experienced/qualified personnel.

6.0 References

None

7.0 Attachments

None

STANDARD OPERATING PROCEDURE F.3
CHAIN-OF-CUSTODY RECORD

1.0 Scope and Application

The purpose of this Standard Operating Procedure (SOP) is to describe protocols for use of the Chain-of-Custody (COC) Form. Sample personnel should be aware that a sample is considered to be in a person's custody if the sample is: (a) in a person's actual possession; (b) in view after being in a person's possession; or (c) locked up so that no one can tamper with it after having been in physical custody.

2.0 Materials

a. Chain-of-Custody Form
b. Indelible black ink pen

3.0 Procedures

3.1 Sample Numbering System

The sample numbering system will be used will be used to identify each sample taken and to provide a tracking procedure for retrieval of information. Sample numbers will be generated in the CXX-YYY-NNN format as follows:

C = Colonie FUSRAP site.

XX = Media type, as follows:

SD = Sediment

YY = Location Code: The following are the locations for sampling:.

US = Along Patroon Creek Upstream of the Colonie FUSRAP Site
UT = Unnamed Tributary that crosses the Colonie FUSRAP Site
PC = Patroon Creek from the Unnamed tributary to the Three Mile Reservoir
3MR = Three Mile Reservoir
DS = Downstream of Three Mile Reservoir
IDM = Investigation-Derived Materials

N = Sequential sample number for each type of sample.

Sample Depth Interval: The sample depth interval will be noted in feet from top to bottom in parenthesis. Some examples include:

(0.0-0.5) = zero to 6 inches
(0.5-1.0) = 6 inches to 1 foot
(0.5-1.5) = 6 inches to 1.5 feet

Examples:

CSD-DS1(0.0-0.5): The first sediment sample collected downstream of Three Mile Reservior at zero to 6 inches.

CSD-PC2 (0.5-1.0): The second sediment sample collected along Patroon Creek at 6 to 12 inches.

3.2 Preservation and Holding Time

Many analytical methodologies require the addition of a preservative to a sample and also have established holding times in order to stabilize and maintain sample integrity. The QAPP specifies the proper preservation and holding time requirements for each type of sample. The clock for sample holding time begins at sample collection.

3.3 Field Custody Procedures

3.3.1 New sample bottles will be received by field personnel and stored in unopened cartons in a designated secure area until they are needed.

3.3.2 Samples will be collected as described in this SAP. Sample locations and sample numbers will be recorded on the Chain of Custody Record (Attached). The sampler is responsible for the custody of the samples until they are properly transferred or dispatched. Once a sample has been collected and preserved (if appropriate), it will be secured in a locked vehicle, locked trailer, custody sealed cooler, or in visual site of the person assuming the sample custody until shipment to the laboratory.

3.4 Transfer of Custody and Shipment

Samples to be analyzed off-site are accompanied by a Chain-of-Custody Record Form (Attached). When transferring samples, the individuals relinquishing and receiving will sign, date and note the time on the Record. This Record documents sample custody transfer from the sampler, often through another person, to the laboratory. The Chain-of-Custody Record is filled out as follows:

3.4.1 Enter header information (project number and name). For each station number, enter date, time, composite/grab, station location, number of containers, analytical parameters, and sample identification number (in remarks column).

3.4.2 Sign, date and enter the time under "Relinquished by" entry.

3.4.3 Make sure that the person receiving the sample signs the "Received by" entry, or enter the name of the carrier (e.g., UPS, Federal Express) under

"Received by." Receiving laboratory will sign "Received for Laboratory by" on the lower line and enter the date and time.

3.4.4 Enter the bill-of-lading or Federal Express airbill number under "Remarks."

3.4.5 Place the original (top, signed copy) of the Chain-of-Custody Record Form in the appropriate sample shipping package. Retain a copy with field records.

3.4.6 The custody record is completed using black waterproof ink. Any corrections are made by drawing a line through the error, initialing and dating the change, and entering the correct information. Erasures are not permitted.

3.4.7 Samples for off-site analysis will be sent via common carrier. Common carriers will usually not accept responsibility for handling Chain-of-Custody Record Forms. This necessitates packing the record in the sample container (enclosed in a plastic zip-lock bag). As long as custody forms are sealed inside the sample container and the custody seals are intact, commercial carriers are not required to sign off on the custody form.

3.4.8 The laboratory representative who accepts the incoming sample shipment will sign and date the Chain-of-Custody Record, completing the sample transfer process. The laboratory will note on the COC the condition that the cooler was received, the condition of the ice remaining in the cooler (if applicable), the temperature measured in the temperature blank (if applicable), and the condition of the custody seals on the cooler.

3.4.9 The off-site analytical laboratory will end the sample shipment COC and initiate their own COC for sample analysis. A copy of the field COC form signed by the off-site laboratory will be returned to IT Corporation along with the analytical results. This copy will be retained in the project files.

3.5 *Laboratory Custody*

It is the laboratory's responsibility to maintain internal custody records of the samples throughout sample preparation and analysis.

3.6 Shipping

All samples to be shipped off-site must be screened on-site to determine if the concentrations of radionuclides exceeds 2,000 pCi/g. This will allow for proper packaging and shipping via IATA Dangerous Goods Regulations. Note that by IATA definition, a material must have an activity greater than 2,000 pCi/g in order to be considered radioactive. If the radioactivity of a material is < 2,000 pCi/g, it does not need to be shipped as radioactive. For packaging and shipping non-radioactive and non-hazardous environmental samples, refer to SOP S.9.

4.0 Maintenance

Not Applicable.

5.0 Precautions

None.

6.0 References

USEPA, 1984. User's Guide to the Contract Laboratory Program.

7.0 Attachments

Chain-of-Custody Record

1130 Central A
Albany, New Y

CHAIN OF CUST[illegible] RECORD

No.

Project No.
823485

Project Name
Colonie FUSRAP Site

IT CONTACT: *(Name and Phone Number)*
Kevin S. Dufek (518) 482-0237

SAMPLERS: *(Printed Names and Signature)*

Preservative

Analysis

Lab:

Carrier:

Field Sample ID	Date	Time	Comp.	Grab	Matrix									Subtotal	Remarks
														0	

RELINQUISHED BY: (Printed Name, Signature and Affiliation)	RELINQUISHED BY: (Printed Name, Signature and Affiliation)	DATE	TIME	REMARKS
	COOLER SEALED FOR SHIPPING			

FOR LAB USE ONLY: Cooler Temperature: °C Custody Seals (circle): Intact Broken Absent

General Comments:

ORIGINAL - *Ship with samples* COPY - *Retain with sampling records* Rev. 1/09.12.00

STANDARD OPERATING PROCEDURE S.1
COLLECTION OF SURFACE AND NEAR-SURFACE SOIL SAMPLES

1.0 Scope and Application

The purpose of this Standard Operating Procedure (SOP) is to describe the protocols for sampling surface and near-surface soils. Soil samples will be used to: define areas where contamination soil and debris may have been placed, spilled or tracked through an area, and confirm whether excavation activities have successfully removed all soils designated for removal (i.e., Final Status Survey samples).

2.0 Materials

a. Stainless-steel trowel
b. Stainless-steel tray or bowls
c. Stainless-steel spoon or spatula
d. Shovel
e Hand auger
f. Photoionization Detector (PID)
g. Gross gamma radiation meter with NaI detector
h. Sample containers and labels
i. Shipping containers (coolers)
j. Field logbook and indelible ink pens
k. Chain-of-Custody Form
l. Wooden stakes, pin flags, or similar markers
m. Hammer
n. Camera and film
o. Appropriate health and safety clothing and equipment

3.0 Procedure

3.1 Surface Soil Sampling

3.1.1 If present, remove rocks, pebbles, above-ground vegetation, twigs, leaves, and other surface organic detritus from the immediate area where the sample is to be taken.

3.1.2 Measure the gross gamma radiation emanating from the soil surface using a calibrated NaI detector. Record the measurement in the Field Logbook.

3.1.3 Collect a soil sample from a depth of 0 to 6 inches using a decontaminated stainless-steel trowel or shovel; remove rock fragments, vegetation debris, and roots; and place sample material into a stainless steel bowl.

3.1.4 Thoroughly mix the bulk sample in the stainless steel bowl. If one sample is to be collected for radiological analysis, fill a one-liter wide-mouth polyethylene bottle with sample material, cap tightly, and fill in all required information on the bottle label.

3.1.5 If replicate samples are to be collected, line the required number of sample bottles (including the original sample bottle) side by side. Place small portions of the homogenized sample into each bottle and repeat process until all of the required bottles are filled. Tightly cap each bottle and fill in all required information on the bottle labels.

3.1.6 Samples collected for radiological analyses do not need to be cooled.

3.1.7 If organic compounds are suspected of being present in the soil, based on data from a photoionization detector (PID), smell, or visual evidence, screen the soil in the fresh sample excavation using a properly calibrated PID. Record PID reading measured directly above the soil surface in a Field Logbook. If it is determined that a sample aliquot should be collected for analysis of organic and inorganic compounds using the Toxic Characteristic Leaching Procedure (TCLP), place a separate sample aliquot into a 16-ounce amber glass jar with a Teflon-lined cap. Once the jar is filled with sample material, securely fasten the cap onto the jar, and fill out the information on the jar label. Place the jar immediately in a cooler containing ice, and keep at 4 ± 2 °C.

3.1.8 Fill in required information in the Field Logbook. Write information on a Chain-of-Custody form if the sample is being shipped off-site for analysis (SOP F.3). A description of the soil material should be included in the Field Logbook, in accordance with the Unified Soil Classification System. The description should include moisture content and soil color.

3.1.9 All soil sampling locations will be staked and marked. Locations will also be marked on a site map. A description of the sampling site will be entered into the Field Logbook. This description shall be adequate to allow the sampling station to be revisited if necessary. If needed, the sampling location and elevation will also be surveyed using an engineer's level and nearby benchmarks, or the position can be located using Global Positioning System (GPS) equipment. Record the sample location coordinates and elevations on the Field Logbook.

3.1.10 Photograph the sample location, if warranted. Record in the Field Logbook that a picture was taken, the roll number, the frame number, and the direction that the camera was facing.

3.2 Near Surface Soil Sampling

3.2.1 If a near-surface soil sample is to be collected (e.g., 1 to 5 feet below surface), then a soil core should be collected using a decontaminated hand auger (3 or 4 inch diameter).

3.2.2 As the soil core is collected, place it on a new plastic sheet in its proper sequence and immediately scan with a photoionization detector (PID) and a gross gamma meter. The characteristics and stratification of the soil materials should be described in the Field Logbook. Core materials should be described according to the Unified Soil Classification System. Depths of contacts between different materials and the distinctness of the contacts should be described. The moisture content and color of each material encountered should also be described.

3.2.3 If a sample aliquot is to be collected for analysis of organic and inorganic compounds using the Toxic Characteristic Leaching Procedure (TCLP), place the soil core interval with the highest PID reading into a 16-ounce amber glass jar with a Teflon-lined cap. Once the jar is filled with sample material, securely fasten the cap onto the jar and fill out the information on the jar label. Place the jar immediately in a cooler containing ice, and keep at 4 ± 2 °C.

3.2.4 A sample (or replicate samples) for radiological analysis should be collected from the interval exhibiting the highest gross gamma reading. The core interval selected for sampling should be placed in a stainless steel bowl, rocks and root fragments should be removed, and the sample should be thoroughly homogenized using the stainless steel trowel or stainless steel spoon.

3.2.5 Perform steps 3.1.6, 3.1.8, 3.1.9, and 3.1.10.

3.3 Decontaminate all sampling equipment.

4.0 Maintenance

Not Applicable.

5.0 Precautions

Refer to the Health and Safety Plan for appropriate health and safety precautions.

6.0 References

None

7.0 Attachments

None

STANDARD OPERATING PROCEDURE S.5
COLLECTION OF SEDIMENT SAMPLES

1.0 Scope and Application

The purpose of this Standard Operating Procedure (SOP) is to describe the protocols for sampling sediments. This procedure can be applied to the collection of sediment samples from streams, rivers, lakes, ponds, springs, seeps, sumps, sediment traps, and silt fences. Sediment samples can be used to evaluate the amount of contamination adsorbed on sediment particles and/or the nature and extent of contaminants being transported by surface water.

If multiple sediment samples are to be collected from a stream, samples will be collected from the furthest point downstream, moving upstream as the sampling progresses. Where applicable, surface water samples will be collected before sediment at each sampling location to prevent the suspension of fine-grained substrate, which may introduce suspended sediment into the overlying water column.

2.0 Materials

a. Stainless-steel bowl
b. Stainless-steel trowel
c. Portable Vibracore with marsh buggy, barge, boat, or truck (as needed based on site conditions).
d. Split Spoon with Slam Bar
e. Sample containers
f. Personal flotation devices (PFDs), as applicable.
g. Personal protective equipment and clothing (PPE) per the site-specific health and safety plan.
h. Photoionization detector (PID)
i. Gross gamma radiation meter
j. Field Logbook and waterproof pens
k. Chain-of-Custody form
l. Camera and film
m. Cooler with ice

3.0 Procedure Using Stainless Steel Trowel

3.1 Sediment sampling should occur one to two days after a major storm event, when suspended sediments have had time to settle and flow rates in streams have diminished approximately to pre-storm levels.

3.2 Samples will be collected with a decontaminated trowel if there is little or no water overlying the sediment at the particular sampling location, and if the water velocity is low. For sampling locations where the water above the sediment is greater than 4 inches in depth, a shovel will be used to collect a sediment sample. This will minimize the loss of fine-grained material from the sediment as it is sampled.

3.3 Scrape a sample from the sediment surface with the trowel or shovel. Penetrate no more than 2 inches below the sediment surface. Decant free water off of a sediment sample while it is still on the trowel or shovel. Place sediment into a stainless steel bowl.

3.4 Screen sediment sample with a properly calibrated photoionization detector (PID) and a gross gamma radiation meter. Record these measurements in the Field Logbook.

3.5 Remove rocks, twigs, and other debris from the sample prior to homogenization. Decant excess liquid off the sample whenever possible. Next, thoroughly mix the sediment by stirring and turning the entire sample over at least three times using a stainless-steel trowel or spoon. Following homogenization, place the required sediment volumes into sample jars, which should then be tightly capped and properly labeled. A one liter polyethylene bottle should be used for radiological analysis.

3.6 If replicate samples are to be collected, line the required number of sample bottles (including the original sample bottle) side by side. Place small portions of the homogenized sample into each bottle and repeat process until all of the required bottles are filled. Tightly cap each bottle and fill in all required information on the bottle labels.

3.7 Samples collected for radiological analyses do not need to be cooled.

3.8 If it is determined that a sample aliquot should be collected for analysis of organic and inorganic compounds using the Toxic Characteristic Leaching Procedure (TCLP), a separate sample aliquot will be placed in a 16-ounce amber glass jar with a Teflon-lined cap. Once the jar is filled with sample material, securely fasten the cap onto the jar, and fill out the information on the jar label. Place the jar immediately in a cooler containing ice, and keep at 4 ± 2 °C.

3.9 Fill in required information in the Field Logbook. A description of the soil material should be included in the Field Logbook immediately after sample collection. The description should include moisture content, soil color, texture, odor, and organic content.

3.10 If the sample is being sent to an off-site laboratory for analysis, fill out the appropriate information on a Chain-of-Custody Form (SOP F.3).

3.11 Place a wooden stake above the visible high water mark on the bank closest to the sampling location and mark the stake with the sampling station identifier. Tie surveyors flagging to nearby vegetation to help identify the location. Locations will also be marked on a site map. A description of the sampling site will be entered into the Field Logbook. This description will be adequate to allow the sampling station to be revisited if necessary. If needed, the sampling location and elevation will also be surveyed using an engineer's level and nearby benchmarks, or the position can be located using Global Positioning System (GPS) equipment. Record the sample location coordinates and elevations on the Field Logbook.

3.12 Photograph the sample location, if warranted. Record in the Field Logbook that a picture was taken, the roll number, the frame number, and the direction that the camera was facing.

3.13 Decontaminate the sampling equipment after each use.

4.0 Procedure Using Vibracore Sampling Assembly

4.1 Sediment sampling should occur one to two days after a major storm event, when suspended sediments have had time to settle and flow rates in streams have diminished approximately to pre-storm levels.

4.2 Portable vibratory coring uses a vibrating head assembly clamped onto a core barrel up to 30 ft in length to obtain a virtually undisturbed core sample in sand, silt, or clay. A plastic sample liner can be fitted into the core barrel to enable collection of continuous sediment samples up to 3 inches in diameter. The Vibracore sampling assembly can routinely collect 10–20-ft continuous core samples in loosely consoli-dated, wet, or submerged media. For all samples, mark the sampling location on a site map. Document and describe each location. Sediment locations located in water bodies will be marked using rebar at the point of sampling. At the discretion of the field team, buoys will be used if current conditions require their use. Else, a numbered stake will be placed immediately adjacent to the sample location.

4.3 Don personal protective equipment in accordance with the site safety and health plan.

4.4 Assemble and test the Vibracore according to manufacturer's instructions and assemble the core liner, core cutter, and catcher.

4.5 Measure and record the length of the Vibracore unit from the bottom to the top of the core barrel.

4.6 Clamp the vibrating head assembly onto the core barrel and raise the unit off the deck until the coring assembly is vertical.

4.7 Measure the depth of water. The weight of the Vibracore sampler assembly may cause the sampler to sink into soft sediments without any discernible indication that the top of sediment has been reached. Therefore, a weighted tape measure or similar item will be used to determine the depth of water (depth to top of sediment) independent of the Vibracore sampler assembly..

4.8 For exposed sediments, 0 ft of penetration can be obtained visually when the core barrel contacts the surface.

4.9 Lower the assembly unit at a rate not to exceed 1 ft/sec.

4.10 Activate the Vibracore and begin lowering the unit to allow penetration into the sediment. A noticeable decrease in penetration will indicate that either a sediment clay layer has been reached or the unit has contacted an impervious object or material. With the latter, a second or third coring attempt may be necessary. Record the final penetration depth and time on Vibracore sampling log.

4.11 Slowly winch the Vibracore out of the sediment and up to the surface of the water. It may be necessary to activate the Vibracore for a short time to withdraw the core barrel from the sediment when collecting deep samples (i.e., 15 ft or deeper).

4.12 Place the core barrel on the deck of the barge or boat. Remove the cutter head and core catcher from the end of the core barrel. Measure the sample recovery. Cap and tape both ends of the core barrel and clearly label the core with the sample ID number and core orientation (“top” on one end and “bottom” on the other).

4.13 Maintain the core sample in a vertical position until the core is delivered to the sample processing area.

4.14 Lay the sample tube horizontally on the sample logging table, remove end caps, and drain excess water.

4.15 Cut the core barrel off on the end labeled “surface” just above sediment and replace the cap. Measure the length of the core sample recovered and record as core recovery in the sampling log. Cut the sample tube lengthwise with a clean stainless steel knife and separate the whole core into two lengthwise halves. Cut away the smeared edges of the core with a clean putty knife.

4.16 Screen sediment sample with a properly calibrated photoionization detector (PID) and a gross gamma radiation meter. Record these measurements in the Field Logbook.

4.17 Remove rocks, twigs, and other debris from the sample prior to homogenization. Decant excess liquid off the sample whenever possible. Next, thoroughly mix the sediment by stirring and turning the entire sample over at least three times using a stainless-steel trowel or spoon. Following homogenization, place the required sediment volumes into sample jars, which should then be tightly capped and properly labeled. A one liter polyethylene bottle should be used for radiological analysis.

4.18 If replicate samples are to be collected, line the required number of sample bottles (including the original sample bottle) side by side. Place small portions of the homogenized sample into each bottle and repeat process until all of the required bottles are filled. Tightly cap each bottle and fill in all required information on the bottle labels.

4.19 Samples collected for radiological analyses do not need to be cooled.

4.20 If it is determined that a sample aliquot should be collected for analysis of organic and inorganic compounds using the Toxic Characteristic Leaching Procedure (TCLP), a separate sample aliquot will be placed in a 16-ounce amber glass jar with a Teflon-lined cap. Once the jar is filled with sample material, securely fasten the cap onto the jar, and fill out the information on the jar label. Place the jar immediately in a cooler containing ice, and keep at 4 ± 2 °C.

4.21 Fill in required information in the Field Logbook. A description of the soil material should be included in the Field Logbook immediately after sample collection. The description should include moisture content, soil color, texture, odor, and organic content.

4.22 If the sample is being sent to an off-site laboratory for analysis, fill out the appropriate information on a Chain-of-Custody Form (SOP F.3).

4.23 Locations will be marked on a site map. A description of the sampling site will be entered into the Field Logbook. This description will be adequate to allow the sampling station to be revisited if necessary. If needed, the sampling location and elevation will also be surveyed using an engineer's level and nearby benchmarks, or the position can be located using Global Positioning System (GPS) equipment. Record the sample location coordinates and elevations on the Field Logbook.

4.24 Photograph the sample location, if warranted. Record in the Field Logbook that a picture was taken, the roll number, the frame number, and the direction that the camera was facing.

4.25 Decontaminate the sampling equipment after each use.

5.0 Procedure Using Slam Bar Technique

5.1 Shallow sediment sampling should occur one to two days after a major storm event, when suspended sediments have had time to settle in the Creek so that visual placement of the sampling equipment can be performed in areas where fine sediments are present and gravel and rocks can be avoided.

5.2 Shallow sediment sampling will be performed with a split barrel sampler (split spoon) attached to a slam or drive bar assembly. The sampling method will be utilized to collect samples from 0-3 feet in depth where possible in areas of the Creek where sediment deposition is likely to have occurred. The split spoon will be of 1.5 inches in diameter and equipped with an acetate liner and a retaining basket to retain soft and/or loose sediment samples up to 3 feet in length.

5.3 For all samples, mark the sampling location on a site map. Document and describe each location. Place a numbered stake on the shoreline immediately adjacent to the sample location.

5.4 Don personal protective equipment in accordance with the site safety and health plan.

5.5 Decontaminate the split spoon with two consecutive alconox washes followed by a distilled water rinse and an acetone rinse. Rinse sampling equipment used to collect for metals and radioactive contaminants with a dilute nitric acid solution prior to the distilled water rinse.

5.6 Attach the split spoon to the slam bar rod and place the tip of the split spoon on the bottom of the Creek at the desired sampling location.

5.7 For submerged sediments the advancement of the split spoon will be measured from the bottom of the Creek subsequent to measuring the depth from the surface of the Creek to the bottom of the Creek. For exposed sediments, 0 ft of penetration can be obtained visually when the core barrel contacts the surface.

5.8 Drive the split spoon to its full length by repetitively hammering the spoon with the slam bar. Record the final penetration depth and time on sampling log. Extract the split spoon by hammering the spoon upward with the slam bar.

5.9 Place the split spoon on a clean sheet of plastic and remove the cutter head, retaining basket, and the shoe of the barrel. Measure the sample recovery. Cap and tape both ends of the acetate liner and clearly label the core with the sample ID number and core orientation ("top" on one end and "bottom" on the other).

5.10 Maintain the core sample in a vertical position until the core is delivered to the sample processing area.

5.11 Lay the sample liner horizontally on the sample logging table, remove end caps, and drain excess water.

5.12 Cut the core barrel off on the end labeled "surface" just above sediment and replace the cap. Measure the length of the core sample recovered and record as core recovery in the sampling log. Cut the sample tube lengthwise with a clean stainless steel knife and separate the whole core into two lengthwise halves. Cut away the smeared edges of the core with a clean putty knife.

5.13 Screen sediment sample with a properly calibrated photoionization detector (PID) and a gross gamma radiation meter. Record these measurements in the Field Logbook.

5.14 Remove rocks, twigs, and other debris from the sample prior to homogenization. Decant excess liquid off the sample whenever possible. Next, thoroughly mix the sediment by stirring and turning the entire sample over at least three times using a stainless-steel trowel or spoon. Following homogenization, place the required sediment volumes into sample jars, which should then be tightly capped and properly labeled. A one liter polyethylene bottle should be used for radiological analysis.

5.15 If replicate samples are to be collected, line the required number of sample bottles (including the original sample bottle) side by side. Place small portions of the homogenized sample into each bottle and repeat process until all of the required bottles are filled. Tightly cap each bottle and fill in all required information on the bottle labels.

5.16 Samples collected for radiological analyses do not need to be cooled.

5.17 If it is determined that a sample aliquot should be collected for analysis of organic and inorganic compounds using the Toxic Characteristic Leaching Procedure (TCLP), a separate sample aliquot will be placed in a 16-ounce amber glass jar with a Teflon-lined cap. Once the jar is filled with sample material, securely fasten the cap onto the jar, and fill out the information on the jar label. Place the jar immediately in a cooler containing ice, and keep at 4 $\pm$ 2 °C.

5.18 Fill in required information in the Field Logbook. A description of the soil material should be included in the Field Logbook immediately after sample collection. The description should include moisture content, soil color, texture, odor, and organic content.

5.19 If the sample is being sent to an off-site laboratory for analysis, fill out the appropriate information on a Chain-of-Custody Form (SOP F.3).

5.20 Locations will be marked on a site map. A description of the sampling site will be entered into the Field Logbook. This description will be adequate to allow the sampling station to be revisited if necessary. If needed, the sampling location and elevation will also be surveyed using an engineer's level and nearby benchmarks, or the position can be located using Global Positioning System (GPS) equipment. Record the sample location coordinates and elevations on the Field Logbook. In addition to the GPS logging, sediment locations located in water bodies will be marked using rebar at the point of sampling. At the discretion of the field team, buoys will be used if current conditions require their use. Else, a numbered stake will be placed immediately adjacent to the sample location.

5.21 Photograph the sample location, if warranted. Record in the Field Logbook that a picture was taken, the roll number, the frame number, and the direction that the camera was facing.

5.22 Decontaminate the sampling equipment after each use.

6.0 Maintenance

PID and gross gamma radiation meters should be maintained as specified in the instrument operating manuals.

7.0 Precautions

Refer to the Health and Safety Plan for other appropriate health and safety precautions.

8.0 References

U.S. Environmental Protection Agency. 1985. Sediment Sampling Quality Assurance User's Guide. USEPA Report. EPA 600/4-85-048.

U.S. Environmental Protection Agency. 1987. *A Compendium of Superfund Field Operations Methods.* EPA/540/P-87/001.

Normandeau Associates. *Technical Practice for Vibracore Sediment Sampling.*

8.0 Attachments

None.

STANDARD OPERATING PROCEDURE S.8
COLLECTION OF EQUIPMENT RINSATE SAMPLES

1.0 Scope and Application

The purpose of this Standard Operating Procedure (SOP) is to describe the protocols for the collection of an equipment rinsate sample. Equipment rinsate samples are quality assurance (QA) samples that are used to determine if sampling equipment has been adequately cleaned during decontamination activities at the site. Surface water samples are collected directly into new, certified clean sample bottles. Hence, no "sampling equipment" is used to collect these samples. Therefore, it is not necessary to collect rinsate samples in conjunction with water sampling activities.

Sampling equipment used to collect soil samples for radiological analyses are decontaminated by scrubbing in soapy water, rinsing with potable water, and air drying. It is extremely unlikely that sampling equipment would retain enough soil on it to cause cross-contamination with the next sample collected. Hence, rinsate samples will not be collected in conjunction with soil sampling equipment used to collect samples for radiological analyses.

If soil samples are to be collected for the analysis of organic or inorganic analytes, then the sampling equipment needs additional decontamination steps prior to use. A field rinsate sample will be collected in the field and should be analyzed for the same organic and inorganic parameters being analyzed in the soil samples. The rinsate samples will be collected at a frequency of one rinsate for every 20 soil samples analyzed for inorganic and organic parameters.

2.0 Materials

a. Water sample containers and labels; containers should be properly selected in order to collect samples for the same organic and inorganic analyses being performed for the soils.
b. Soil sampling equipment (e.g., trowel)
c. Analyte-free ASTM Type II water (deionized and distilled [DD])
d Stainless steel bowl with pour spout
e. Cooler with ice
f. Field Logbook and waterproof pens
g. Chain-of-Custody Form Sheet

3.0 Procedure

3.1 Check that all appropriate sample bottles (new, laboratory certified clean) are present that need to be filled for the rinsate sample. Bottles should already have the proper preservatives placed in them by the laboratory supplying the bottles.

3.2 Obtain soil sampling equipment that has been fully decontaminated using soapy water scrub, potable water rinse, DD water rinse, and methanol rinse.

3.3 Hold the soil sampling equipment over the bowl and pour analyte-free water over the equipment until an adequate amount of water has been collected to fill all appropriate sample bottles.

3.4 Place the soil sampling equipment down on a clean surface.

3.5 Pour water from the bowl into the proper sample bottles. If samples are being collected for analysis of volatile organic compounds, fill the 40-mL vials before any other bottles. The 40-mL vials should be filled completely so that no air remains in the vial when the cap is secured shut.

3.6 As the sample bottles are filled, securely cap, and fill out information on the bottle label, including date, time, site name, sample identification number, required analyses, and preservative if any.

3.7 Rinsate sample bottles should be immediately stored in a cooler with ice and kept at 4 ± 2 °C.

3.8 Record the appropriate information in the Field Logbook and the Chain-of-Custody form.

4.0 Maintenance

Not Applicable

5.0 Precautions

Refer to the Health and Safety Plan for health and safety precautions.

6.0 References

None

7.0 Attachments

None.

STANDARD OPERATING PROCEDURE S.9
SAMPLE PACKAGING AND SHIPPING

1.0 Scope and Application

The purpose of this Standard Operating Procedure (SOP) is to describe protocols for the packing and shipping of environmental samples to the off-site laboratory for analysis. Any soil, sediment, or solid waste sample that has a specific activity greater than 2,000 pCi/g can not be shipped as an environmental sample, but must be classified as a radioactive material and shipped accordingly. This requires special packaging according to regulations of the U.S. Department of Transportation (49 CFR 171-178) for ground shipments of radioactive (Class 7) materials, or the International Air Transport Association (IATA) for air shipments.

This SOP applies to the shipment of environmental samples only, with the following exceptions:

(1) Swipe samples and air filter samples should be shipped in their outer protective envelopes within a sturdy cardboard box. A completed Chain-of-Custody Form sealed inside a ziploc plastic bag should be included within the box. These samples should not be shipped in coolers containing ice.

(2) Small numbers of soil samples (e.g., 8 or less one-liter bottles) requiring only radiological analysis can be shipped in sturdy cardboard boxes, as long as some cushioning material is included between the bottles and the bottles are placed inside a plastic garbage bag within the box. Samples must dried before shipping. A completed Chain-of-Custody Form sealed inside a ziploc plastic bag should be included within the box. Note: water samples for radiological analysis must be shipped in coolers with absorbent packing material as described below.

2.0 Materials

a. Waterproof hard plastic coolers
b. Custody seals
c. Absorbent packing material
d. Sample documentation
e. Ice
f. Plastic garbage bags
g. Clear packing tape
h. Clear ziploc plastic bags
i. Inert cushioning material

3.0 Procedure

3.1 Ensure sample caps are tightly closed.

3.2 Check that required information has been entered on the sample labels.

3.3 Enclose each sample in a clear ziploc bag, and make sure that sample labels are visible.

3.4 Check that all sample bottles have been entered on the Chain-of-Custody Form and that the analyses requested for each bottle are correct. If appropriate, include a temperature blank and trip blank with the samples and enter on the Chain-of-Custody Form. Fill out any remaining information required on the Chain-of-Custody Form (see SOP F.3). Sign and date release of the Chain-of-Custody Form. Tear off and retain sender's copy of the form.

3.5 *Place inert cushioning material (e.g., bubble wrap) in the bottom of the cooler.*

3.6 Place all the samples inside a garbage bag and tie the bag shut. If any of the samples are being analyzed for non-radiological parameters, a temperature blank should be included with the samples inside the garbage bag. The inclusion of a temperature blank in the cooler should be entered on the Chain-of-Custody Form, as stated in Step 3.4.

3.7 If the samples are being analyzed for non-radiological parameters, the samples must be stored and shipped in a cooler containing ice. Double bag and seal loose ice in ziploc bags to prevent melting ice from soaking the packing material. Place the ice outside the garbage bag containing the samples. Place sufficient ice in cooler to maintain the internal temperature of the samples at 4±20C during transport.

3.8 Fill cooler with enough absorbent and packing material to prevent breakage of the sample bottles and to absorb the entire volume of the liquid being shipped.

3.9 Enclose sample documentation *(i.e., COCs) in a waterproof plastic bag and tape* the bag to the underside of the cooler lid. If more than one cooler is being used, place all documentation in one cooler. Number the coolers and note on the sample documentation the cooler number in which each sample was shipped.

3.10 Remove extraneous stickers and old tape from the cooler, if present. Tape the cooler shut with strapping tape and place tape over the cooler drain.

3.11 Seal coolers at a minimum of two locations along the lid of the cooler with signed and dated custody seals.

3.12 Attach completed shipping label to the top of the cooler. The address of the analytical laboratory must be clearly marked on the shipping label on each cooler. The ~~ICF Kaiser~~ SHaw E+I return address should also be included on each shipping label. Samples shipped on Friday need to be specified on the shipping form as "Saturday Delivery." Failure to mark the cooler for Saturday delivery will likely cause temperature, preservation, or extraction time requirements of the samples to be violated.

3.13 Place "Fragile" and "This Side Up" stickers on two sides of each cooler.

3.14 Contact the analytical laboratory prior to shipping in order to make them aware of the impending shipment, particularly if a Saturday delivery is involved.

3.15 Ship all samples via overnight delivery within 24 hours of collection.

4.0 Maintenance

Not Applicable.

5.0 Precautions

Any individual sample should be shipped according to DOT or IATA requirements if the specific activity of the sample exceeds 2,000 pCi/g, which qualifies it as a radioactive (Class 7) material.

6.0 References

Code of Federal Regulations (CFR). 1991. Title 49, U.S. Department of Transportation, Subpart I - Class 7 (Radioactive) Materials. Washington, DC, U.S. Government Printing Office.

International Air Transport Association (IATA). 1998. Dangerous Goods Regulations. 39th Edition, Montreal, Canada.

USEPA. 1990. Sampler's Guide to the Contract Laboratory Program. EPA/540/P-90/006, Directive 9240.0-06, Office of Emergency and Remedial Response, Washington, D.C., December 1990.

USEPA. 1991. User's Guide to the Contract Laboratory Program. EPA/540/O-91/002, Directive 9240.0-01D, Office of Emergency and Remedial Response, January 1991.

7.0 Attachments

None

APPENDIX C

SOUTHWEST LABORATORIES OF OKLAHOMA, INC. LABORATORY QUALITY ASSURANCE PLAN

ICL2001-8.009

SOUTHWEST LABORATORY OF OKLAHOMA, INC. *and*
AMERICAN ANALYTICAL & TECHNICAL SERVICES, INC.

Standard Operating Procedure

Laboratory Quality Assurance Plan

FILE COPY

Document No.: SWL-GA-100
Rev No. / Date: Rev. 7.0 — 05/18/01

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APPROVALS	DATES
Chuck Hoover Procedure Prepared By	5/18/01 Date
Robert W. Harris Laboratory Manager or Director	5/29/01 Date
Chuck Hoover Laboratory Safety Officer	5/18/01 Date
Chuck Hoover Laboratory QA/QC Officer	5/18/01 Date

(Effective Date is 10 calendar days after the last signature above - QA/QC Officer)

Document Status

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STATE OF NEW YORK
DEPARTMENT OF HEALTH

Wadsworth Center The Governor Nelson A. Rockefeller Empire State Plaza P.O. Box 509 Albany, New York 12201-0509

Antonia C. Novello, M.D., M.P.H., Dr. P.H.
Commissioner

Dennis P. Whalen
Executive Deputy Commissioner

February 28, 2002

Dear Laboratory Director:

Please note that although your ELAP Certificate of Approval expires on 12:01 AM April 1, 2002, it is still valid until June 15, 2002, as per ELAP Certification Manual, No. 140, Page 13 of 42, dated 12/6/95, Part 55-2.4e NYCRR. "...during any extension or grace period permitted by this Subpart, a laboratory approval shall remain in force beyond the expiration date of the certificate of approval, unless such approval is specifically terminated or suspended in writing."

Further verification of your laboratory's approved ELAP status is available by calling the Program Office at (518) 485-5570.

Sincerely,

Linda L. Madlin

Linda L. Madlin
Administrative Assistant
Environmental Laboratory
Approval Program

LLM:mes

STATE OF NEW YORK
DEPARTMENT OF HEALTH

Wadsworth Center The Governor Nelson A. Rockefeller Empire State Plaza P.O. Box 509 Albany, New York 12201-0509

Antonia C. Novello, M.D., M.P.H., Dr. P.H.
Commissioner

Dennis P. Whalen
Executive Deputy Commissioner

Dear Laboratory Director:

Enclosed are the ELAP Certificate(s) of Approval for permit year 2001-2002 issued to your environmental laboratory. The Certificate(s) supersede any previously issued and are in effect through March 31, 2002. Please carefully examine the Certificate(s) to insure that the categories, subcategories, analytes and methods for which your laboratory is approved are listed correctly, as well as verifying your laboratory's name, address, director and identification number.

Please notify this office of any corrections required.

Sincerely,

Linda L. Madlin

Linda L. Madlin
Administrative Assistant
Environmental Laboratory
Approval Program

LLM:mes
Enclosure

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER
Antonia C. Novello, M.D., M.P.H., Dr.P.H. Commissioner

Expires 12:01 AM April 01, 2002
Issued August 18, 2001

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. ROBERT W. HARRIS
SOUTHWEST LAB OF OKLAHOMA
1700 W ALBANY
BROKEN ARROW OK 74012 USA

NY Lab Id No: 11672
EPA Lab Code: OK00006

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards for the category
ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Chlorinated Hydrocarbons	
Hexachlorobenzene	EPA 625
Hexachlorobutadiene	EPA 625
Hexachlorocyclopentadiene	EPA 625
Hexachloroethane	EPA 625
Dioxins	
[illegible]-Tetrachlorodibenzo-p-d	EPA 1613
[illegible]troaromatics and Isophorone	
2,4-Dinitrotoluene	EPA 625
2,6-Dinitrotoluene	EPA 625
Isophorone	EPA 625
Polynuclear Aromatics	
Acenaphthene	EPA 625
Anthracene	EPA 625
Benzo(a)anthracene	EPA 625
Benzo(a)pyrene	EPA 625
Benzo(b)fluoranthene	EPA 625
Benzo(ghi)perylene	EPA 625
Fluoranthene	EPA 625
Fluorene	EPA 625
Indeno(1,2,3-cd)pyrene	EPA 625
Naphthalene	EPA 625
Phenanthrene	EPA 625
Pyrene	EPA 625

Purgeable Halocarbons	
1,1-Dichloroethane	EPA 601
	EPA 624
2-Chloroethylvinyl ether	EPA 601
	EPA 624
cis-1,3-Dichloropropene	EPA 601
	EPA 624
Dichlorodifluoromethane	EPA 601

Serial No.: 12708

Pr[illegible] of the New York State Department of Health. Valid only at the address shown. [illegible] conspicuously posted. Valid certificates have a raised seal and may be [illegible]ed by calling (518)485-5570.

[illegible]-3317 (3/97)

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER
Antonia C. Novello, M.D., M.P.H., Dr.P.H. *Commissioner*

Expires 12:01 AM April 01, 2002
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MR. ROBERT W. HARRIS
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BROKEN ARROW OK 74012 USA

NY Lab Id No: 11672
EPA Lab Code: OK00006

is hereby APPROVED as an Environmental Laboratory for the category
ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved subcategories and/or analytes are listed below:

Chlorinated Hydrocarbon Pesticides

4,4 -DDE	Method Not Specified
4,4 -DDT	Method Not Specified
4,4-DDD	Method Not Specified
Aldrin	Method Not Specified
eta-BHC	Method Not Specified
rdane Total	Method Not Specified
[illegible]	Method Not Specified
Heptachlor	Method Not Specified
Heptachlor epoxide	Method Not Specified

Nitroaromatics and Isophorone

Nitrobenzene	EPA 625

Phthalate Esters

Benzyl butyl phthalate	Method Not Specified

Polychlorinated Biphenyls

PCB-1248	Method Not Specified
PCB-1260	Method Not Specified

Polynuclear Aromatics

Acenaphthylene	EPA 625
Benzo(k)fluoranthene	EPA 625
Chrysene	EPA 625
Dibenzo(a,h)anthracene	EPA 625

Priority Pollutant Phenols

2-Methyl-4,6-dinitrophenol	Method Not Specified
4-Chloro-3-methylphenol	Method Not Specified

Purgeable Aromatics

1,2-Dichlorobenzene	Method Not Specified
1,3-Dichlorobenzene	Method Not Specified
1,4-Dichlorobenzene	Method Not Specified
Benzene	Method Not Specified
Ethyl benzene	Method Not Specified
Toluene	Method Not Specified

Purgeable Halocarbons

1,1,1-Trichloroethane	Method Not Specified
1,2-Dichloroethane	Method Not Specified
Bromodichloromethane	Method Not Specified
Bromoform	Method Not Specified
Carbon tetrachloride	Method Not Specified
Chloroform	Method Not Specified
Dibromochloromethane	Method Not Specified
Methylene chloride	Method Not Specified
Tetrachloroethene	Method Not Specified
Trichloroethene	Method Not Specified

Wastewater Metals I

Barium, Total	EPA 200.7
Cadmium, Total	EPA 200.7

Serial No.: 12709

of the New York State Department of Health. Valid only at the address shown.
conspicuously posted. Valid certificates have a raised seal and may be
ed by calling (518)485-5570.

-3317 (3/97)

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER
Antonia C. Novello, M.D., M.P.H., Dr.P.H.   Commissioner

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NY Lab Id No: 11672
EPA Lab Code: OK00006

is hereby APPROVED as an Environmental Laboratory for the category
ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved subcategories and/or analytes are listed below:

Wastewater Metals I

Calcium, Total	EPA 200.7
Chromium, Total	EPA 200.7
Copper, Total	EPA 200.7
Iron, Total	EPA 200.7
Lead, Total	EPA 239.2
[illegible]gnesium, Total	EPA 200.7
[illegible]ese, Total	EPA 200.7
Nickel, Total	EPA 200.7
Potassium, Total	EPA 200.7
Silver, Total	EPA 200.7
Sodium, Total	EPA 200.7

Wastewater Metals II

Aluminum, Total	EPA 200.7
Antimony, Total	EPA 200.7
Arsenic, Total	Method Not Specified
Beryllium, Total	EPA 200.7
Mercury, Total	EPA 245.1
Selenium, Total	EPA 270.2
Vanadium, Total	EPA 200.7
Zinc, Total	EPA 200.7

Wastewater Metals III

Cobalt, Total	EPA 200.7
Molybdenum, Total	EPA 200.7

Wastewater Metals III

Thallium, Total	EPA 200.7
Titanium, Total	Method Not Specified

Serial No.: 12709

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3317   (3/97)

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER
Antonia C. Novello, M.D., M.P.H., Dr.P.H. Commissioner

Expires 12:01 AM April 01, 2002
Issued August 18, 2001

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. ROBERT W. HARRIS
SOUTHWEST LAB OF OKLAHOMA
1700 W ALBANY
BROKEN ARROW OK 74012 USA

NY Lab Id No: 11672
EPA Lab Code: OK00006

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards for the category ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved analytes are listed below:

Chlorinated Hydrocarbon Pesticides

4,4 -DDE	SW-846 8081A
4,4 -DDT	SW-846 8081A
4,4-DDD	SW-846 8081A
Aldrin	SW-846 8081A
alpha-BHC	SW-846 8081A
eta-BHC	SW-846 8081A
[illegible]n	SW-846 8081A
Endrin	SW-846 8081A
Heptachlor	SW-846 8081A
Heptachlor epoxide	SW-846 8081A
Lindane	SW-846 8081A
Methoxychlor	SW-846 8081A

Chlorinated Hydrocarbons

1,2,4-Trichlorobenzene	SW-846 8270C
Hexachlorobenzene	SW-846 8270C
Hexachloroethane	SW-846 8270C

Metals I

Barium, Total	SW-846 6010B
Lead, Total	SW-846 6010B
	SW-846 7421

Metals II

Antimony, Total	SW-846 6010B
	SW846 7041

Metals II

Arsenic, Total	SW-846 6010B
	SW846 7060A
Chromium VI	SW-846 7196A
Selenium, Total	SW-846 6010B
	SW-846 7740

Nitroaromatics and Isophorone

2,4-Dinitrotoluene	SW-846 8270C
Isophorone	SW-846 8270C
Nitrobenzene	SW-846 8270C

Phthalate Esters

Benzyl butyl phthalate	SW-846 8270C
Bis(2-ethylhexyl) phthalate	SW-846 8270C
Di-n-butyl phthalate	SW-846 8270C

Polynuclear Aromatic Hydrocarbons

Acenaphthylene	SW-846 8270C
Anthracene	SW-846 8270C
	SW-846 8310
Benzo(a)anthracene	SW-846 8270C
	SW-846 8310
Benzo(a)pyrene	SW-846 8270C
	SW-846 8310
Benzo(b)fluoranthene	SW-846 8270C
Benzo(ghi)perylene	SW-846 8270C

Serial No.: 12710

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ied by calling (518)485-5570.

H-3317 (3/97)

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All approved analytes are listed below:

Polynuclear Aromatic Hydrocarbons

Chrysene	SW-846 8270C
	SW-846 8310
Dibenzo(a,h)anthracene	SW-846 8270C
Naphthalene	SW-846 8270C
	SW-846 8310
[illegible]nanthrene	SW-846 8270C
	SW-846 8310
Pyrene	SW-846 8270C
	SW-846 8310

Priority Pollutant Phenols

2,4,6-Trichlorophenol	SW-846 8270C
2,4-Dichlorophenol	SW-846 8270C
2-Chlorophenol	SW-846 8270C
4-Chloro-3-methylphenol	SW-846 8270C
Pentachlorophenol	SW-846 8270C
Phenol	SW-846 8270C

Purgeable Aromatics

1,2-Dichlorobenzene	SW-846 8021B
	SW-846 8260B
1,3-Dichlorobenzene	SW-846 8021B
	SW-846 8260B
1,4-Dichlorobenzene	SW-846 8021B
	SW-846 8260B

Purgeable Aromatics

Benzene	SW-846 8021B
	SW-846 8260B
Chlorobenzene	SW-846 8021B
	SW-846 8260B
Ethyl benzene	SW-846 8021B
	SW-846 8260B
Total Xylenes	SW-846 8260B

Purgeable Halocarbons

1,1,1-Trichloroethane	SW-846 8021B
	SW-846 8260B
1,1,2,2-Tetrachloroethane	SW-846 8021B
	SW-846 8260B
1,1,2-Trichloroethane	SW-846 8021B
	SW-846 8260B
1,1-Dichloroethene	SW-846 8021B
	SW-846 8260B
1,2-Dichloroethane	SW-846 8021B
	SW-846 8260B
1,2-Dichloropropane	SW-846 8021B
	SW-846 8260B
2-Chloroethylvinyl ether	SW-846 8021B
	SW-846 8260B
Bromodichloromethane	SW-846 8021B

Serial No.: 12710

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[illegible] by calling (518)485-5570.

[illegible]3317 (3/97)

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SOUTHWEST LAB OF OKLAHOMA
1700 W ALBANY
BROKEN ARROW OK 74012 USA

NY Lab Id No: 11672
EPA Lab Code: OK00006

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards for the category ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE All approved analytes are listed below:

Purgeable Halocarbons	
Bromodichloromethane	SW-846 8260B
Bromomethane	SW-846 8021B
	SW-846 8260B
Carbon tetrachloride	SW-846 8021B
	SW-846 8260B
loroethane	SW-846 8021B
	SW-846 8260B
Chloroform	SW-846 8021B
	SW-846 8260B
Chloromethane	SW-846 8021B
	SW-846 8260B
cis-1,3-Dichloropropene	SW-846 8021B
	SW-846 8260B
Dibromochloromethane	SW-846 8021B
	SW-846 8260B
Dichlorodifluoromethane	SW-846 8021B
	SW-846 8260B
Methylene chloride	SW-846 8021B
	SW-846 8260B
Tetrachloroethene	SW-846 8021B
	SW-846 8260B
trans-1,3-Dichloropropene	SW-846 8021B
	SW-846 8260B
Trichloroethene	SW-846 8021B
Trichloroethene	SW-846 8260B
Trichlorofluoromethane	SW-846 8021B
	SW-846 8260B
Vinyl chloride	SW-846 8021B
	SW-846 8260B

Serial No.: 12710

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ed by calling (518)485-5570.

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER
Antonia C. Novello, M.D., M.P.H., Dr.P.H. Commissioner

Expires 12:01 AM April 01, 2002
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MR. ROBERT W. HARRIS
SOUTHWEST LAB OF OKLAHOMA
1700 W ALBANY
BROKEN ARROW OK 74012 USA

NY Lab Id No: 11672
EPA Lab Code: OK00006

is hereby APPROVED as an Environmental Laboratory for the category
ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved subcategories and/or analytes are listed below:

Nitroaromatics and Isophorone

2,6-Dinitrotoluene	SW-846 8270C

Polynuclear Aromatic Hydrocarbons

Acenaphthene	SW-846 8270C
Fluoranthene	SW-846 8270C
Fluorene	SW-846 8270C
[illegible](1,2,3-cd)pyrene	SW-846 8270C

Purgeable Aromatics

Toluene	Method Not Specified

Serial No.: 12711

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[illegible]fied by calling (518)485-5570.

[illegible]OH-3317 (3/97)

DEPARTMENT OF DEFENSE
UNITED STATES OF AMERICA

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
HTRW CENTER OF EXPERTISE
12565 WEST CENTER ROAD
OMAHA, NEBRASKA 68144-3869

REPLY TO
ATTENTION OF:

March 21, 2002

Hazardous, Toxic and Radioactive Waste
Center of Expertise

Southwest Laboratory of Oklahoma, Inc.
ATTN: Chuck Hoover
1700 West Albany, Suite C
Broken Arrow, OK 74012-1421

Gentlemen:

This correspondence addresses the recent evaluation of Southwest Laboratory of Oklahoma, Inc. of Broken Arrow, OK, by the U.S. Army Corps of Engineers (USACE) for chemical analysis in support of the USACE Hazardous, Toxic and Radioactive Waste Program.

Your laboratory is now validated for the parameters listed below:

METHOD	PARAMETERS	MATRIX(1)
8330	Explosives	Water(2)
8330	Explosives	Solids(2)
7196A	Hexavalent Chromium	Water(5)
3060A/7196A	Hexavalent Chromium	Solids(5)
8081A	Organochlorine Pesticides	Water(2)
8081A	Organochlorine Pesticides	Solids
6010B/7000A	TAL Metals(3)	Water(2)
6010B/7000A	TAL Metals(3)	Solids(2)
8015B	TPH - GRO/DRO	Water(5)
8015B	TPH - GRO/DRO	Solids(5)
8260B	Volatile Organics	Water(2)
8260B	Volatile Organics	Solids

Remarks:

1) 'Solids' includes soils, sediments, and solid waste.

2) The laboratory has successfully analyzed a performance evaluation sample for this method/matrix.

3) TAL Metals: Aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc. (Analysis by ICP/GFAA.)

4) Anions: nitrate, ortho-phosphate, chloride, sulfate, and fluoride.

5) Approval this parameter is based on review of SOPs.

Based on the successful analysis of the performance evaluation samples and the outcome of the laboratory audit conducted by the Navy on June 20, 21 and 22, 2001 your laboratory will be validated for sample analysis by the methods listed above. Note that any corrective action committed to by your laboratory as a result of the Navy inspection will also apply to this USACE validation. The period of validation is 24 months and expires on March 21, 2004.

The USACE reserves the right to conduct additional laboratory inspection or to suspend validation status for any or all of the listed parameters if deemed necessary. It should be noted that your laboratory may not subcontract USACE analytical work to any other laboratory location without the approval of this office. This laboratory validation does not guarantee the delivery of any analytical samples from a USACE Contracting Officer Representative.

Any questions of comments can be directed to Richard Kissinger at (402) 697-2569. General questions regarding laboratory validation may be directed to the Laboratory Validation Coordinator at (402) 697-2574.

Sincerely,

Marcia C. Davies

Marcia C. Davies, Ph.D.
Director, USACE Hazardous,
Toxic and Radioactive Waste
Center of Expertise

DEPARTMENT OF DEFENSE
UNITED STATES OF AMERICA

DEPARTMENT OF THE NAVY

NAVAL FACILITIES ENGINEERING SERVICE CENTER
1100 23RD AVE
PORT HUENEME CA 93043-4370

IN REPLY REFER TO:
NFESC 413
January 25, 2002

Mr. Chuck Hoover
Quality Assurance Officer
Southwest Laboratory of Oklahoma, Inc.
1700 West Albany Suite C
Broken Arrow, OK 74012-1421

Dear Mr. Hoover,

This correspondence addresses the status of Southwest Laboratory of Oklahoma, Inc. (SWLO) Broken Arrow, OK in the Navy Installation Restoration (IR) Quality Assurance (QA) Program as administered by the Naval Facilities Engineering Service Center (NFESC).

Your laboratory is accepted to perform sample analysis for the methods listed in Table 1. The period of acceptance expires January 25, 2004. This acceptance does not guarantee the delivery of any analytical samples. Acceptance is facility specific and can not be transferred to an affiliated or subcontract laboratory.

Acceptance is based on the last assessment executed under the auspices of the Navy IR QA Program. The period of acceptance is consistent with the evaluation cycle identified by the Navy IR QA Program. The assessment included an onsite inspection performed June 20-22 2001, and the review of proficiency testing (PT) results.

The Navy reserves the right to conduct additional laboratory assessments or to suspend or revoke acceptance status for any or all of the listed parameters if deemed necessary.

Table 1

METHOD	PARAMETER	MATRIX
8260B	Volatile Organic Compounds	Water/Solid
8021B	Volatile Organic Compounds	Water
8270C	Semivolatile Organics	Water/Solid
8081A	Pesticides	Water
8141A	Organophosphorus pesticides	Water/Solid
8151A	Herbicides	Water/Solid
8082	Polychlorinated Biphenyls	Water/Solid
8015B	TPH-DRO/GRO	Water/Solid
8310	Polynuclear aromatic hydrocarbons	Water/Solid
8332 and 8330	Explosives	Water/Solid

---

[1] The assessment included a review of Toxicity Characteristic Leaching Procedure (TCLP; EPA Method 1311).

6010B,7470A and 7471A	TAL Metals: Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, and Zinc	Water/Solid
9056	Anions	Water
8290 8280A 1613B	Dioxin	Water/Solid
9010B and 9012A	Cyanide	Water
9013	Cyanide	Solid
9320	Radium 228	Water/Solid
CLP-ILM	Inorganics – Metals	Water/ Solid
CLP-OLM	Organics	Water/ Solid

Acceptance for use for parameters not identified on the table will be determined by Navy project personnel.

The laboratory should notify NFESC if there are parameters not presented on Table 1 that the laboratory expects to run on a routine basis in support of Navy installation restoration projects. In these circumstances the laboratory's capability to run the tests will be reviewed and the table will be modified accordingly.

Questions concerning the information provided should be directed to the NFESC IR QA Program coordinator, Ms. Patricia Moreno at (805) 982-1659, or via email at morenop@nfesc.navy.mil.

Sincerely,

Rebecca L. Biggs (for)

Douglas A. Zillmer
Supervisor, Consultation/Information
Management Branch

№ 1156

STATE OF MARYLAND

DEPARTMENT OF HEALTH AND MENTAL HYGIENE
LABORATORIES ADMINISTRATION

Certifies That

SOUTHWEST LABORATORY OF OKLAHOMA, INC.
1700 West Albany, Broken Arrow, Oklahoma 74012

having duly met the requirements of the
Regulations Governing Laboratory Certification
And Standards Of Performance In Accordance With
The Annotated Code of Maryland,
is hereby approved as a

State Certified Water Quality Laboratory

To perform the analyses indicated on the Annual Certified Parameter List,
which must accompany this certificate.

Approved Analyses: Arsenic, Barium, Beryllium, Cadmium, Chromium, Copper, Mercury; Inorganics 1,2,3,5; THM; VOC 1; SOC 2.

Certification # 274

Date Issued September 26, 2001

Expiration Date September 30, 2002
(Not Transferable)

Director, Laboratories Administration

This certification is subject to u[illegible]nounced laboratory inspections

CONSPICUOUSLY DISPLAY IN THE LABORATORY WITH THE ANNUAL CERTIFIED PARAMETER LIST.

TABLE OF CONTENTS

1.0 QUALITY ASSURANCE

1.1 Introduction

This document details the quality assurance system employed by Southwest Laboratory of Oklahoma, Inc./American Analytical and Technical Services, Inc. (located in Broken Arrow, Oklahoma). Figure 1.1 on the following page shows other affiliates in the laboratory network as well as field office locations. The Broken Arrow laboratory has been carefully constructed and organized to operate as a single entity. This document details laboratory procedures utilized at our Broken Arrow facility. The emphasis is on the Quality Assurance requirements based on such agency guidelines as the USEPA Contract Laboratory Program, Navy Installation Restoration Laboratory Quality Assurance Guide, US Army Corps of Engineers shell for Chemical Analytical Services, and the Air Force Center for Environmental Excellence Quality Assurance Plan, and NELAC (National Environmental Laboratory Accreditation Conference.) It defines the system(s) used in identifying, documenting and implementing project specific requirements. The purpose of this manual is to assure that data of a stated quality and defensibility are being reported by SWLO/AATS.

1.2 Corporate QA Policy Statement

The management has directed all of the staff to maintain a system which ensures the generation of consistent and accurate data which meets the data quality objectives of our clients, and for the various programs in which we participate.

1.3 Quality Assurance

The Quality assurance program is part of the sound analytical protocol used by individuals and laboratories to detect and correct problems in the measurement process or to demonstrate attainment of a state of statistical control. The objective of the quality assurance program is to reduce measurement errors to agreed-upon limits and to produce results of acceptable quality. Two concepts are involved in quality assurance: (1) quality control, the mechanism established to control errors, (2) quality assessment, the system used to verify that the analysis is operating within acceptable limits.

1.4 Quality Control

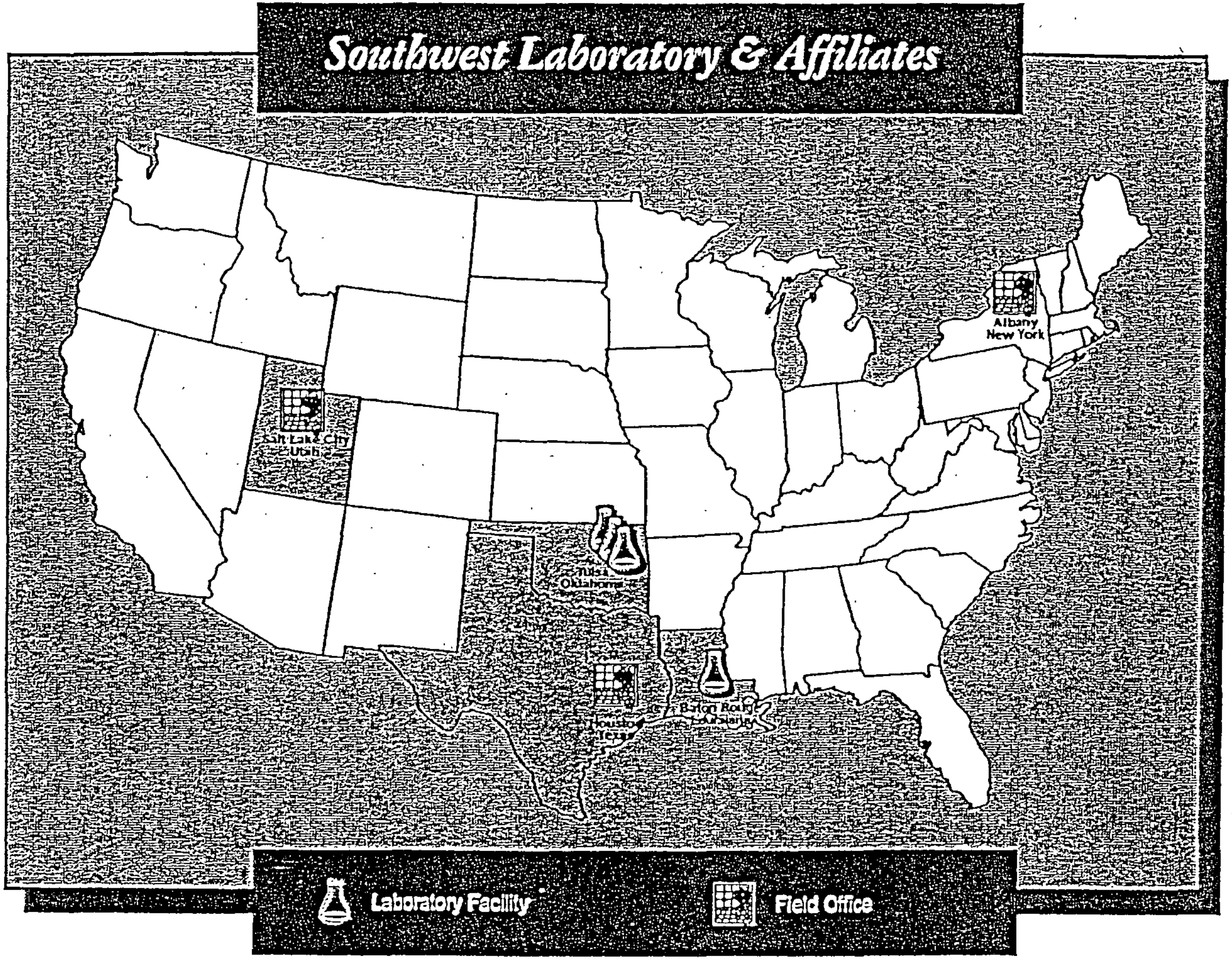
The quality control program includes the following:

- Development of and strict adherence to principles of good laboratory practice.
- Consistent use of standard operation procedures.
- Establishment of and adherence to carefully designed protocols for specific measurement programs,
- Reliable and well-maintained equipment,
- The close supervision of all operations by management and senior personnel.

When properly conceived and executed, a quality control program will result in a measurement system operating in a state of statistical control, which means errors have been reduced to acceptable levels and have been characterized statistically.

Figure 1.1

Southwest Laboratory and Affiliate Locations



1.5 Quality Assessment

Quality assessment includes a variety of techniques required to assess the quality of the measurement process and the results. The establishment of a system of "control charts" is a basic principle. Control charts are plots of multiple data points from the same or similar sample processes versus time. They are used to determine if a system is in a state of statistical control. Control charts are used to visualize or monitor the relative variability of repetitive data. They are used as appropriate with reference materials, spike samples, and the analysis of surrogates as a means to assessing the accuracy of measurements.

1.5.1 Quality Assessment Procedures

Procedures used to assess the effectiveness of the quality control system include:

1.5.1.1 Internal Performance Audits conducted by the QA Officer to assure adherence to the LQAP, and SOPs to assure systems are performing correctly. The use of control samples, replicate measurements, and use of reference materials in conjunction with control charts are also used to monitor the system performance.

1.5.1.2 External Performance Audits-conducted by the use of inter-laboratory checks such as:

1) Participation in laboratory evaluation programs; State Programs (Arkansas, California, Florida, Louisiana, Oklahoma, etc.) USEPA CLP Organics and Inorganics, and US Army Corps of Engineers' HTRW Program.
2) Participation in WP & WS Performance Studies.

Using the assessment process, the overall quality system is maintained. Problems identified are routed through the Corrective Action Process, through which implementation of specified corrective actions improve the overall quality system. The quality system will be monitored using internal audits and blind PE's.

1.5.2 Quality Assessment Procedure Summary

The basic quality control program and its effectiveness, shall be maintained on a daily basis by tracking the following parameters:

- Laboratory Control Samples.
- Areas of the internal standard for specific organic analysis.
- Surrogate spike recovery for organic analysis.
- Matrix spike and matrix spike duplicate sample results for accuracy and precision.
- Managerial Quality Systems Assessment is performed weekly as per Section 18.2 and SOP SWL-GA-143.

1.6 QA Review

Assembled data shall be reviewed by the Project Officer (PO) before technical compilation into contract deliverables. Final review of about 8 - 12% of the assembled deliverables package is performed by the Quality Assurance Officer.

1.7 Data Quality

Data quality is the totality of features and characteristics of data that bear on their ability to satisfy a given purpose. Measurements of major importance are accuracy, precision, completeness, representativeness, and comparability, (see Section 10.3.2. for definition).

1.8 Quality Assurance Plan Review

An overall review of the Laboratory Quality Assurance Plan (LQAP) is performed on an annual basis to ensure that the document adheres to current principles of good laboratory practice. The LQAP is revised more frequently, if necessary, and is reviewed by the Laboratory Operations Manager and the Quality Assurance Officer. Review and revision of the LQAP generally includes:

- Any procedure or policy changes
- Changes in Organizational Chart or Resumes

- Changes in responsibilities
- Any revisions to certifications and accreditations
- Changes in the facility or layout
- Changes in equipment or instrument inventory
- Changes to internal laboratory forms
- Changes to external and internal quality control checks
- Performance and system audit upgrades
- Method detection limits updates
- Typographical errors
- Grammar or context errors

Revisions are documented and placed in the LQAP file. The revised LQAP is then reviewed again to ensure that the changes are correct. The final published document is then placed under document control and released to the laboratory. Outdated copies of the LQAP are archived.

1.9 Contract Review/Project Management

1.9.1 New work is brought into the Laboratory via the Marketing Dept's responses to and awards of IFBs (Invitation for Bid), RFPs (Request for Proposal), and RFQs (Request for Quotation.)

These bid packages are logged into the Marketing Department's proposal log and assigned a consecutive proposal number. The bid packages are copied and copies are distributed to applicable personnel for comments/questions. The Marketing Dept. collects comments/questions and submits them to the client for clarification and/or as exceptions to bid items.

When contracts are awarded the Marketing Dept. reviews the contract to verify that the exceptions are addressed and alert the Project Officer of any issues involved.

The detailed procedures for contract review and project initiation/management are found in SWL-GA-144, "*Review of Proposals, Bids, and Contracts*", and in the project management SOP SWL-GA-131, "*Project Management*". A Project Officer (PO) is assigned to each project and he or she will be the client's representative for the laboratory.

1.9.2 Upon award of a project or at a client's request; where and when their requirements depart from our QA Plan and SOPs, the P.O. can initiate a "GP" series procedure. The departures are drafted by P.O., QAO and/or Program Managers into a "GP-SOP". Upon approval by the P.O., Laboratory Director/Manager, QAO, and Client, the GP-SOP is presented to the appropriate personnel for training. Once personnel are trained regarding this procedure, its' guidelines are carried out with the analyses of the client's procedures.

The case narrative regarding this work contains a reference to this procedure and provided as a deliverable with the data.

Details of the GP-Series SOPs can be found in GA-101 "*Preparation, Review, Revision, and Control of Documents.*"

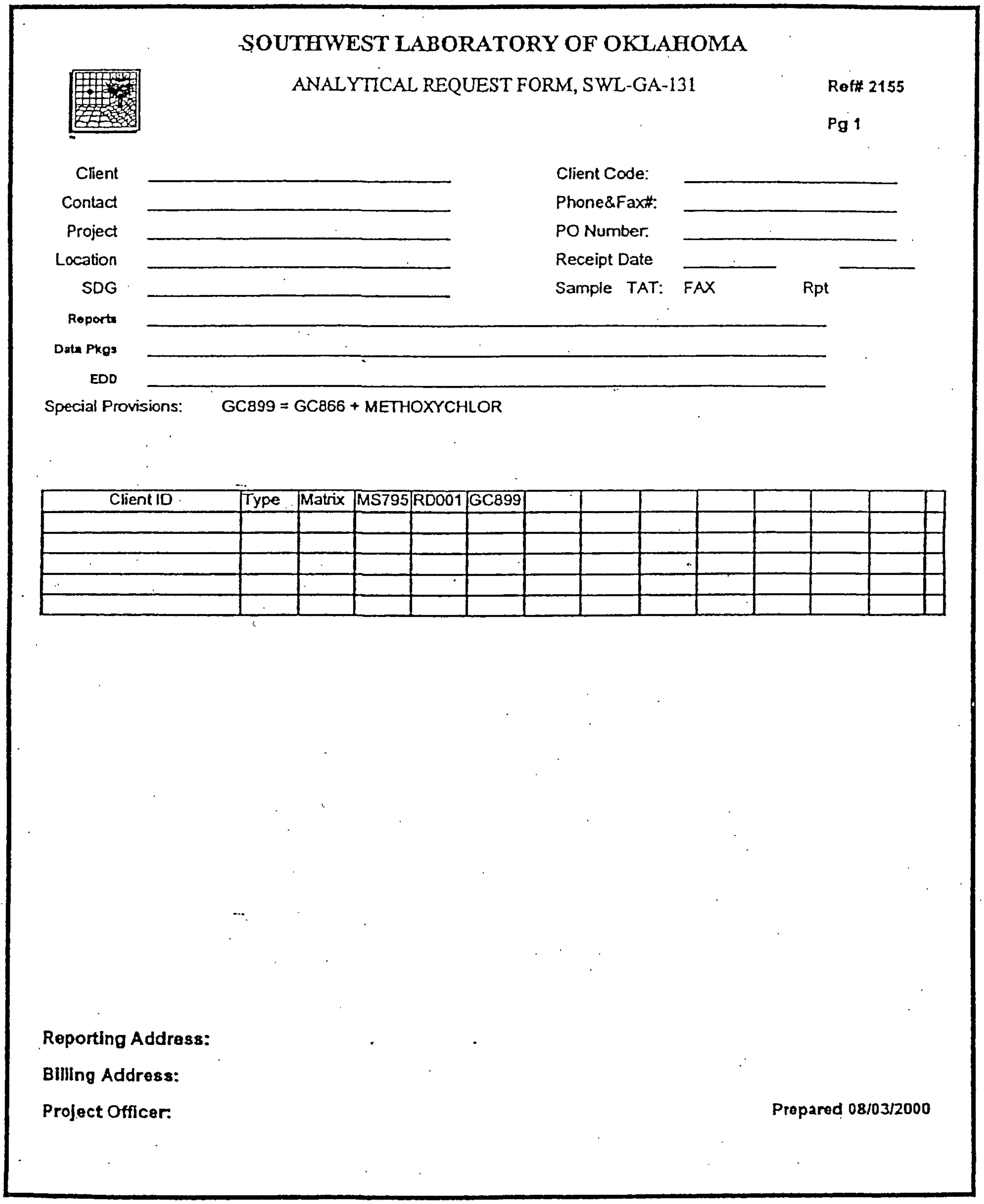
1.9.3 The PO works with the client to determine the type and amount of sample containers that are needed, the parameter lists for analyses, methodology and quality control requirements. The PO will supply the sample custodian with an "Analytical Request Form" (see Fig.1.2) along with any special project requirements. The special requirements will be attached to the laboratory worksheets, which are distributed to the applicable departments. The PO is responsible for monitoring the project from the time the samples are received until the final report is submitted to the client.

1.9.4 He is also responsible for communicating the project requirements and changes to those requirements to laboratory personnel. When a project requires a departure from normal quality system procedures, the Project Officer initiates a new "GP" Series SOP. Appropriate personnel are trained on the project-specific SOP to ensure meeting the client's needs.

1.9.5 The PO is the first line of communication with the client and in so doing they must communicate with the laboratory any relevant concerns or complaints. Complaints are relayed to the QA Officer via e-mail. This/these e-mail message(s) is/are printed out and becomes part of the QA Dept.'s weekly report. The complaint is discussed during the weekly operations meeting with the Lab Director, Lab Manager, Program Managers, and Supervisors. Decisions are made regarding whether Non-Conformances have been encountered and whether a N.C. Report with re-training and/or a Corrective Action will be required. Details regarding the procedure of handling these issues are presented in SWL-GA-145, "Handling Complaints."

Figure 1.2

Analytical Request Form



SOUTHWEST LABORATORY OF OKLAHOMA

ANALYTICAL REQUEST FORM, SWL-GA-131

Ref# 2155

Pg 1

Client

Contact

Project

Location

SDG

Client Code:

Phone&Fax#:

PO Number:

Receipt Date

Sample TAT: FAX Rpt

Reports

Data Pkgs

EDD

Special Provisions: GC899 = GC866 + METHOXYCHLOR

Client ID	Type	Matrix	MS795	RD001	GC899								

Reporting Address:

Billing Address:

Project Officer:

Prepared 08/03/2000

2.0 ORGANIZATION AND RESPONSIBILITIES

2.1 Corporate Organization

SWLO/AATS is located at 1700 West Albany, Broken Arrow, Oklahoma 74012, with Affiliate Labs in Baton Rouge, Louisiana and St. Louis, Missouri.

Specific QA/QC responsibilities are summarized in the following subsections. Figure 2.1 shows the line-staff relationships within the Broken Arrow facility. Resumes of Key Personnel and experience of all technical personnel is presented in Appendix A.

2.1.1 President

The president oversees the job performance of the Laboratory Director, Marketing Director, and Financial Officers. He gives guidance and sets priorities with respect to these duties.

2.1.2 Laboratory Director

The Laboratory Director reports directly to the President and has overall responsibility for laboratory technical quality and personnel management. This overall management involves the quality assurance of the following items:

- Deliverable reports
- Subcontractor work product if required
- Task performance of key personnel

2.1.3 Operations Manager

The Operations Manager reports directly to the Laboratory Director and assists the Laboratory Director as the need arises. He is closely involved with the day-to-day activities of sample preparation/analyses and coordinates all laboratory activities necessary to fulfill contract and QC requirements.

2.1.4 Quality Assurance Officer

The Quality Assurance Officer (QAO) is responsible for monitoring the quality of laboratory work and taking appropriate actions to ensure that quality standards are being met. The QAO reports directly to the Laboratory Director in reviewing the work of teams and individuals and to report quality problems. The QAO is responsible for the following:

- Preparation of Performance Audit Samples, insertion of Performance Audit Samples into the laboratory sample stream, and review of results.
- Overseeing the laboratory's participation in external PE programs and following up with corrective actions when unacceptable scores are obtained.
- Coordinating external Quality Assessment audits and initiating corrective actions in response to deficiencies identified during the audits.
- Preparing and revising the Laboratory QA Plan (LQAP).

- Establishing QC procedures and reviewing warning and control limits for every test to assure they meet the reference method limits.
- Monitoring compliance with the LQAP by:

    1) Reviewing QC-related activities and documentation.

    2) Identifying and referring any instances in which QC objectives are not met to the section heads or the laboratory director for corrective action; Following up on these referrals to ensure that QC objectives are once again being met.

    3) Perform system and technical audits.

    4) Reviewing corrective action reports for out-of-control events and implementation of those Corrective Actions to improve/maintain the overall quality system.

    5) Review Non-Conformance Reports (NCR) and ensure training is conducted (where applicable), to avoid re-occurrence of NC.

- Maintaining documentation of method capability and proficiency.
- Communicating complaints received from the POs to Management.
- Oversight of Laboratory Training Program.
- Oversight of Laboratory Document Control Program.
- Prepare weekly QA reports to Management.

2.1.5 Technical Director

The Technical Director is responsible for research and development of new methods. The Technical Director will resolve technical issues related to GC/MS Analysis and will advise clients on technical issues. The Technical Director oversees the Dioxin and Air Toxic Programs.

2.1.6 Program Manager

The Program Manager oversees the primary functions of their department, including sample analysis, document control, data management, and client services. The Program Manager provides supervision and guidelines for sample handling and storage prior to analyses, maintenance of project files, data entries into the computer system after sample analysis, and quality review of the final data deliverables. The Program manager assures adherence to all standard operating procedures in their area. The Program manager is responsible for maintaining and compiling data for control charts, precision, accuracy and MDL data.

2.1.7 Department Supervisors/Group Leaders

The Department Supervisors and Group Leaders have primary responsibility for the technical quality of all data generated within their respective sections. In addition, they are responsible for the adherence to delivery schedules, management and utilization of manpower and the technical aspects of all Standard Operating Procedures (SOPs). They are responsible for scheduling routine instrument preventive maintenance.

2.1.8 Analysts

The Analysts are responsible for the analysis of a sample, sample extract, or digestate on a particular piece of instrumentation. The analytical sequence is conducted according to the document SOP, which includes the required quality control monitoring. The process is documented in various run logs, including all associated Quality Control. The analysts are responsible for performing and documenting instrument preventive maintenance.

2.1.9 Sample Preparation Technicians

Sample Preparation Technicians (Organic & Inorganic) prepare samples requiring digestion, distillation, extraction, cleanup, etc. This process is documented in the various preparation logbooks, and follows method requirements. All method-specified QC is processed and documented likewise (i.e., blanks, spikes, etc.)

2.1.10 Project Officers (PO)

Project Officer — responsibilities include direct client representation within the laboratory. The PO acts in an advocacy role for the client. The PO will consult clients, as necessary, on technical aspects of the analytical results and how the results relate to the clients' needs. The PO will monitor all analytical projects as they progress through the laboratory and is responsible for communicating project requirements and changes in those requirements to laboratory staff.

2.1.11 Sample Custodian

Sample Custodian (SC) — responsibilities include receipt, inspection, and log-in of samples. The SC initiates internal chain-of-custody for samples upon log-in, monitors the sample storage areas and oversees the maintenance of internal chain-of-custody forms. The SC also moves samples in and out of archive and documents their dumping into waste drums, taken to the incinerator for disposal.

2.1.12 Data Managers

Data Managers — responsibilities include: document organization, assembly of all documents relating to contracts or projects (including project file and analytical file) to ensure clerical veracity during data handling, data assembly, and data report production and follow all associated SOPs.

2.1.13 Information Systems

Computer Services Personnel are responsible for the management and quality control of all computing systems (hardware, software, documentation and procedures), generating, updating, and performing quality control reviews of automated deliverables in accordance with SOP SWL-GA-102, "Information Systems Quality Assurance Program".

2.1.14 Information Systems Manager

The Information Systems Manager is responsible for the installation, operation, and maintenance of software and programs, generating, updating, and performing quality control reviews of analytical databases and automated deliverables in accordance with SOP SWL-GA-102, "Information Systems Quality Control Assurance Program."

2.2 Authorization of Personnel

Following is the system, in place to ensure that authorized personnel are designated to replace those personnel who are absent from the laboratory. Replacements for personnel generally flow upward on the Laboratory Organizational Chart (see Figure 2.1).

- When the Sample Custodian is absent, the Laboratory Director will designate a replacement from the trained backup Personnel.
- When an analyst is absent, the Group Leader will designate a qualified replacement or the Group Leader will replace the analyst.
- When a Group Leader is absent, the Department Supervisor will replace the Group Leader.
- When a Department Supervisor is absent, the Program Manager will replace the Department Supervisor.
- When a Project Officer is absent, the Laboratory Director will designate another Project Officer as a replacement, or the Laboratory Director will replace the Project Officer.
- When the Quality Assurance Officer is absent, the Laboratory Director will replace the Quality Assurance Officer.
- The Operations Manager will be responsible for the duties of the Laboratory Director in the Director's absence.

2.3 Stop Work Authority

- The analyst has the authority to stop work on the task they are performing when adherence to the quality control in the SOP is not achieved. The analyst is responsible for bringing the analytical system under control and reanalyzing the affected samples.
- Department Supervisors have the authority to stop work in their department when the stated LQAP or SOP policies, procedures, and practices are not met. The Department Supervisor is responsible for bringing the system back into control.
- The Program Managers have the authority to stop work for their areas when quality assurance or safety procedures are directly affected.
- The Quality Assurance Officer has the authority to stop work in all areas of the laboratory when it is deemed that a system is out of control. The QAO will meet

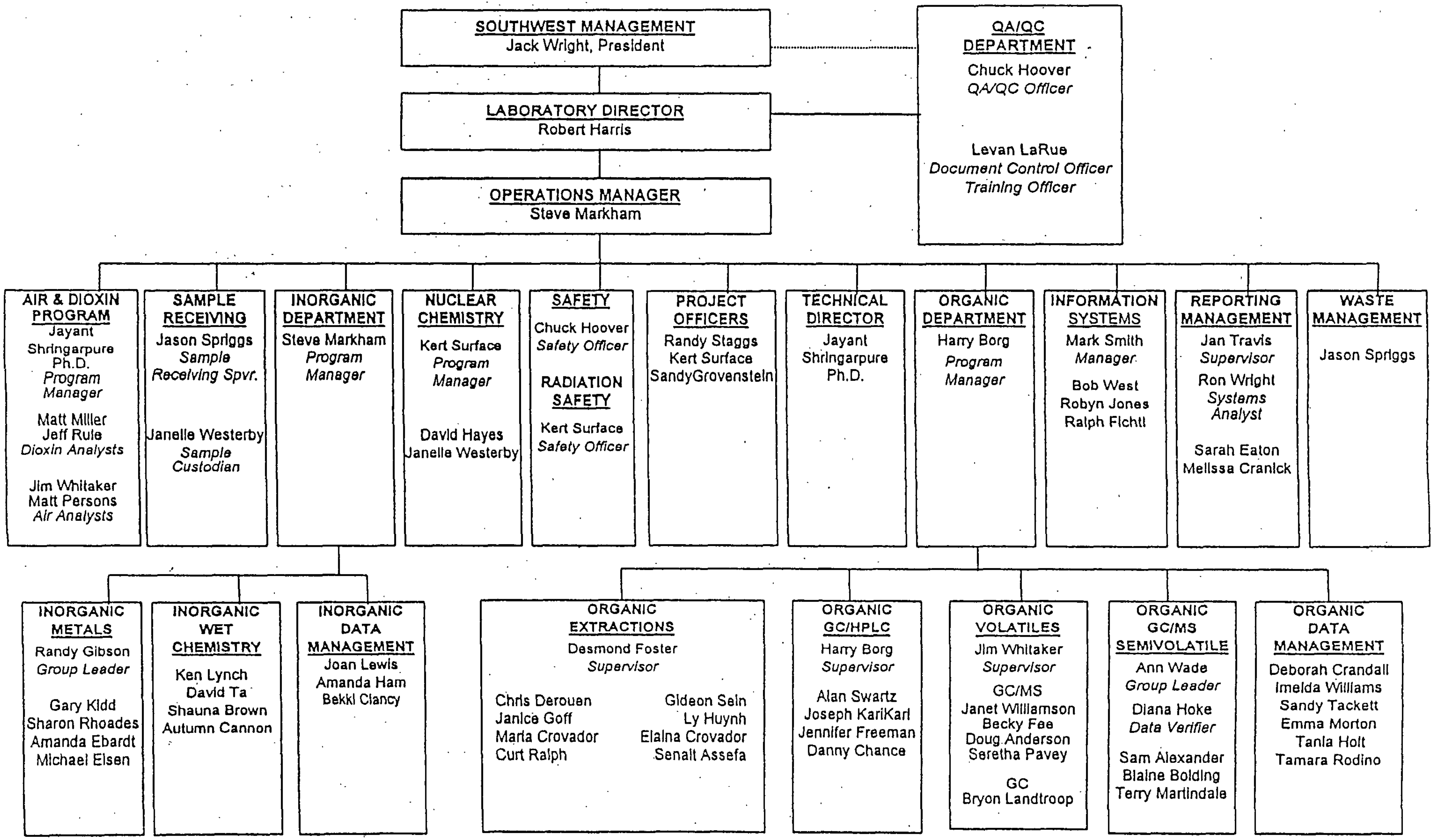
the Laboratory Director and the Supervisor of the affected area to bring the system back under control.

- The Safety Officer has the authority to stop work when he feels the task being performed is harmful to employees.
- The President, Laboratory Director, and Operations manager have the authority to stop work for quality, safety, or financial reasons.

Figure 2.1

Organizational Chart

Southwest Laboratory of Oklahoma • Broken Arrow, Oklahoma



3.0 PERSONNEL TRAINING

3.1 Introduction

Training consists of a combination of formal sessions and "On the Job Training", both of which are detailed in SOP, SWL-GA-104, "Personnel Training". All new employees receive formal training in general orientation, safety and quality assurance as outlined in this SOP. When the training is completed, form 104-ATT1, "General, Quality Assurance and Safety Training for New Employees and/or Temporary Workers" (Fig. 3.1), is signed in acknowledgement that they received and understood the training. Those employees who will work in the radioactive materials control area will undergo further safety training in accordance with SOP, SWL-RD-141, "Radiation Safety". Supervised "On the Job Training" is provided to employees performing the technical tasks.

3.2 Safety Training

Health and safety hazards are initially introduced to all employees through a series of videotapes that cover pertinent safety topics. SOP, SWL-GA-111, "Laboratory Safety Plan" detailing the hazards involved in laboratory work, and the safeguards taken by the employees and Laboratory Management is presented to all employees at the inception of their employment. Refresher training is given to all employees on an annual basis.

3.3 Quality Assurance Training

Quality Assurance training is vital to all technical positions. The "Laboratory Quality Assurance Plan", SWL-GA-100, is discussed with all employees. The "Quality Assurance Training Checklist", shown in Figure 3.2[1] is used for this training. Annual training is conducted following the yearly update of the LQAP and prior to the LQAP effective date.

3.4 SOP Training and Proficiency Demonstration

All personnel are required to read and comply with the Laboratory Quality Assurance Plan and relevant Standard Operating Procedures. After the SOP(s) have been read and training has been completed for the appropriate analytical area, employees involved in analytical and technical data generation are certified as being proficient for those procedures. This proficiency determination is achieved by an "Initial Demonstration of Capability (IDC). IDCs will be performed by each analyst required to perform that method. Records of the IDC along with the raw data are maintained in the employees training file. Personnel shall be re-certified annually in the tasks for which they have been qualified. Details of the IDC are found in SWL-GA-104, "*Personnel Training.*"

3.5 Other Training

Records of classes taken outside of the work environment which are work related and/or aid in job performance are also maintained. These records include certificates, grade cards or transcripts from college classes or college institutions. Documents regarding job descriptions and training requirements with aspects to the employees position are also maintained. These records are updated at least annually.

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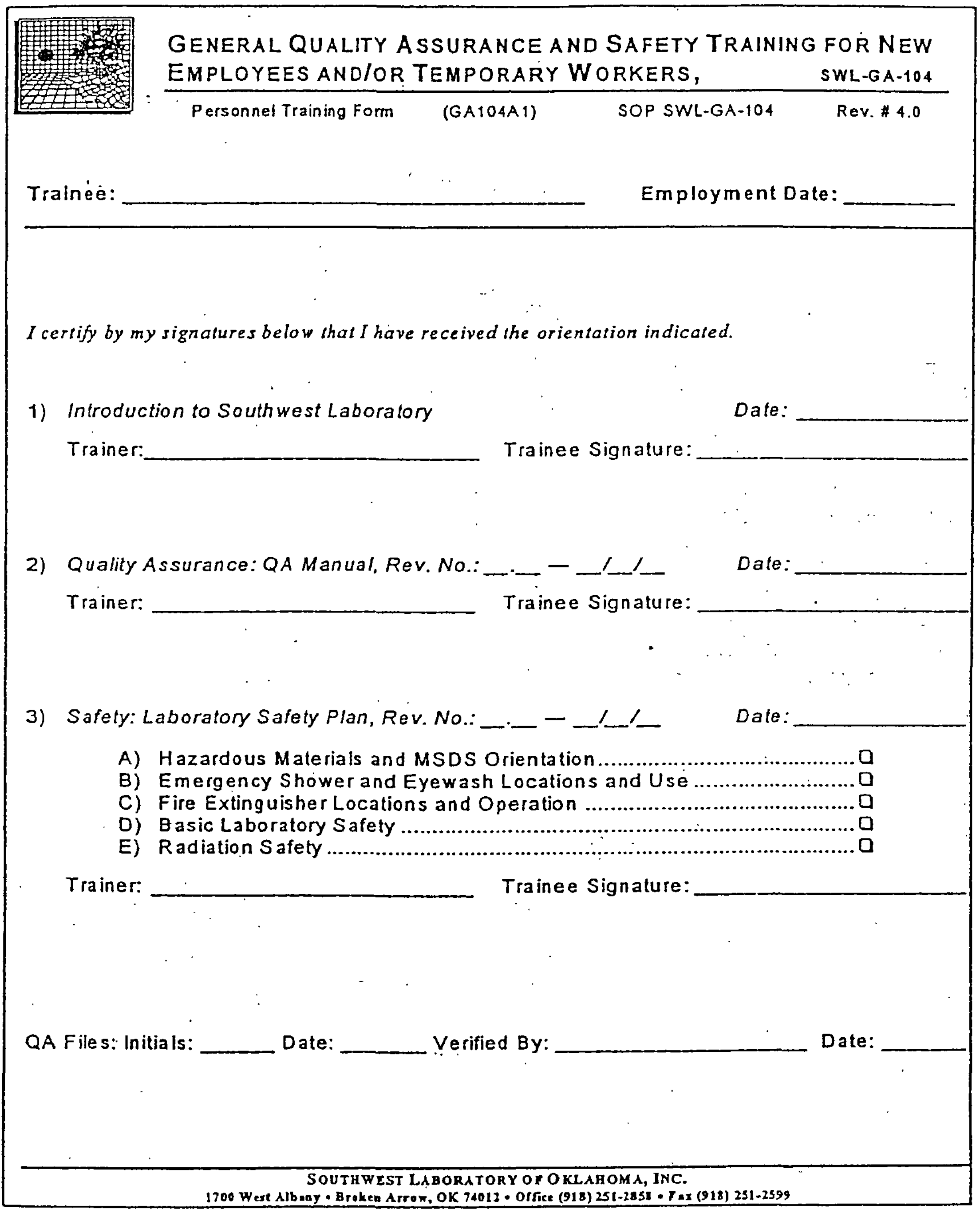
[1] A written, open-book exam is then given to the employee.

Figure 3.1

Training Documentation Forms



GENERAL QUALITY ASSURANCE AND SAFETY TRAINING FOR NEW EMPLOYEES AND/OR TEMPORARY WORKERS, SWL-GA-104

Personnel Training Form (GA104A1) SOP SWL-GA-104 Rev. # 4.0

Trainee: ______________________ Employment Date: __________

I certify by my signatures below that I have received the orientation indicated.

1) *Introduction to Southwest Laboratory* *Date:* __________
Trainer: ______________ Trainee Signature: ______________

2) *Quality Assurance: QA Manual, Rev. No.:* __.__ — __/__/__ *Date:* __________
Trainer: ______________ Trainee Signature: ______________

3) *Safety: Laboratory Safety Plan, Rev. No.:* __.__ — __/__/__ *Date:* __________

- A) Hazardous Materials and MSDS Orientation .... ☐
- B) Emergency Shower and Eyewash Locations and Use .... ☐
- C) Fire Extinguisher Locations and Operation .... ☐
- D) Basic Laboratory Safety .... ☐
- E) Radiation Safety .... ☐

Trainer: ______________ Trainee Signature: ______________

QA Files: Initials: ______ Date: ______ Verified By: ______________ Date: ______

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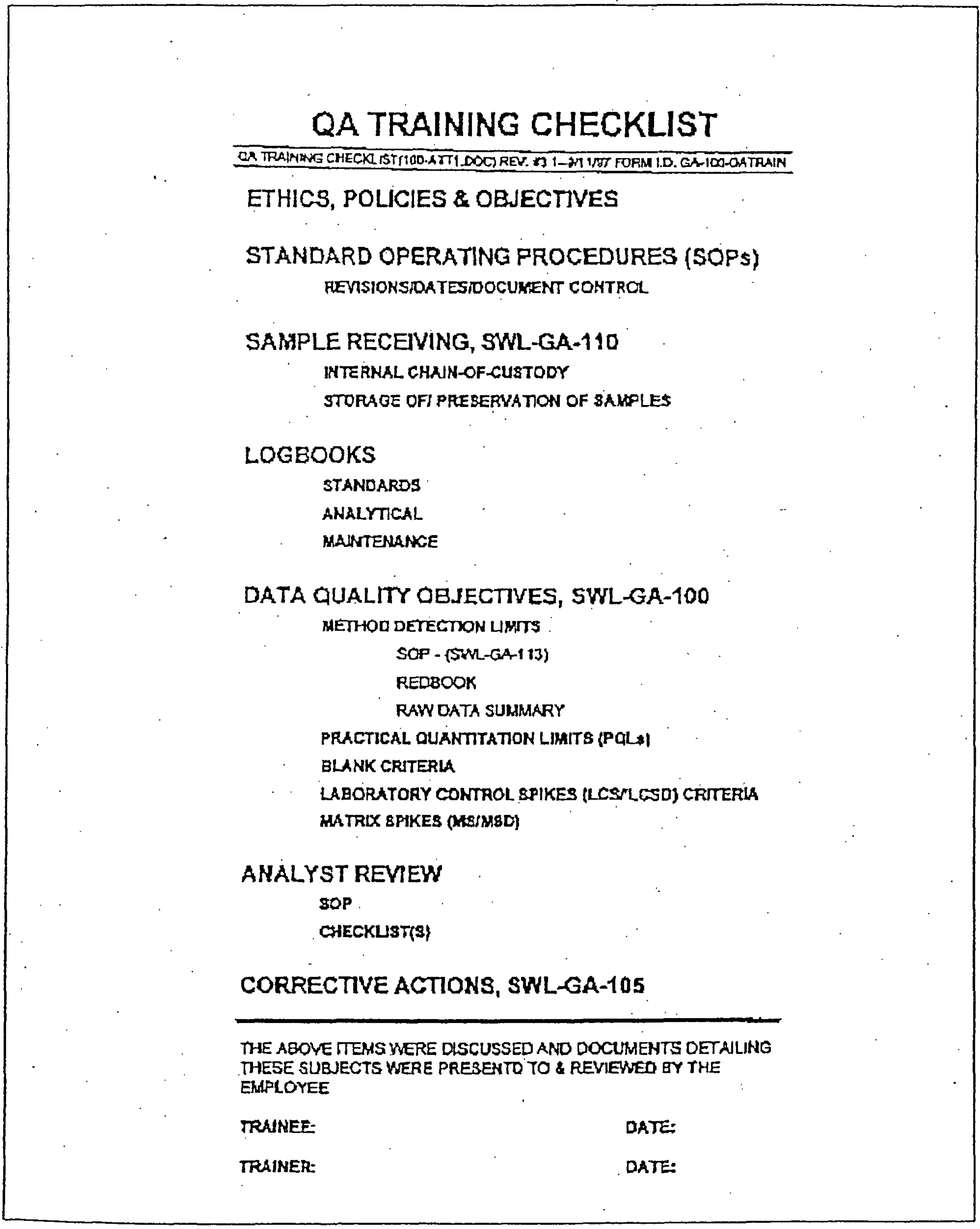
Figure 3.2

QA Training Checklist



QA TRAINING CHECKLIST

QA TRAINING CHECKLIST(100-ATT1.DOC) REV. #3 1—3/11/97 FORM I.D. GA-100-QATRAIN

ETHICS, POLICIES & OBJECTIVES

STANDARD OPERATING PROCEDURES (SOPs)

- REVISIONS/DATES/DOCUMENT CONTROL

SAMPLE RECEIVING, SWL-GA-110

- INTERNAL CHAIN-OF-CUSTODY
- STORAGE OF/ PRESERVATION OF SAMPLES

LOGBOOKS

- STANDARDS
- ANALYTICAL
- MAINTENANCE

DATA QUALITY OBJECTIVES, SWL-GA-100

- METHOD DETECTION LIMITS
  - SOP - (SWL-GA-113)
  - REDBOOK
  - RAW DATA SUMMARY
- PRACTICAL QUANTITATION LIMITS (PQLs)
- BLANK CRITERIA
- LABORATORY CONTROL SPIKES (LCS/LCSD) CRITERIA
- MATRIX SPIKES (MS/MSD)

ANALYST REVIEW

- SOP
- CHECKLIST(S)

CORRECTIVE ACTIONS, SWL-GA-105

THE ABOVE ITEMS WERE DISCUSSED AND DOCUMENTS DETAILING THESE SUBJECTS WERE PRESENTD TO & REVIEWED BY THE EMPLOYEE

TRAINEE: DATE:

TRAINER: DATE:

4.0 SAMPLE CUSTODY, PRESERVATION AND TRACKING

4.1 Sample Custody

A critical aspect of sound sample collection and analysis protocols is the maintenance of strict Chain of Custody (COC) procedures. COC procedures include inventory and documentation during sample collection, shipment, and laboratory processing. A sample is considered to be in an individual's custody if the sample is:

(1) In the physical possession or view of the responsible party.[2]
(2) Secured to prevent tampering.
(3) Placed in a restricted area[3] by the responsible party.

The laboratory is responsible for the documentation of sample custody throughout the handling, processing, and analysis of samples.

The policies and procedures for internal and external chain of custody practices are outlined in SOP SWL-GA-110, "Laboratory Documentation of Sample Custody."

4.2 Sample Control

The Sample Control Program describes the laboratory custody procedures associated with sample receipt, storage, preparation, analysis, disposal, and security. Sample control is maintained at SWLO with several tracking systems designed to protect the integrity of the samples. Tracking systems include the use of laboratory COC procedures and sample analysis requests (in the form of worksheets), internal COC forms, the Laboratory Information Management System (LIMS), laboratory logbooks (extraction, digestion and analytical run logs). For a detailed description of the Sample Control Program see the SOPs SWL-GA-115, "Sample Custodian" and SWL-GA-124, "LIMS for Sample Receiving".

4.3 Sample Containers

During the course of a project, the client will periodically call a Project Officer with a request for sample containers. The order is taken and a "Shipping Request Form" (see Figs. 4.1 and 4.2) is filled out for either "Priority" or "Standard" shipment. Information regarding client, client contact, project reference, requested carrier, shipping address, date the containers are required, quantity requested, sampling matrix, container types and preservative requirements are recorded.

SWLO/AATS uses sample containers supplied by I-Chem and/or ESS. Certified bottles are available if requested by the client, including the necessary documentation. Bottle Certifications are reviewed by Project Officers/Purchasing Agents to verify that

---

[2] The Responsible Party is the person who has signed for custody/possession of the sample(s) or has relinquished custody back into storage areas.

[3] Restricted areas (e. g. Radiation Containment Area, VOA Refrigerator, etc.) are areas of the laboratory which have limited access exclusive to certain employees.

contamination will not effect reporting limits. All documentation of certification is maintained by the bottle shipment personnel.

The Project Officer delivers the Sample Container Request Form to the Sample Receiving department where the sample containers are prepared with the appropriate preservative, packaged (usually in coolers), and shipped with custody seals. The type of shipment, airbill, preservatives used and all other pertinent information is recorded on the request form. The request form is maintained in a file for future reference. Logs are maintained in document shipping.

4.3.1 Preservatives

Preservatives are prepared in the Inorganic or Volatile Organic department. When these preservatives are prepared, lot numbers are assigned. These reagents are checked for purity prior to use and their lot numbers are recorded on the Sample Container Request Form for tracking purposes. Table 4.1 lists the common preservatives used in bottle preparation.

Table 4.1

Preservatives

Preservative	Concentration	Parameters
Hydrochloric Acid (HCl)	1:1	Volatile Organics, Total Petroleum Hydrocarbons, Oil and Grease
Nitric Acid (HNO_3)	1:1	Metals
Sulfuric Acid (H_2SO_4)	1:1	Nitrate/Nitrite, Phenols, Total Organic Chloride (TOX), Total Organic Carbon (TOC), Chemical Oxygen Demand (COD)
Sodium Hydroxide (NaOH)	10N	Sulfide, Cyanide
Zinc Acetate	2N	Sulfide
Sodium Thiosulfate ($Na_2S_2O_3$)	0.008%	Chlorinated Drinking Water Organics

4.4 Sample Storage

All samples are stored in a secured area with separate storage facilities for volatile organics and radio chemistry samples. Unless otherwise specified by the client, all samples are stored at 2^o - 6^oC with a daily monitoring of all storage refrigerators. If temperatures exceed these limits immediate corrective action is implemented to bring the system back under control.

4.5 Sample Disposal

The provisions of 40 CFR, Part 262 apply to SWLO/AATS, its procedures, policies and personnel as a generator of on-site accumulation, and transfer of hazardous waste to a transporter for off site disposal. Details of storage and disposal of samples and hazardous waste are contained in SOP SWL-GA-114, "Hazardous Waste Management Plan".

4.6 Security

Southwest Laboratory is a secured facility[4]. Samples are stored in the Sample Receiving cold storage areas except during laboratory analysis[5]. The worksheet informs the analyst which samples are needed for preparation and/or analysis. All laboratory personnel who receive samples are responsible for the care and custody of all samples. Internal Chain of Custody forms are maintained outside the sample storage area where analysts sign, initial and date the removal and return of samples from storage. Subsets (extracts and digestates) of the samples may be kept in a storage area which is controlled by the appropriate laboratory department manager. In the case of metal digestates, samples are maintained on racks between the ICP and Furnace AA analysis areas. Software security details are found in SOP SWL-GA-102, "Information Systems Quality Assurance Plan."

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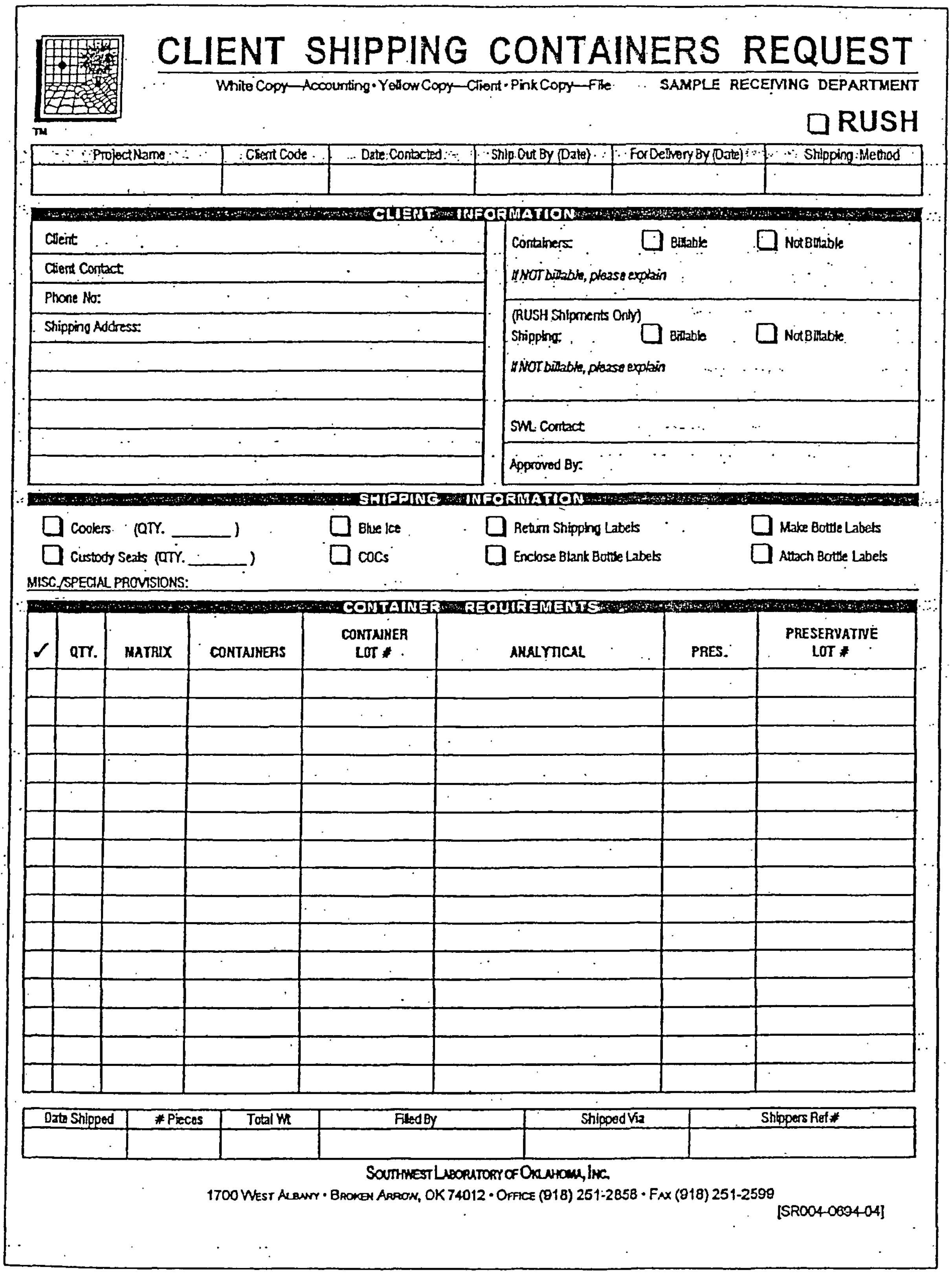
[4] Access is limited to employees. All doors except the front door remain locked, and the front door is monitored by the receptionist. All visitors are required to sign in and are escorted throughout their visit at the laboratory. Sample cold storage areas are secured at night and access is authorized to employees during business hours.

[5] Aqueous metals samples for Navy Projects are stored at room temperature on shelves in the Sample Receiving area unless refrigeration is specified by the project QAPP.

Figure 4.1

Shipping Containers Request Form



CLIENT SHIPPING CONTAINERS REQUEST

White Copy—Accounting • Yellow Copy—Client • Pink Copy—File   SAMPLE RECEIVING DEPARTMENT

☐ RUSH

Project Name	Client Code	Date Contacted	Ship Out By (Date)	For Delivery By (Date)	Shipping Method

CLIENT INFORMATION

Client:
Client Contact
Phone No:
Shipping Address:

Containers: ☐ Billable ☐ Not Billable
If NOT billable, please explain

(RUSH Shipments Only)
Shipping: ☐ Billable ☐ Not Billable
If NOT billable, please explain

SWL Contact:

Approved By:

SHIPPING INFORMATION

☐ Coolers (QTY. ________)
☐ Custody Seals (QTY. ________)
☐ Blue Ice
☐ COCs
☐ Return Shipping Labels
☐ Enclose Blank Bottle Labels
☐ Make Bottle Labels
☐ Attach Bottle Labels

MISC./SPECIAL PROVISIONS:

CONTAINER REQUIREMENTS

✓	QTY.	MATRIX	CONTAINERS	CONTAINER LOT #	ANALYTICAL	PRES.	PRESERVATIVE LOT #

Date Shipped	# Pieces	Total Wt	Filled By	Shipped Via	Shippers Ref #

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[SR004-0694-04]

5.0 FACILITIES

5.1 Broken Arrow

SWLO/AATS's Broken Arrow facility contains 32,000 square feet of space allocated as shown in Figures 5.1 and 5.2.

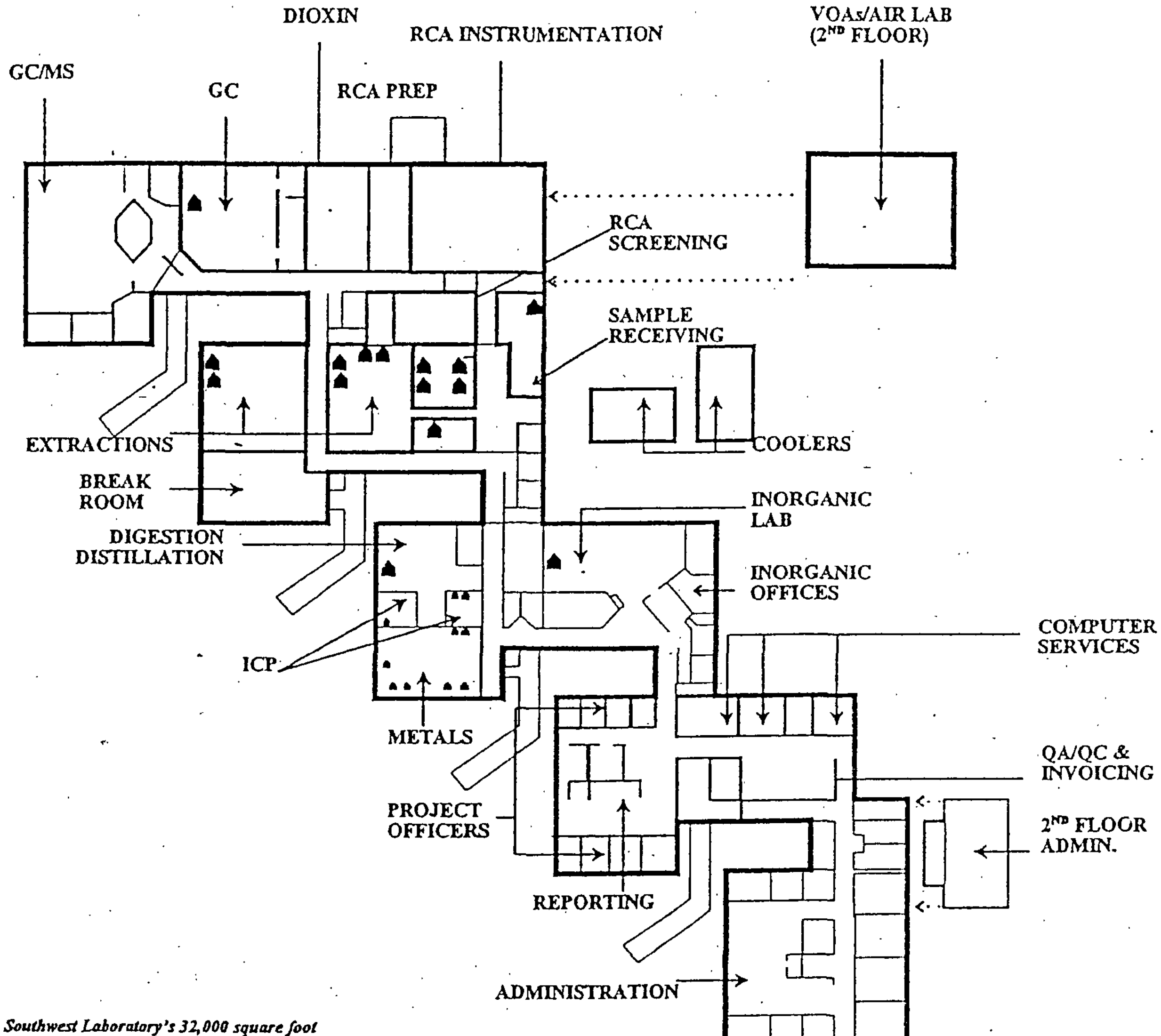
Figure 5.1

Southwest Laboratory Space Allocation

Layout of SWLO's 32,000 sq. ft. facility located in Broken Arrow, Oklahoma	Area Sq. Ft.
Volatile GC/MS	2200
Semivolatile	3200
Pesticide GC/HPLC	1100
Organic Extraction	1800
Metal Analysis	1000
Wet Chemistry	1900
Sample Receiving	1000
Radiochemistry	2600
Administrative/Reporting	4000
Dioxin	1000
Mechanical areas, walkways, and other non-work areas	14,400

Figure 5.2

Facility Layout



Southwest Laboratory's 32,000 square foot facility located in Broken Arrow, Oklahoma.

5.2 Instrumentation and Equipment

An inventory of computer hardware is found in SOP SWL-GA-102, "Information Systems Quality Assurance Plan".

Following is a current list of instrumentation and associated equipment used in providing analytical services:

Lab ID	Description	Year
70M	**GC/MS Hewlett Packard 5970 MSD** Connected to DOS Chemstation with Enviroquant data procession on HP710 Packed/Capillary Injector W/ Jet Separator Hewlett Packard 5890 Gas Chromatograph	1986
70F	**GC/MS Hewlett Packard 5970 MSD** Connected to DOS Chemstation with Enviroquant data procession on HP715a Packed/Capillary Injector Hewlett Packard 5890 Gas Chromatograph Hewlett Packard 7673 Auto Sampler	1987
70K	**GC/MS Hewlett Packard 5970 MSD** Connected to DOS Chemstation with Enviroquant data procession on HP710 Packed/Capillary Injector W/ Jet Spearator Hewlett Packard 5890 Gas Chromatograph Tekmar 2000 with 2016, 2032 Auto Sampler	1988
70J	**GC/MS Hewlett Packard 5970 MSD** Connected to DOS Chemstation with Enviroquant Packed/Capillary Injector Hewlett Packard 5890 Gas Chromatograph Hewlett Packard 7673 Auto Sampler	1988
70P	**GC/MS Hewlett Packard 5970 MSD** Connected to DOS Chemstation with Enviroquant Electronic Pressure Control Capillary Injector Hewlett Packard 5890 Gas Chromatograph Hewlett Packard 7673 Auto Sampler	1989
70A	**GC/MS Hewlett Packard 5970 MSD** Connected to DOS Chemstation with Enviroquant Packed/Capillary Injector Hewlett Packard 5890 Gas Chromatograph Hewlett Packard 7673 Auto Sampler	1989

Lab ID	Description	Year
70C	**GC/MS Hewlett Packard 5970 MSD** Connected to DOS Chemstation with Enviroquant ..data procession on HP715b Packed/Capillary Injector W/ Jet Spearator Hewlett Packard 5890 Gas Chromatograph Tekmar 3000 with 2016, 2032 Auto Sampler	1989
70H	**GC/MS Hewlett Packard 5970 MSD** Connected to DOS Chemstation with Enviroquant data procession on HP715c Packed/Capillary Injector Hewlett Packard 5890 Gas Chromatograph Hewlett Packard 7673 Auto Sampler	1990
71L	**GC/MS Hewlett Packard 5971 MSD** Connected to DOS Chemstation with Enviroquant data procession on HP710 Packed/Capillary Injector W/ Jet Spearator Hewlett Packard 5890 Gas Chromatograph Tekmar 2000 with 2016, 2032 Auto Sampler	1990
71N	**GC/MS Hewlett Packard 5971 MSD** Connected to DOS Chemstation with Enviroquant data procession on HP715b Packed/Capillary Injector W/ Jet Spearator Hewlett Packard 5890 Gas Chromatograph Tekmar 3000 with Precept II Auto Sampler	1991
71I	**GC/MS Hewlett Packard 5971 MSD** Connected to DOS Chemstation with Enviroquant .data procession on HP715b Packed/Capillary Injector W/ Jet Spearator Hewlett Packard 5890 Gas Chromatograph Tekmar 3000 with 2016, 2032 Auto Sampler	1991
71R	**GC/MS Hewlett Packard 5971 MSD** Connected to DOS Chemstation with Enviroquant data procession on HP715b Packed/Capillary Injector W/ Jet Separator Hewlett Packard 5890 Gas Chromatograph Tekmar 3000 with Precept II Auto Sampler	1991
70S	**GC/MS Hewlett Packard 5970 MSD** Connected to DOS Chemstation with Enviroquant data procession on HP715a Packed/Capillary Injector Hewlett Packard 5890 Gas Chromatograph Hewlett Packard 7673 Auto Sampler	1992

Lab ID	Description	Year
72O	**GC/MS Hewlett Packard 5972 MSD** Connected to DOS Chemstation with Enviroquant Packed Capillary Injector Hewlett Packard 5890 Gas Chromatograph Tekmar LSC 2000 with 6016 Auto Sampler	1994
72V	**GC/MS Hewlett Packard 5972 MSD** Connected to DOS Chemstation with Enviroquant Packed Capillary Injector W/ Jet Separator Hewlett Packard 5890 Gas Chromatograph Tekmar 2000 w/2016,2032 Auto Sampler	1994
72U	**GC/MS Hewlett Packard 5972 MSD** Connected to DOS Chemstation with Enviroquant .data procession on HP715b Packed/Capillary Injector Hewlett Packard 5890 Gas Chromatograph Tekmar LSC 3000 W/ Auto Sampler Precept II	1996
72T	**GC/MS Hewlett Packard 5972 MSD** Connected to DOS Chemstation with Enviroquant .data procession on HP715c Electronic Pressure Control Capillary Injector Hewlett Packard 5890 Gas Chromatograph Hewlett Packard 7673 Auto Sampler	1994
72W	**GC/MS Hewlett Packard 5972 MSD** Connected to DOS Chemstation with Enviroquant .data procession on HP715c Electronic Pressure Control Capillary Injector Hewlett Packard 5890 Gas Chromatograph Entech 2000 Preconcentrator	1993
72Z	**GC/MS Hewlett Packard 5972 MSD** Connected to DOS Chemstation with Enviroquant data procession on HP715b Packed/Capillary Injector W/ Jet Spearator Hewlett Packard 5890 Gas Chromatograph Aerotrap Auto Sampler	1993
70S	**High Resolution GC/MS VG-70S** Dioxin Analysis Connected to Vax 4000 data system Packed/Capillary Injector Hewlett Packard 5890 Gas Chromatograph Fisons A200S Autosampler	1989

Lab ID	Description	Year
Autospec	**High Resolution GC/MS Autospec** Dioxin Analysis Connected to Vax 4000 data system Packed/Capillary Injector Hewlett Packard 5890 Gas Chromatograph Fisons A200S Autosampler	1989
Ultima	**High Resolution GC/MS Ultima** Dioxin/PCBs Analysis Connected to Vax 4000 data system Packed/Capillary Injector Hewlett Packard 5890 Gas Chromatograph Fisons A200S Autosampler	1998

Data Systems

HP Chemstation (10)
Enviroquant Software G1701AA Version 3.02

Support Equipment

Purge and Trap, Tekmar LSC2 (2)
Tekmar, ALS - 10 Position Auto Samplers (2)
Tekmar 1000 - Capillary CRYO Focuser (1)
NesLab Refrigeration Cooler (2)
Ultra Sonic Cleaner, Mettler (1)
Frigidaire Coolers - Extract Storage (2)
Tekmar LSC 2000 Purge & Trap Units (4)
Tekmar 3000 Purge & Trap Units (3)
Tekmar 2016, 16 port ALS's (5)
Tekmar 2032, 16 port ALS's (5)
Tekmar 6016 16 port ALS's
Tekmar 6032 16 port ALS's
Precept II Autosamplers (Modified) (3)
Entech 2000 preconcentrator
2016 cm Autosampler for Summa Canisters

GC Laboratory

Lab ID	Description	Year
	Gas Chromatograph Carle TCD (Nat Gas)	1989
	Gas Chromatograph Carle TCD (Nat Gas)	1989
D	**Gas Chromatograph, HP 5890** Tekmar 750 Headspace Autosampler	1991
1	**Gas Chromatograph, HP 5890 ECD/ECD** Dual Split/Splitless Injectors Dual HP 7673 Auto Sampler	1986
2	**Gas Chromatograph, HP 5890 ECD/ECD** Dual Split/Splitless Injectors Dual HP 7673 Auto Sampler	1987
3	**Gas Chromatograph, HP 5890 ECD/ECD** Dual Split/Splitless Injectors Dual HP 7673 Auto Sampler	1987
4	**Gas Chromatograph, HP 5890 ECD/ECD** Dual Split/Splitless Injectors Dual HP 7673 Auto Sampler	1987
X	**Gas Chromatograph, HP 5890 PID/HALL** Tekmar LSC2000 Purge and Trap Tekmar ALS 2016 & 2032 Position Auto Sampler	1987
11	**Gas Chromatograph, HP 5890 FID** Dual Split/Splitless Injectors HP 7673 Auto Sampler	1988
5	**Gas Chromatograph, NPD** Dual Split/Splitless Injectors HP 7673 Auto Sampler	1988
15	**Gas Chromatograph, HP 5890 ECD/ECD** Dual Split/Splitless Injectors HP 7673 Auto Sampler	1988
16	**Gas Chromatograph, HP 5890 Series II ECD/ECD** Dual Split/Splitless Injectors Dual HP 7673 Auto Sampler	1989

Lab ID	Description	Year
17	**Gas Chromatograph, HP 5890 Series II FID** Dual Split/Splitless Injector Dual HP 7673 Auto Sampler	1989
Q	**Gas Chromatograph, HP 5890 PID/FID** Tekmar ALS 2016 & ALS 2032 Position Autosampler Tekmar LSC2000	1989
G	**Gas Chromatograph, HP 5890 PID/FID** Tekmar ALS 2016 & 2032 Position Autosampler Tekmar LSC2000 Archon 2	1989
Y	**Gas Chromatograph, HP 5890 HALL/PID** Tekmar ALS 2016 & 2032 Position Autosampler Tekmar ALS 2000 Purge and Trap	1989
18	**Gas Chromatograph, HP 5890 FID** Split/Splitless Injectors HP 7673 Auto Sampler	1989
7	**Gas Chromatograph HP-5890B ECD** Dual Split/Splitless Injectors Twin 7673A Auto Samplers	1991
	Whatman Hydrogen Generator	1999
	Gas Chromatograph, Fisons 8130 EC/ECD	1994
	Gas Chromatograph, Fisons 8130 EC/ECD	1995
	Gas Chromatograph HP 5890 Series II Tekmar 7000 Automated Headspace Analyzer	1998

Liquid Chromatography

Lab ID	Description	Year
LC5	**Hewlett Packard HPLC (1)** Variable Wavelength Detector 1050C 1050 Autosampler HP 1050 Series Pumps (2) HP 1050 solvent cabinet and column heater	1992
LC4	**Hewlett Packard HPLC System** HP 1100 autosampler HP 1100 pump HP 1100 variable wavelength UV detector Timberline column heater	1997

Lab ID	Description	Year
LC2	**Hewlett Packard HPLC**	1998
	Variable Wavelength Detector 1050A	
	1050 Autosampler	
	HP 1050 Series Pumps (2)	
	HP 1050 solvent cabinet and column heater	
LC3	**Waters HPLC System**	1999
	Waters 712 WISP (autosampler)	
	Waters 510 pump (two)	
	Waters 680 gradient controller	
	Waters 2487 Dual Wavelength UV detector	
	Waters 474 Scanning variable wavelength Fluorescence detector	

Support Equipment

Oven, VWR 1310 (1)
Frigidaire Cooler - Sample Storage (1)

Extractions Laboratory

Concentrators

Kudera Danish (124)	1987
Drying Oven, Blue M	1980
Millipore (24)	1987

Extraction Apparatus

Continuous Liquid Extractors (96)	1987
Soxhlet Extractors (20)	1987
Gel Permeation Clean-up (GPC) Apparatus, ABC1002B	1998
Applied BioSystems UV Detector, Model 757	1988
Gel Permeation Clean-up (GPC) Apparatus, ABC1002B	1991
Sontek UV Detector	1991
Zymark Benchmate	1992
SSI Pumps (2)	
Sontek UV Detectors (2)	
Zymark Turbovap (2)	1992
Marathon GPC	1994
Sontek Pump (1)	
Sontek UV Apparatus (1)	
Delfield Storage Refrigerator, Extracts	
General Electric Storage Refrigerator, Standards	
8-Place Auto Seperatory-funnel Shaker	1988
Glass Columns	
Extraction Apparatus (20) Seperatory Funnels, 2000 ml	
Funnels (75)	

Dioxin Columns (80 sets)	
400 ml Beakers (75)	
250 ml Erlenmeyers (50)	
500 ml Boiling Flask (90)	
Sample Concentrator, Nitrogen Blow Down, 30 Place	1984
Sample Concentrator, Nitrogen Blow Down, 30 Place	1988
Sonic Disruptor, Sonicator (Sonics)	1989
Sonic Disruptor, Sonicator (Sonics)	1990
Sonic Disruptor, Sonicator (Sonics)	1990
Top Loading Balance, Ohaus 400	1992
Top Loading Balance, Ohaus GT 4000	
Knauer UV Photometer (4)	

Metal Analyses Laboratory

Atomic Absorption

Description	Year
Perkin Elmer 5100 Zeeman	1990
PE HGA 600	
PE AS-60	
Varian 400Z GFAA (2)	1992
Buck Scientific Mercury Analyzer 400	1990
Leeman PS200 Mercury Analyzer	1992
Leeman PS200 Mercury Analyzer	1993

Inductively Coupled Plasma

Lab ID	Description	Year
3	ICP 61 E Trace Analyzer Plasma Spectrometer (Thermo Jarrel Ash)	1994
	Auto sampler-TJA	
1	ICP 61E Trace Analyzer (Thermo Jarrel Ash)	1993
2	ICP, 61E Trace Analyzer (Thermo Jarrel Ash)	1994
	Ultrasonic Nebulizer	

Wet Chemistry - Inorganic

Air Compressor
Analytical Balance, Mettler H80
Balance, top-loading, Ohaus model 400 (3)
Centrifuge, Damon IEC Clinical
Conductivity Meter, HACH
Electrode (Ammonia) 95-12 Orion
Electrode (Fluoride) 94-09-00 Orion
Flow Injection Analyzer, Lachet Quikchem

Description	Year
Gooch Crucibles	
Glass Dessicators	
Hoods, Labconco - 6 Foot	
Hot Plates & Stirrers	
Ion Chromatograph, Dionex,2010i	
Dionex-DX100 Ion Chromatograph	
Mettler Ultrasonic Cleaner	
MuffleFurnace, Themdyne, Type 1300	
pH Meter, Orion (Portable)	
Plastic Dessicators, Large	
Spectrometer, Bausch & Lomb, Spectronic 21	
Total Organic Carbon Analyzer, Schmadzu 5050	

TOX Analyzer Mitsubishi 10E-C	
TOX Analyzer — Dohrmann	
Carbon Analyzer Leco CR12	
Dohrman Microcoulometer MCTS-20	
Vacuum-Pressure Pump, Thomas	
Balance-Anayltical American Scientific Products Model SP180	
Balance- Top Loading; Ohaus AS120	
Balance- Top Loading; Ohaus GT2100	
BOD Incubator - White Westinghouse, Model:MS-U14F3BW4	
BOD Incubator - E Series	
PH Meter, Fisher Scientific	
Centrifuge, Fisher Model: 225	
IEC Clinical COD Reactor, Model: 2090-OIC	
Queue Radial Shaker	
Turbidmeter, HF Instruments: DRT100B	
Drykeeper Desicators (10)	
Blue M Oven, Stabletherm (2)	
Labline, L-C- Model 2310, Model 3512	
Imperial IV Water Bath	
Griddles (Teflon coated hotplates for use in metals digestion) (8)	

High Hazards Laboratory

Description	Year
Analytical Balance, ASP Model 2410	
Blender, Waring	
Chemical Carcinogen Glove Box, LABCONCO	
Heated Dessicator, Precision Scientific	
Shaker, Eberbach	
Special Glassware	
Columbia Fisheries Dioxin Protocol	
Sonic Disruptor, Sonicator - Heat Systems	
Muffle Furnace, Linberg	
Samsung Storage Refrigerator	
Laboratory Furniture	
1 - Four Foot Hood, KEEWANEE	
1 - Six Foot Hood, KEEWANEE	

Data Management

Lims System

Description	Year
Computer, Gateway 2000 P5-90	1994
32 MB Memory, 1 G Hard Drive (2)	
2 G Tape Backup	
450 Watt Ups	
Software:	
SCO Unix — Version 3.2v4.2	
TCP/IP 1.1.3F	
Informix:	
Online — 5.00.UD5	
1-SQL — 4.10.UC2	
1-STAR — 5.00.UD5	
WYSE 60 Terminals (1)	

GC/MS Lab (Voa Lab Server) This system is used for retrieval of historical data only now.

Description	Year
Computer, Gateway 2000 P5-100	1996
32 MB Memory	
2 G Hard Drive	
2 G Tape Backup	
Ups	
Software:	
SCO Unix — 3.2v2.0	
TCP/IP 1.1.3F	
Informix:	
Online — 5.00.UD5	
1-SQL — 4.10.UC2	
1-STAR — 5.00.UD5	

Metals Lab

Description	Year
Computer, Gateway 2000 P5-90	1994

82 MB Memory
4 G Hard Drive
2 G Tape Backup
Ups
Software:
- SCO Unix 3.2v4.2
- TCP/IP 1.2.10
- Informix:
  - Online — 5.01.UD2
  - I-SQL — 4.10.UC2
  - I-STAR — 5.01.UD2

Spare

Description	Year
Computer, Gateway 2000 P5-60	1994

16 MB Memory
4 G Hard Drive
2 G Tape Backup
Ups
Software:
- SCO Unix 3.2v4.2
- TCP/IP 1.2.1i
- Informix:
  - Online — 5.00.UD5
  - I-SQL — 4.10.UC2
  - I-STAR — 5.00.UD5

Dev. Sys.

Description	Year
Computer, Gateway 2000 486DX2/50	1992

16 MB Memory
500 Hard Drive
2 G Tape Backup
Ups
Software:
- SCO Unix 3.2v2.05
- TCP/IP 1.1.3F
- CGI 1.1.02
- Informix:
  - Online — 5.00.UD5
  - I-SQL — 4.10.UC2
  - I-STAR — 5.00.UD5

Miscellaneous Computer Equipment

Terminal Ports (196)
Computer Ports (96)
Packard Bell 2400 baud modems (4)
One Hundred Computers, IBM PCs and Compatibles 1991-1996
40 MB to 2.5 GB Disk Drives
Streamer Tape Back-Up System (2)

Mixed Waste Laboratory/Radiochemistry

Description	Year
Oxford HpGe Gamma Spectroscopy System 40 Percent efficient detector, Be thin window, using Oxford GammaTrac analysis software.	1995
Oxford HpGe Gamma Spectroscopy System 40 Percent efficient detector, Be thin window, using Oxford GammaTrac analysis software.	1995
Oxford Oasis Alpha Spectroscopy System 20 Chamber/Detector series using TC256 NIM modules.	1995
Oxford LB4100 Low Background Gas Proportional Alpha/Beta Counting System Multi-setector system running 8 detectors in two drawer assemblies.	1995
Packard Tri-Carb 2550 TR/LL Liquid Scintillation Counting System	1995
The Nucleus Sodium Iodide Gamma Detector System 4 NaI Detector array system using DMR-II Digital Multiplexer Router and associated analytical software.	1995
Ludlum Radon Flask Counter, Lucas Cell Counter (7)	1995
ChemCheck Kinetic Phosphorescence Analyzer ChemCheck KPA-11.	1995
Ordela Photon-Electron-Rejecting Alpha Liquid Scintillation (PERALS) Spectrometer	1995
Ludlum Handheld 1X 1 NaI microR Survey Meter	1995
Ludlum Model 3 GM Survey Meter with Pancake Probe (2)	1995
Ludlum Model 177 Scaler with Hand Frisk Platform (2) Platform – 2 each, pancake type halogen quenched G – M.	1995
Ludlum Model 177 Scaler with Hand Frisk Platform (2) Platform – 3 each, pancake type halogen quenched G – M.	1995

Support Equipment

Description	Year
Accumet pH Meter (2)	
Denver Instruments Analytical Balances (2)	
Mettler PM2000 Top Loader Balance	
Marathon 10K Large 32 location Centrifuge	
Fisher Centrifuges (2)	
Large Muffler Furnace	
Large Drying Oven	
Ball Mill (60 can capacity)	
Large Industrial Jaw Crusher	
Explosion Proof Freezer	
Electroplating Unit	
Tritium Distillation Column Array (8)	

Dell 4300 (SWLO1)
- Two PIII 450mHz Processor
- 512m Memory
- (5) 18gig hard drives
- UPS
- File Server

Gateway NS-7000 (SWLO2)
- Two PII 333mHz Processor
- 512m Memory
- (6) 6gig
- (1) 2gig
- UPS
- Exchange, SQL, Information Server, Proxy Server
- UPS

Micron (SWLO3)
- One PII 350mHz Processor
- 196m Memory
- (One) 6gig hard drive
- (One) 4gig hard drive
- DHCP, Wins, printer server

6.0 EQUIPMENT MAINTENANCE

6.1 Preventive Maintenance

A preventive maintenance program for the instrumentation ensures fewer interruptions of analyses, personnel efficiency, and lower repair costs. It eliminates premature replacement of parts, and reduces discrepancy among test results. It increases reliability of results. Detailed information on preventive maintenance is found in SOP SWL-GA-127, "Preventive Maintenance".

6.1.1 The laboratory has established the following preventive maintenance program:

6.1.1.1 Each type of equipment/instrument has a written Standard Operating Procedure (SOP) describing the methods for routine inspection, cleaning, maintenance, testing, calibration, and/or standardization of the equipment. Instrument operating manuals are kept near the instrument or where analysts have easy access.

6.1.1.2 Analysts using the instruments are properly trained and develop trouble-shooting skills in equipment failure to reduce dependence upon outside servicing agencies. In complicated cases, the servicing agency or supplier is called to solve the problem.

6.1.1.3 Written equipment records are kept to document all inspection, maintenance, trouble-shooting, calibration, or modifications. Whenever maintenance is performed on an instrument, it is documented in a preventive maintenance logbook, which is kept near the equipment. The records contain the date (month, day, year), description of the maintenance done, the actual findings, the name of the person doing the maintenance, a statement of whether the maintenance operations were routine, and if those operations followed the written SOP and the documented return to control after maintenance was completed.

6.1.1.4 Performance criteria is established for judging when data from instrument performance checks indicate the need to make adjustments in the instrument operating conditions.

6.1.1.5 Backup instrumentation is prevalent throughout the laboratory. This ensures the client that should an instrument develop problems, the samples can still be analyzed on the backup instruments.

6.2 Chromatographic Instruments

Preventive maintenance is done through daily performance checks. Parameters such as retention time and response factors are observed and back-checked with prior operational performance. Details are found in SOPs, SWL-OP-201, "Preventive Maintenance of Hewlett Packard and Fisons Gas Chromatographs", and SWL-GA-103, "Tekmar Maintenance".

In addition, the following are done:

- Septa are replaced as needed.
- Incoming gas drying cartridges are changed whenever the color of the absorbent is noticed.
- Effluent absorbent traps are changed every month.
- Columns (GC and HPLC) are checked by performance and operating conditions when in use, or prior to use.
- Oven performance checked daily prior to use.

6.3 Gas Chromatography/Mass Spectroscopy (GC/MS)

The preventive maintenance is provided by Hewlett-Packard on a semi-annual basis.

6.4 Inorganic Instrumentation – the preventive maintenance schedules are in SOP, SWL-IN-103, "Inorganic Preventive Maintenance Schedule".

6.5 General Laboratory Equipment

Analytical balances of various capacities and operational modes are calibrated annually by a licensed specialist and officially recorded as verification of performance.

Balances calibrations are checked with standard Class S weights before usage.

7.0 LABORATORY METHODS

7.1 References

The laboratory follows analytical procedures based on EPA-approved methods for both inorganic and organic analyses of multimedia environmental samples. Methods used for inorganic and organic analysis of routine samples are based on guidance documents such as "SW846 Test Methods for the Evaluation of Solid Waste" (3rd Edition), 40 CFR part 136 as published in the Federal Register, "Standard Methods for the Examination of Water and Wastewater", 18th Edition, 1992", and "The Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air". Unless otherwise notified by the client, the above methods shall be followed. All methods are available to the analysts. The laboratory's Standard Operating Procedures for each method are available to clients. Table 7.1 lists the analytical protocols utilized at Southwest Laboratory. Table 7.2 lists the most common analytical methods used. Table 7.3 gives estimated monthly production capacity for the laboratories. These production numbers can vary due to matrix or method.

If typical methods are rendered ineffective by matrix interferences, or if analytical parameters (detection limits, precision, specificity, etc) would require method variance (e. g. modification of the method), the Project Officer will notify the client/contractor of the method modification. A copy of the variance will be sent to the client/contractor to seek approval of the method change. The modification request must show that the conditions for the laboratory variance are similar to the expected conditions (e. g. sampling and handling techniques, environmental matrix concentration range, interferences) in the EPA approved methods.

Changes in operations prior to instrumental analysis (e. g. sample preparation and storage) must be documented and authorized by the client.

When newly released versions of a method are promulgated, the laboratory will evaluate the significance of any modifications made to the method. The laboratory will start the process of method development , validation and proficiency testing after evaluating the demand for the method by laboratory clientele.

7.2 Analytical Protocols

An initial demonstration of method performance is made prior to using any method. This same practice applies if at any time there is a change of personnel or instrument type. This demonstration is performed by completing the following:

- Analysis of four replicate aliquots of a quality control check standard where the comparability to the method, or laboratory generated acceptance criteria, are compared for precision and accuracy in required methods.
- Analysis of a single blind performance sample which meets method acceptance criteria.
- Analysis to determine method detection limits, for applicable methods.

The Quality Assurance Officer (QAO) has overall responsibility for overseeing that the method demonstrations are performed. The Department Supervisors are responsible for the maintenance of the data for their departments and ensuring the demonstration is performed when necessary.

TABLE 7.1

Analytical Protocols Used

Standard Methods for the Examination of Water and Wastewater: APHA, AWWA and WPCG, 18th Edition, 1985.

Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act, USEPA.

40CFR, Part 136, Federal Register, Volume 49, Number 209, Friday, October 26, 1984.

Methods for Chemical Analysis of Water and Wastes, USEPA, EPA-600/4-79-020, March 1979 and as amended December 1982 (EPA-600/482-055).

Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater, USEPA, EPA-600/4-85-057, July 1982 and as subsequently amended.

Pesticide Analytical Manual, Volume I, Food and Drug Administration, Revised September 1977.

Recommended Methods of Analysis for the Organic Components Required for AB1803, State of California, 5th Edition, April 1986.

NIOSH Manual of Analytical Methods, US Department of Health and Human Services, 3rd Edition, February, 1984.

500 Series Methods-Drinking Water Test Methods, USEPA Compendium of Methods.

Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, USEPA, EPA-600/4-84-041, April 1984.

Annual Book of ASTM Standards, Water and Environmental Technology, ASTM, 1987, Volume 11.01 and 11.02.

Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, USEPA SW846, 3rd Edition, September 1986, and Update III, December 1996.

Statement of Work (SOW) Multimedia, Multiconcentration Organics, US EPA Contract Laboratory Program, 3/90.

Statement of Work (SOW) Multimedia, Multiconcentration Organics, US EPA Contract Laboratory Program, OLM03.2.

Statement of Work (SOW) Multimedia, Multiconcentration Organics, US EPA Contract Laboratory OLM04.2.

State of Work (SOW) Organic Analysis, Low Concentration Water OLC01.2 (10/92) and OLC02.0 (3/95).

Statement of Work (SOW) Multimedia, Multiconcentration Inorganics, US EPA Contract Laboratory Program, ILM03.1.

Statement of Work (SOW) Multimedia, Multiconcentration Inorganics, US EPA Contract Laboratory Program, ILM04.0.

Superfund Analytical Methods for Low Concentration Water for Inorganic Analysis (10/91).

Prescribed procedures for Measurement of Radioactivity in Drinking Water, EPA 600/4-80-032, August, 1980

TABLE 7.2

Analytical Methods Typically used by Southwest Laboratory

INORGANICS S = Soil, Sediment, Sludge W = Water, Ground Water, Surface Water P = Petroleum

Method	Matrix	Description
EPA 305.1	W	Acidity
EPA 310.1/SM2320B	W	Alkalinity
EPA 350.2/350.3	W	Ammonia
EPA 405.1	W	BOD
EPA 300.0/9056	W	Bromide
EPA 130.2	W	Hardness
EPA 351.3	W	Total Kjeldahl Nitrogen
EPA 9071B/1664A	W/S/P	Oil & Grease
EPA 415.1/9060	W/S/P	Total Organic Carbon
EPA 365.1	W	Phosphorus, Total
EPA 420.2/9066/420.4	W/S/P	Phenols
EPA 410.1/410.2/410.4	W	Chemical Oxygen Demand
EPA 160.1	W	Total Dissolved Solids
EPA 160.2	W	Total Suspended Solids
EPA 160.3	W	Total Solids
EPA 160.4	W	Total Volatile Solids
EPA 160.5	W	Total Settleable Solids
EPA 300.0/9056	W/S	Chloride, Sulfate, Nitrate, o-Phosphate, Nitrite, Fluoride
EPA 340.2/300.0/9056	W	Fluoride
EPA 353.2/300.0/9056	W	Nitrate
EPA 354.1/300.0/9056	W	Nitrite
EPA 9010A/9012A/335.1/335.3/335.4/4500 CN E/4500 CN G	W/S	Cyanide
SM4500 B	W	Cyanide, Amenable
EPA 375.4/9038/9056/300.0	W	Sulfate
EPA 376.1/9030B	W/S/P	Sulfide
EPA 9034	W/S/P	Sulfide, Acid Soluble and Insoluble
EPA 377.1	W	Sulfite
EPA 325.3/9252A/300.0/9056/4500Cl F	W	Chloride
EPA 120.1/9050A	W	Specific Conductance
EPA 150.1/9040/9045A	W/S	pH
EPA 6010B/200.7	W/S/P	Metals by ICP
EPA 206.2/7060, 239.2/7421, 204.2/7041, 213.2/7131A 270.2/7740, 279.2/7841/200.9/218.2/7191/272.2/7761/200.9	W/S/P	Furnace AA
EPA 7196/7195/218.4/218.6	W/S/P	HexCr
EPA 245.1/245.2/7470A/7471A	W/S	Mercury by Cold Vapor
CLP ILM04	W/S	CLP Inorganics
EPA 1664	W	TRPH
EPA 1010	S/P	Ignitibility
EPA 1110	S/P/W	Corrosivity
EPA 330.4/4500 Cl	W	Chlorine, Total Residual
EPA 365.1/300.0/9056	W	Orthophosphate
EPA Reactivity, Section 7.3 SW-846	W/S/P	Reactivity
EPA 180.1	W	Turbidity
EPA 9095A	W/S/P	Paint Filter Liquids Test

SAMPLE PREPARATION

S = Soil, Sediment, Sludge W = Water, Ground Water, Surface Water P = Petroleum

Prep#/Method#	Matrix	Description
3020A/7060A, 7421, 7440, 7841	W	Acid Digestion
3050A/6010B, 7060A, 7421, 7740, 7841	S	Acid Digestion
3510C/8080A, 8081A, 8082, 8041, 8141A, 8310	W	Separatory Funnel
3520C/8080A, 8081A, 8082, 8270C	W	Continuous Liq/Liq
3540C	S	Soxhlet
3550B/8080A, 8270C, 8140, 8141, 8310, 8330	S	Ultrasonic
3580A/8080A, 8081A, 8082, 8270A	P	Waste Dilution
5030B/8010A, 8020, 8021, 8240A, 8260B	W/S	Purge & Trap
5035/8021, 8260B	S	Purge & Trap
3660B/8081A	W/S	Sulfur Cleanup
3665B/8082	W/S	Sulfuric Acid Cleanup
3640A/8270C, 8081A	S	Gel Permeation Chrom.
8330/8330	W/S	Methanol Extraction Acetonitrile Extraction
1311, 6010B, 8081A, 8260B, 8270C, 8151A, 7470A	W/S/P	TCLP
1312	W/S/P	SPLP

ORGANICS

S = Soil, Sediment, Sludge W = Water, Ground Water, Surface Water P = Petroleum

Method	Matrix	Description
EPA 8010A/601	W	Halogenated Volatile Organics by GC
EPA 8010A	S	Halogenated Volatile Organics by GC
EPA 8011	W/S	Ethylene Dibromide GC
EPA 8015B/FL PRO/CA/IOWA OA-1/OA-2/OK/TN/TNRCC/8015AZ	W/S	Total Petroleum Hydrocarbons DRO/GRO
EPA 8020/602	W	Aromatic Volatile Organics by GC/PID
EPA 8020	S	Aromatic Volatile Organics by GC/PID
EPA 8021	W/S	Volatiles by GC/PID/HALL in series
EPA 8041	W/S	Phenol
EPA 8080A/8081A/8082/608	W/S/P	Organochlorine Pesticides/PCBs
CLP OLMO1.8/OLM03.2/OLM04.2	W/S	Organochlorine Pesticides/PCBs
CLP OLCO1	W	Low Conc. Organics (Pesticides/PCBs)
EPA 8140/8141A	W/S	Organophosphorus Pesticides
EPA 8150B/8151A	W/S	Chlorinated Herbicides
EPA 8240B/8260B/624/524.2	W/S/P	Volatile Organics by GC/MS
CLP OLMO1.8/OLM03.2/OLM04.2	W/S	CLP Volatile Organics
CLP OLCO1	W	Low Conc. Organics (Volatiles)
EPA 8270B/8270C/625	W/S/P	Semivolatile Organics by GC/MS
CLP OLMO1.8/OLM03.2/OLM04.2	W/S	Semivolatile Organics by GC/MS
CLP OLCO1	W	Low Conc. Organics (Semivolatile)
EPA 8310/610	W/S	Polynuclear Aromatic Hydrocarbons by HPLC
EPA 8330	W/S	Explosives
EPA 8280	W/S	Polychlorinated Dibenzo-p-Dioxins/Furans
EPA 8290/1613	W/S	Polychlorinated Dibenzo-p-dioxins/Furans by HRMS
TO-1	AIR	Volatile organics using Tenax Adsorption
TO-3	AIR	Volatile organics using cryogenic preconcentration
TO-14	AIR	Volatile organics using summa canisters
TO-4	AIR	Pesticides/PCB's
TO-13	AIR	HPLC or GC/MS semi-volatiles
TO-9	AIR	Dioxins

RADIOLOGICAL

S = Soil, Sediment, Sludge W = Water, Ground Water, Surface Water P = Petroleum

Method	Matrix	Description
EPA 900.0 Mod./9310	W/S	Gross Alpha
EPA 900.0 Mod./9310	W/S	Gross Beta
EPA 900.1 Mod./9315	W/S	Total Radium (Alpha)
EPA 903.1 Mod.	W/S	Radium 226 (RN/DEEM)
EPA 901.1 Mod.	W/S	Radium 226 (G.Spec.)
EPA 904.0 Mod./9320	W/S	Radium 228
EPA 901.1 Mod.	W/S	Gross Gamma
EPA 906.0 Mod.	W/S	Tritium
EPA 905.0	W/S	Radioactive Strontium
EPA 905.0	W/S	Strontium 89
EPA 905.0	W/S	Strontium 90
EPA 907/908 M	W/S	Isotopic Uranium
EPA 907/908 M	W/S	Uranium 233/234
EPA 907/908 M	W/S	Uranium 235
EPA 907/908 M	W/S	Uranium 238
EPA 907/908 M	W/S	Uranium (Total)
EPA 907/908 M	W/S	Isotopic Thorium
EPA 907/908 M	W/S	Thorium 228
EPA 907/908 M	W/S	Thorium 230
EPA 907/908 M	W/S	Thorium 232
EPA 907/908 M	W/S	Thorium 234

TABLE 7.3

Estimated Monthly Production Capacity for SWLO/AATS – Broken Arrow

Department	Nominal	Peak
Organics Department		
GC/MS		
Volatiles	1,950	2,166
Semivolatiles	1,300	1,625
Dioxins	1,516	1,733
Special Services	542	758
GC/LC		
Volatiles	823	975
Herbicides	325	542
Pesticides/PCBs	975	1,408
Explosives	650	866
Miscellaneous	650	866
Inorganics Department		
Metals		
AA Furnace	1,083	1,300
Cold Vapor	1,083	1,300
ICP	1,083	1,300
Wet Chemistry		
Anions	1,516	1,820
Carbon, Organic	866	1,040
Chloride, Organic	650	866
Cyanide	866	1,300
Oil & Grease	520	866
Total Petroleum Hydrocarbons	866	1,300
Phenols	520	650
Sulfides	520	650
Hazardous Waste Department		
GC/MS		
TCLP Extraction/Analysis	520	650
TCLP Zero Headspace	468	624

Capacity:	Monthly maximum capacity
Metals:	Production figures are set for samples, not individual elements. Most samples are analyzed for multiple elements.
Categories of Analysis:	Production categories include various analyses of a similar nature (e. g. GC/LC Volatiles include SW846-8020, SW846-8010, EPA 601, BTEX, THM)

8.0 CALIBRATION

Calibration is the process for determining the correctness relative to physical or chemical standards used or assigned values in scales of measuring instruments. It establishes a reproducible reference point to which all sample measurements are correlated. Instruments are calibrated as per the SOP. All calibrations used are documented in run logs and calibration summary forms for both Initial and Continuing Calibrations. Section 10.0 describes the QC checks used to verify instrument calibrations.

8.1 Geiger Counter

Geiger counters are sent annually to an independent contractor for calibration.

8.2 Atomic Absorption Spectrophotometer Systems (AAS)/Inductively Coupled Argon-Plasma Emission Spectrophotometer (ICAP).

For graphite furnace AA and ICP, the instruments are calibrated daily, or each time the instrument is set up for measuring different analytes. Operating Parameters are found in the Method SOPs.

Calibration standards are prepared fresh before each analysis and are discarded after use. These calibration standards are purchased from commercial vendors and are certified by the vendor as to traceability to standard reference materials.

8.2.1 Detailed calibration procedures for metals analysis are found in the following SOPs:

- SWL-IN-202, "ILM03.0 and ILM04.0 Analysis of Mercury by Cold Vapor"
- SWL-IN-203, "CLP ILM03.0/ILM04.0 Analysis of Metals by Inductively Coupled Argon Plasma"
- SWL-IN-204, "CLP ILM03.0/ILM04.0 Analysis of Metals by Graphite Furnace Atomic Absorption"
- SWL-IN-207, "Mercury SW846 Methods 7470A/7471A Digestion and Analysis"
- SWL-IN-209, "Metals by SW846 Method 6010A Inductively Coupled Argon Plasma (ICP)"
- SWL-IN-210, "GFAA SW846 7000 Series Analysis"

8.3 Spectrophotometers

The manufacturer instructions for instrument operation are followed for proper operating procedures.

Spectrophotometers are calibrated daily prior to any sample analysis. The calibration standards are prepared from reference materials or commercial standards (traceable to EPA or NIST reference materials) at a minimum of three concentrations, including a calibration blank to cover the anticipated range of measurements. The requirement for an acceptable initial calibration is a correlation coefficient equal to or greater than 0.996 (based on statistical historical data). Before sample analysis, an initial calibration verification standard is analyzed. The response of this standard must be within ±10% of the true values. If not, the instrument must be re-calibrated.

The instruments are also checked for wavelength calibration. For UV/IR instruments, polystyrene film is used to calibrate the wavelength.

All absorption cells (i.e., cuvettes, quartz cells) are kept clean, free of scratches and fingerprints, and are rinsed with the solution to be analyzed prior to use. Matched cells are checked to see that they are equivalent by placing portions of the same solution in both cells and taking several readings of the transmittance or absorbance.

8.4 Total Organic Carbon Analysis (TOC)

For TOC calibration, a known concentration of potassium hydrogen phthalates (KHP) solution is analyzed as the calibration solution on the carbon analyzer. A minimum of three calibration solutions encompassing the linear range of the carbon analyzer is prepared and analyzed daily or prior to the sample analysis. Linear regression analysis of standard concentration in ug C versus response in millivolts (mv) is done to obtain a calibration curve. The correlation coefficient must be equal or greater than 0.995 or the standards are rerun and a new correlation coefficient is calculated. Details of TOC calibration are found in the SOPs SWL-IN-310, "Total Organic Carbon (TOC) in Water", and SWL-IN-311, "Total Organic Carbon (TOC) in Soil/Sediment".

8.5 Laboratory Instrumentation — Organic Processing Section

Gel Permeation Chromatograph (GPC)

8.5.1 The following general procedure is employed for preparing the GPC system for calibration:

- *Packing the column* — Place 70 grams (g) of Bio Beads SX-3 in a 400 milliliter (mL) beaker. Cover the beads with 50/50 methylene chloride and allow the beads to swell overnight before packing the column. Transfer the swelled beads to the column and start pumping solvent through the column, from bottom to top, at 5.0 mL/minute. After approximately 1 hour, adjust the pressure on the column to 7-10 psi and pump an additional 4 hours to remove air from the column. Adjust the column pressure periodically as required to maintain 7-10 psi.
- *GPC calibration solutions* — Prepare a calibration solution in methylene chloride containing the following analytes at the minimum concentrations, as listed below:

Compound	Concentration mg/mL
Corn Oil	25.0
Bis(2-Ethylhexyl Phthalate)	0.5
Methoxychlor	0.1
Perylene	0.02
Sulfur	0.08

- The GPC column is calibrated daily using the following procedure:
    1) *Calibration of the column* — Load sample loop #1 with calibration solution. Switch the value so that the GPC flow is through the UV flow-through cell. Adjust the detector to produce a UV trace that meets the following requirements.
        A. The corn oil and the phthalate peaks exhibit ≥ 85% resolution.
        B. The phthalate and the methoxychlor peaks exhibit ≥ 85% resolution.
        C. Methoxychlor and perylene peaks must exhibit ≥ 85% resolution.
        D. Perylene and sulfur peaks must not be saturated and must exhibit ≥ 90% baseline resolution.
    2) Choose the "collect time" to extend at least 10 minutes after the elution of pentachlorophenol. Wash the column at least 7 minutes between samples.
    3) Typical parameters selected are: Dump time = 16 minutes; collect time = 10 minutes; and wash time = 7 minutes; Elute volume collected = 50 ml.

8.5.2 Gas Chromatographs (GC) — The external calibration procedures are found in the following technical SOPs:

SWL-OP-400, "Pesticides/PCBs as Aroclors by GC Capillary Column Technique (Air)".

SWL-OP-401, "Determination of Pesticides and PCBs as Aroclors for AFCEE".

SWL-OP-402, "Determination of Pesticides and PCBs as Aroclors by GC Capillary Column Technique, Method 8080A".

SWL-OP-403, "Analysis of Pesticides/PCBs by GC/EC by EPA OLM03.2".

SWL-OP-404, "Analysis of Pesticides/PCBs by GC/EC by EPA OLM01.8".

SWL-OP-405, "Determination of Low Concentration Water for Pesticides/PCBs".

SWL-OP-406, "Analysis of 1,2-Dibromoethane (EDB) in Water by GC".

SWL-OP-407, "Analysis of Chlorinated Herbicides by Gas Chromatography".

SWL-OP-408, "Determination of Total PCBs as Aroclors by GC Capillary Column Technique for Gary Sanitary District".

SWL-OP-409, "Analysis of Phenols".

SWL-OP-410, "Analysis of Organophosphorus Pesticides by Gas Chromatography, Capillary Column Technique".

SWL-OP-411, "Extraction and Analysis of Pesticides by EPA Method 608".

SWL-OP-412, "Pesticides/PCBs as Aroclors by GC Capillary Column Technique, SW846-8081".

8.5.3 High Performance Liquid Chromatographs (HPLC) — The calibration procedure are found in the following technical SOPs:

SWL-OL-200, "Nitroaromatics and Nitroamines by HPLC".
SWL-OL-201, "Polynuclear Aromatic Hydrocarbons (PAH) by HPLC".
SWL-OL-202, "Low Detection Polynuclear Aromatic Hydrocarbons (PAH) by HPLC".
SWL-OL-203, "Polynuclear Aromatic Hydrocarbons (PAH) in Air by HPLC".
SWL-OL-204, "Formaldehyde by HPLC".
SWL-OL-205, "Carbamate Pesticides by HPLC".

8.5.4 Ion Chromatographs (IC) — The calibration procedure is found in SOP, SWL-IN-301, "Anions in Water by Ion Chromatography – Dionex 2010".

8.5.5 Mass Spectrometry Section — The calibration procedure are found in the following technical SOPs:

SWL-OV-301, "Volatile Organics".
SWL-OV-303, "Volatile Organics by GC/MS (SW846, Method 8260)".
SWL-OV-304, "Volatile Organics by GC/MS (SW846, Method 8260, 25mL Purge)"
SWL-OV-305, "Volatile Organics 3/90, New Protocol".
SWL-OV-306, "Volatile Organics New Protocol OLM03.2".
SWL-OV-307, "Volatile Organics — Skinner's List".
SWL-OV-308, "Volatile Organics — Appendix IX".
SWL-OV-309, "Volatile Organics — TCLP".
SWL-OV-310, "Volatile Organics — BTEX".
SWL-OV-311, "Volatile Organics — 6/91 New Protocol (Low Concentration Water, 25 mL Purge)".
SWL-OV-312, "Volatile Organics for AFCEE Projects Only".
SWL-OV-313, "Low Level Volatile Organics by 25 mL Purge".
SWL-OV-314, "Volatile Organics by Modified 524.2, Drinking Water, 25 mL Purge".
SWL-OV-315, "Volatile Organics by 524.2, Drinking Water, 25 mL Purge".
SWL-OS-500, "Semivolatile Organics by SW846, Method 8270".
SWL-OS-501, "Semivolatile Organics by CLP OLM01.8".
SWL-OS-502, "Semivolatile Organics by CLP OLM03.2".
SWL-OS-503, "Semivolatile Organics in Low Concentration Water".
SWL-OS-504, "Semivolatile Organics for AFCEE Projects Only".
SWL-OS-505, "Semivolatile Organics in Air by GC/MS".
SWL-OS-506, "Analysis of N-Nitrosodimethylamine".

SWL-OD-202, "Polychlorinated Dibenzo-P-Dioxins and Dibenzofurans".
SWL-OD-203, "Polychlorinated Dibenzo-P-Dioxins and Polychlorinated Dibenzofurans (USEPA DFLM01.0)".
SWL-OD-204, "PCDD and PCDF by High Resolution Mass Spetroscopy (EPA 1613A)".
SWL-OD-205, "PCDD and PCDF by High Resolution Mass Spetroscopy (SW846, Method 8290, and TO-9)".
SWL-OA-101, "Volatile Organics in Air by TO-1".
SWL-OA-102, "Volatile Organics in Air by GC/MS".
SWL-OA-103, "Analytical Modified Method TO-3 for the Determination of Volatile Organics in Air by GC/MS".

8.6 Balance Checks

Analytical balances of various capacities and operational mode are calibrated annually by a licensed specialist and officially recorded as verification of performance. Details of the calibration procedures are found in SOP SWL-IN-120, "Calibration of Electronic Balances".

Stickers documenting the calibration are placed on the balance noting the calibration date as well as the date of the next calibration. Certificates of calibration are maintained in the QA/QC department.

Balances are checked with known calibration weights before using. If the values of the calibration are not within limits, the balance will be calibrated per manufacturer's instructions.

8.7 Calibrating Thermometers

Thermometers are calibrated quarterly against an NIST thermometer using the following procedure:

- Install the NIST thermometer in the same environment as the thermometer in question (e. g. cold storage refrigerator, oven, etc.)
- Should the thermometer in the cold storage be in glycerin, verify that the NIST thermometer is in the same solution.
- Allow the thermometers to equilibrate.
- Read both thermometers and record in the calibration log.
- Verify that the thermometer in question is within the ±0.2 acceptance limit.
- Should the temperature be outside this limit, the thermometer should be replaced with a new calibrated thermometer.
- Flag thermometer with any applicable bias.

8.8 Calibration Verification Volumetric Labware

Labware used for sample measurement (i.e. pipettor, etc.) are calibrated each day of use as per manufacturers' instructions and checked gravimetrically checked every 6 months. Details of these checks are provided in SOPs SWL-IN-100 and SWL-OP-203.

8.9 Radiochemistry

The calibration procedures are found in the following SOPs:

- SWL-RD-117, “LB4100 Low Background Counting System”
- SWL-RD-119, “Alpha Spectrophotometer Operation/Calibration”
- SWL-RD-125, “Gamma Spectrophotometer Operation/Calibration”
- SWL-RD-131, “Liquid Scintillation Operation/Calibration”
- SWL-RD-135, “Sodium Iodide Detector Operation/Calibration”
- SWL-RD-136, “Survey Meters/Probes”

8.10 Documentation

See Appendix B on Logbook Maintenance Standard Operating Procedures.

9.0 DETECTION LIMITS

All MDLs will be determined annually for each instrument, method, matrix and analyte using SOP, SWL-GA-113, “Definition and Determination of Detection Limits”. MDL studies will also be performed if the Section Supervisor determines that a significant change in the analytical process has occurred, or to allow the operator to demonstrate initial and continuing analytical proficiency. The QAO, or his designee, must approve all MDL study results, and all associated reporting limits.

The value reported to clients as the lowest possible concentration is based on the reference method or client-specific requests. The value to be reported is documented in the project-specific QAP for client-specific requests as well as in the “Redbook”. The Redbook lists the in-house, validated, lowest possible concentration as measured by the in-house test method. The MDL determined by SWLO should not exceed the MDL as defined in the reference Method. The Redbook lists the in-house method, revision number, date performed, the calculated MDL, and the reporting limit. The IDL, when applicable, is discussed in the appropriate in-house method.

In some reference methods, a process for determining the lowest possible concentration to be measured is not specified. The SWLO procedure found in SOP, SWL-GA-113, “Definition and Determination of Detection Limits”, which is based on 40 CFR Part 136 for the determination of MDLs is followed when the reference method does not specify a mechanism for determining the lowest possible concentrations. The process for determining the lower limit to be reported by the laboratory when not specified by the client or the reference method is defined in the SWLO in-house method.

The reporting limit as presented on the laboratory reports as “detection limit” is defined by the in house analytical SOP. This limit may correspond to the MDL, PQL, IDL, CRQL, CRDL or other limits as appropriate for the reference method, client or contract. The use of IDLs, MDLs and PQLs and other contract required limit determinations (e. g. CRDLs or CRQLs) in reporting results are determined first by any specific customer contract requirements. If there are no contract-specific requirements, then the applicable reference method requirements for limit reporting are observed. Finally, if there are no method requirements for reporting, the reporting limits as defined in each SWL analytical SOP are observed. For contracts/projects requiring the use of non-EPA approved methods, the laboratory shall establish detection limits according to the contract requirements and protocol. Clients requiring matrix specific MDL studies using site specific matrices are performed using SWL-GA-113 as referenced above, or a documented client-specific procedure.

9.1 Reporting Limit

If the reporting limit is less than one half (½) of the lowest calibration standard, then a check standard must be analyzed at the reporting limit.

The reporting limit may be the method specified (e. g. the CRQL in CLP) or method defined practical quantitation limit as specified in the RCRA methods or other method defined sensitivity. In all cases the establishment of the reporting limit is documented in the in-house analytical SOPs. The reporting limit must never be less than the calculated Method Detection Limit from the in-house method as determined by the laboratory.

The reporting limit is always adjusted based on sample dilution, sample concentration or sample size. Client's developed or project's reporting limits based on project-specific requirements are documented in the client file and noted in the report to the client. In no case are client specific reporting limits, using the same in-house procedure, less than laboratory developed method detection limits.

10.0 QUALITY CONTROL CHECKS

10.1 Laboratory Control Checks

10.1.1 Method Blanks

Method blanks, also known as reagent blanks, are analyzed for each matrix with each batch of 20 or fewer samples. An aliquot of equal volume or weight to the sample is used for method blank analysis. The method blank, like that of duplicate and spike samples, is taken through the whole analytical process. The method blank shall not be contaminated with any analyte of interest above the reporting limit. In the case of volatiles and semivolatiles, contamination must be less than the reporting limit of common laboratory solvents or phthalates, except for EPA, CLP or client permission where the contamination can be up to 5X the reporting limit.

10.1.2 Calibration Blank/System Blank

A calibration blank/system blank is prepared by analyzing the same matrix used for the preparation of the calibration standards. It is used to establish the analytical curve by taking into account background responses during the calibration process. It is also used to check for carry-over contamination after a standard run or after a contaminated sample run.

10.1.3 Calibration Verification

Calibration Verifications are used to assure calibration accuracy during each analysis run. It must be analyzed for each analyte as described in the particular SOP. For inorganic analysis an initial calibration verification (ICV) must be analyzed to verify the accuracy of the initial calibration. A continuing calibration verification (CCV) must be analyzed at the beginning of the analysis, after every ten samples, and at the end of the run. The ICV is prepared from an independent source different than the calibration standards. The CCV is prepared to be near or at the mid-range levels of the calibration curve. CCVs must also vary over the range of the calibration.

10.1.4 Laboratory Control Spikes (LCS)

Laboratory Control Spikes (LCS) are prepared from standards received from commercial vendors. These are a secondary source from those standards used to prepare calibration (either from another vendor or another lot from the same vendor). LCS are analyzed each day for every sample batch run to check proficiency of the analysis in terms of working standards preparation, monitor standard degradation, and check traceability of the prepared standards. A measure of comparability between batches is established with the analysis of the LCS. It is also used to check efficiency of both the digestion/extraction, and the instrumental analysis. An LCS duplicate (LCSD) may also be analyzed with each batch to check precision (except for air analyses).

The percent recovery is determined by the following equation:

$$\text{Percent Recovery} = \frac{\text{LCS Found Value}}{\text{LCS True Value}} \text{ X } 100$$

10.1.5 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

MS/MSD is used to assess the impact of the sample matrix on analyte recovery and precision. These are replicate samples spiked with a known spike concentration that are taken through the whole sample preparation process. MS/MSD analyses are performed on one sample in each group of 20 samples (5%), and/or on each type of sample matrix per concentration. Normally the client decides which sample(s) is/are to be analyzed as matrix spikes. In those instances where samples are not specified, the procedure is for the laboratory to randomly pick a sample (excluding field blanks, trip blanks, etc.) representative of the batch. Table 10.1 shows a list of matrix spike compounds routinely employed by the laboratory. If the client requires that all targeted analytes of interest be spiked, this will also be done for each MS/MSD. For inorganic analyses, all elements of interest are spiked.

The amount of spike added varies according to the working range of the analytical instrument and is at least 10X the MDL.

After the value of the sample is determined, the value of the sample spike is determined. The percent (%) recovery of the spike is calculated using the following equation:

$$\%\text{ Recovery} = \frac{(\text{Spike Sample Result - Sample Result}) \times 100}{\text{Spike Added}}$$

At times the sample value is outside the linear range of the analytical method. In such cases it is impossible to know the magnitude of the analyte before the spike is added. Occasionally, the sample and the spike sample require dilution to perform sample analysis within the linear range of the instrument. This dilution adjusts the analyte in the sample to the proper concentration, but it will sometimes also dilute the spike added below a detectable recovery. In this case, it is not possible to report spike recovery for that particular analyte.

The lack of spike recovery data for an analyte that has been diluted to levels outside the working concentration of the instrument is supplemented by the periodic analysis of spiked QC check sample and other additional sample data.

The calculated % recoveries are then used to assess data precision expressed as relative percent deviation (RPD). It is calculated using the following equation:

$$\text{RPD} = \frac{(\text{MS Result - MSD Result}) \times 100}{\text{Mean of MS and MSD Results where MS denotes Matrix Spike.}}$$

10.1.6 Duplicate Analyses

RPD can also be measured by duplicate sample analysis of one sample. In this case the (2) sample results take the place of the MS and MSD values in the above equation. The procedure of choosing which sample to duplicate when unspecified by the client is the same as detailed above in Section 10.1.5.

10.1.7 Surrogate Spike Analyses

Where applicable (organic analysis), the analytical process includes the addition, subsequent detection, and recovery calculation of surrogate spiking compounds. Surrogate compounds are analyte compound substitutes, (i.e., compounds not specifically requested to be determined as analytes in a particular scope of work) which most often do not occur naturally. Surrogate compounds are added to samples for analysis and are taken through the whole sample preparation process. Surrogate compounds, to be useful in QC analysis, must not interfere with the determination of the analytes of interest. Surrogates must also be chemically similar to the analytes of interest and capable of emulating the analyte response.

Surrogate standard determinations are performed on all samples and blanks. All samples and blanks are spiked with surrogate spiking compounds before purging or extraction in order to monitor preparation and analysis of samples.

Table 10.2 shows a list of surrogate spike compounds routinely employed by the laboratory.

Acceptance criteria for surrogate recoveries are method dependent and are found in the Method SOPs.

10.1.8 Method of Standard Addition (MSA)

A method of standard addition is used to check the accuracy of the analysis method under optimum conditions, excluding chemical interference from sample matrix. The MSA procedure is performed for GFAA analysis in accordance with CLP protocol for all samples.

10.1.9 ICP Interference Check Sample (ICS) Analysis

ICP interference check sample verifies interelement and background correction factors of the ICP instrument. The ICS is analyzed at the beginning and at the end of the run, or every 8 hours, whichever is more frequent. Recoveries must be ± 20% of the true value or all samples in that run must be reanalyzed.

10.1.10 Internal Standards Analysis

Internal standard areas are monitored as a measure of instrument calibration. Internal standard determinations are performed on GC/MS analyses to monitor instrumental efficiency and also used as a reference retention time indicator to check retention time shifts of peaks of interest.

A known amount of internal standard concentration is added to a sample extract prior to instrumental analysis. Like the surrogate standard, it must not interfere with the determination of the analytes of interest. It must also be chemically similar to the analytes of interest and capable of emulating the analyte response.

10.1.11 Post-Digestion Spike

If the matrix spike is outside of method control limits for metal and cyanide analyses, an aliquot of the unspiked sample will be used to determine if matrix interference is the cause. The sample will be spiked with a concentration of either two times the reporting limit or two times the sample concentration, whichever is greater.

TABLE 10.1

List Of Matrix Spiking Standards for Organic Analysis (Unless Otherwise Requested by the Client)

Matrix Spikes

Method 601/602/8021B (GC Purgeables)
All Compounds of Interest

Method 608/8081A/IFB (Pest/PCB)
All Pesticides

Method 8151A (Herbicides)
All Compounds of Interest

Method 625 (Semivolatiles)
All Compounds of Interest

Method 8082 PCB
Aroclors 1016/1260

Method 8260B/624 (GC/MS Volatiles)
All Compounds of Interest

Method 8270C (Semivolatiles)

Base/Neutrals	Acids
1,2,4-Trichlorobenzene	Phenol
Acenaphthene	Pentachlorophenol
2,4-Dinitrotoluene	4-Chloro-3-Methylphenol
Pyrene	2-Chlorophenol
N-Nitroso-di-N-Propylamine	4-Nitrophenol
1,4-Dichlorobenzene	

TABLE 10.2

List Of Surrogates Spiking Standards For Organic Analysis

Surrogates

Method 601/602/8021B (GC Purgeables)
Bromochloromethane
Bromofluorobenzene

Method 608/8081A/IFB/8082 (Pest/PCB)
Tetrachloro-m-xylene (TCX)
Decachlorobiphenyl (DCB)

Method 624/8260B/IFB (GC/MS Purgeables)
1,2 Dichloroethane-d4
Bromofluorobenzene
Toluene-d8

Method 8260B (GC/MS Purgeables)
4-Bromoflurobenzene
Dibromofluoromethane
Toluene-d8

Method 625/8270C/IFB (Semivolatiles)
Nitrobenzene-d5 Phenol-d5
2-Fluorobiphenyl 2-Fluorophenol
2,4,6-Tribromo-phenol Terphenyl-d14
2-Chlorophenol-d4* 1,2-Dichlorobenzene-d4*

Method 8151A (Herbicides)
2,4-Dichlorophenylacetic Acid (DCAA)

*Advisory Surrogates

10.2 Sample Batching

A batch is defined as a group of samples prepared at the same time and location, using the same method. At SWLO/AATS the number of samples in a batch will not exceed (a) twenty field samples or (b) the number of samples which can be ran simultaneously or in a continuous sequence without interruption, whichever is lower.

Each batch of samples will contain at a minimum, a method blank (PB), a laboratory control sample (LCS), a matrix spike (MS), and a matrix spike duplicate or duplicate. The acceptance criteria for these quality control samples are present in each Method SOP. All preparation batches are labeled with a unique identification. For example:

```
        970508SB
where:  YYMMDDMR
         e o a a u
         a n y t n
         r t   r
           h   i
               x
```

Each PB and LCS is labeled with an identifier to tie them to the preparation batch.

10.3 Data Quality Objectives

10.3.1 Introduction

The laboratory scope and approach to produce data of known and sufficient quality are described in this section. Guidelines are provided for the assessment and reporting of data quality for any environmentally related measurements, and for the incorporation of such assessments into major environmental databases.

Controlled sample receiving, logging, and tracking throughout the length of the project/contract is maintained to ensure sample integrity throughout the sample analysis scheme. Documentation of instrument performance and preventive maintenance is used to provide a permanent record for data validation. SWLO checks the quality of analytical work through analysis of quality control (QC) reference samples, duplicate samples, or matrix spike duplicate and spike samples.

10.3.2 Data Quality

Data quality is the totality of features and characteristics of data that bear on their ability to satisfy a given purpose. Parameters of major importance are accuracy, precision, completeness, representativeness, and comparability. These are defined as follows:

- *Accuracy* — The degree of the difference between measured or calculated values and true value.
- *Precision* — The reproducibility or degree of agreement among replicate measurements of the same quantity.
- *Completeness* — The percentage of valid data obtained from a measurement system.

- *Representativeness* — The degree to which the data accurately represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.
- *Comparability* — The confidence with which one data set can be compared to another.

10.3.3 Accuracy

The accuracy of the measurement data is evaluated by the comparison of the *percent recovery of the QC reference material* of known or established concentration, independent of routine calibration. Statistically based control limits are established for each method of analysis and sample matrix (soil/water). A Laboratory Control Spike (LCS) is analyzed for each batch and is dependent upon the sample matrix, method of analysis and concentration level. Recoveries are assessed to determine method efficiency. Analytical accuracy is expressed as the percent of recovery of an analyte/parameter that has been added at a known concentration before preparation and analysis. The equation used to calculate percent recovery is as follows:

$$\text{Percent Recovery} = \frac{\text{LCS Result x 100}}{\text{Amount of Spike Added}}$$

Accuracy can also be assessed on the recoveries of spiked analytes in a sample Matrix Spike.

$$\text{Percent Recovery} = \frac{\text{(Matrix Spike Result - Sample Result) x 100}}{\text{Amount of Spike Added}}$$

10.3.4 Precision

The laboratory uses Laboratory Control Spike Duplicates, Matrix Spike Duplicates or duplicate sample analysis to assess precision. An LCS/LCSD, MS/MSD, or a duplicate sample are analyzed for each batch of 20 samples (5%) for in-house QC and are dependent upon the sample matrix and method of analysis. A more frequent analysis is performed (i.e., one in 10 samples) on a reference method or contract-specific basis. The basic precision statistics obtained from the multiple batch frequency are compared to develop a graph assessment (using control limits) for given sample matrix.

Analytical precision is expressed as a percentage of the difference between the results of two matrix spike samples or two duplicate sample analysis for a given analyte. Relative percent difference (RPD) is calculated as follows:

$$\text{RPD} = \frac{\text{(LCS Result - LCS Duplicate Result) x 100}}{\text{Mean of LCS and LCS Duplicate Results}}$$

Where: LCS denotes Laboratory Control Spike.

$$\text{RPD} = \frac{(\text{MS Result} - \text{MS Duplicate Result}) \times 100}{\text{Mean of MS and MS Duplicate Results}}$$

Where: MS denotes Matrix Spike.

...Or ...

$$\text{RPD} = \frac{\text{Sample Result} - \text{Duplicate Result}}{\text{Mean of Sample and Duplicate Results}}$$

10.3.5 Completeness

For the data to be valid, it must meet all the acceptance criteria including accuracy, precision and any other criteria specified by the analytical method used. Data validation procedures are employed to minimize the amount of bad data from getting through data collection.

While the quality objective is to obtain the greatest accuracy and precision, the specific accuracy/precision level is dependent on the method of analysis and type of sample matrix. The Methods SOP statistical control limits are used as guidelines to validate the data generated unless client or contract requirements set more stringent criteria.

10.3.6 Representativeness

Data generated by the laboratory shall be representative of the samples received and analyzed by the laboratory. It shall be representative of the laboratory database of accuracy and precision measurements of the particular parameter(s), matrix and analytical method.

10.3.7 Comparability

Data shall be comparable to data sets recorded in the past to check for historical consistency. In order to maximize its usefulness, data shall be reported in appropriate units and in a consistent manner and following the reference method. Data shall be reproducible under similar conditions whether generated by the laboratory or another firm. This is demonstrated through the use of inter-laboratory performance audit samples (e. g. WP, WS).

10.4 Method Validation

All analysts must be certified for proficiency in each test method they performed. Details of the proficiency testing program are found in SOP, SWL-GA-104, "Personnel Training".

10.5 Statistical Evaluation of the Data

10.5.1 Control Charts

The performance of a measurement system will be demonstrated by the measurement of homogeneous and stable control samples in a planned repetitive process. The data generated is plotted in control charts to indicate whether the system is in control. It warns the laboratory of possible deviation from 95% confidence level by identifying systematic errors, drifts, or other types of problems. The control chart mechanism is how SWLO develops internal statistical limits. The discussion on the use and generation of control charts are found in the SOP, SWL-GA-112, "Control Charts".

The use of control charts is summarized as follows:

- They provide graphic assessment of accuracy and precision for the analysis of each analyte and instant detection of erroneous data
- They allow efficient observation of recovery trends for any particular analysis.
- They provide a long-term mechanism for self-evaluation of analytical output.
- They provide assessment of the analytical capability of the staff chemists with regard to the output of valid analytical data.
- They allow observations of deviations from control trends.

10.5.2 Control charts are generated monthly for laboratory control samples and quarterly for MS/MSD samples. Automated control charts are generated for Volatiles, Semivolatiles, Pesticides/PCBs, Metals and Cyanide. Manual control charts are generated in the Radiochemistry and HPLC laboratories.

Control Chart Analysis

The following actions will require immediate corrective action:

- One measurement exceeds the control limit.
- Two successive points exceed the warning limit.
- Seven successive points on one side of the mean.
- Six successive points are in decreasing or increasing order.

11.0 OUT-OF-CONTROL EVENTS

11.1 An "out of control" event is defined as any occurrence failing to meet the Laboratory QA Plan, SOP, Reference Method or client specifications.

11.2 Criteria Used for Determination of an "out of control" Event:

Factors that affect data quality (failure to meet calibration criteria, inadequate record keeping, improper storage, or preservation of samples) require investigation and corrective actions.

11.3 Responding to an "out of control" Event

11.3.1 Roles and Responsibilities:

When an "out of control" event is recognized, each individual involved with the analysis in question has an interactive role and responsibility. Some examples are as follows:

- Sample Receiving
  If a sample is broken upon receipt, the Project Officer/Client is notified and the decision is documented.
- The Analyst
  He/she must be able to recognize QC failure and immediately notify the Laboratory Supervisor and work with the QAO to solve the problem.
- The Laboratory Supervisor
  He/she must review all analytical and QC data for reasonableness, accuracy, and clerical errors; also responsible to monitor QC charts (in terms of control limits). In an "out of control" event, the Laboratory Operations Manager works with the analyst and QAO to solve the problem. Stopping work on the analysis prevents the reporting of suspect data and ensures that all results that are suspect are repeated, if possible, after the source of the error is determined and remedied.
- QA Officer
  In the event an "out of control" situation occurs that is unnoticed at the bench or supervisory level (e. g. performance failure on a QC sample), the QAO will notify the Laboratory Operations Manager. The QAO will help identify and solve the problem where applicable, and ensure that work is stopped on the analysis and no suspect data is reported.
- Project Officer
  The Project Officer will immediately notify the client when project or method requirements are not met. The Project Officer will discuss possible consequences of not meeting project requirements with the client.

11.4 Procedures for Stopping Analysis

Whenever the analytical system is "out of control", investigation/ correction efforts are initiated by all concerned personnel.

If the problem is instrumental or specific only to preparation of that sample batch, samples analyzed during the "out of control" event are processed after the instrument is repaired and re-calibrated, provided holding times are not exceeded.

If a sample batch is still "out of control" after reanalysis, all method-related activities shall stop immediately. A detailed laboratory-wide investigation shall be conducted to isolate and correct faulty operations. Sample security, integrity of standards, reagents, glassware, laboratory notebooks, instrument performance and adherence to the methods shall be included in the investigation following the guidelines in SOP SWL-GA-108, "Performance and System Audits" and/or SOP SWL-GA-105, "Corrective Action".

All actions shall be documented and placed in their respective case/contract file as well as the Corrective Action file. Upon correction, departmental follow-up, and QA follow-up the corrective action can be closed out with "return to control" (see SWL-GA-105).

11.5 QC Reports

Results from QC are evaluated at the analyst level. Blank contamination and Laboratory Control Spikes outside of control limits warrant the re-preparation/analysis of the sample batch. Surrogate spikes are also evaluated to determine whether there were adequate recoveries from the extraction process. The method blanks and spikes are reported to the client. Internal standard recoveries are evaluated to assure that they meet the requirements of the SOP.

12.0 DATA PROCESSING

12.1 Laboratory Data Recording

All analysts/technicians shall document all information relating to the conduct of analytical test methods and related activities in bound laboratory notebooks. These notebooks serve as the primary record for subsequent data reduction. "Stand alone" computers generate the data for GC/MS, AA, ICP, Mercury and GC analyses. Details of maintaining these log books can be found in a series of SOPs listed in Appendix B. Following the review by the Analyst, Group Leader and/or supervisor, the data is downloaded from the instrument to the department's database. The results for other analyses are transcribed manually onto "Analytical Results" forms specific to the analysis.

12.2 Data Review

The review of data quality involves several levels of evaluation. In general, the analysts and the Program Manager are responsible for reviewing the data relative to instrument calibration, standard preparation, method blanks, raw data, calculations and transcriptions. The analyst reviews 100% of the raw analytical data generated, including the calibration data and all calculations. Upon completion of the analysis process, a

100% peer review is performed. Group Leaders/Section Supervisors perform a second level of review of the raw data. At this level, a 100% review for compliance is performed for method, QC, and Project requirements.

12.2.1 A third level of review involves the Program Managers or Project Officer[8]. This is generally the final review prior to the QA Officer's review.

12.2.2 At the next level of data quality review, the QA Officer is generally responsible for a review of a minimum of 10% of the data generated. The emphasis is on the data acceptability relative to the data quality indicators and on the accuracy of the final data summaries.

12.2.3 Review Checklists

The review checklist and review procedures are found in the department data review SOPs: SWL-OV-103, "Volatile Data Review"; SWL-OS-103, "Semivolatile Data Review"; SWL-OP-100, "Gas Chromatography Data Review"; SWL-IN-106, "1st and 2nd Review of ICP, GFAA, Mercury, and Cyanide"; SWL-IN-107, "1st and 2nd Review of Wet Lab Analysis".

12.3 Data Collection/Data Reduction

Following the reviews by the analyst and the group leader and/or supervisor, the data is downloaded from the instrument to the departmental database. Data clerks transfer the results into the software report forms. The data is then qualified and organized in accordance with the following SOPs: SWL-GA-132, "Data Reporting — Non-EPA"; SWL-IN-102, "Inorganic Data Package Assembly"; SWL-OS-400, "GC/MS Data Package Generation with Envision Processing Software"; SWL-OV-200, "GC/MS Data Package Generation with Envision Processing Software"; SWL-OS-301, "Organic Data Package Assembly"; SWL-OP-102, "Gas Chromatography Laboratory Data Reduction."

Data packages are then prepared. The Supervisor and/or Program Manager then reviews the data packages.

12.3.1 Gas Chromatograph Results

Calculations are performed for each analyte after it is identified. Identification is based on analyte peaks falling within established retention time windows on both the primary and secondary (confirmation) columns. The concentration of the analyte is determined by using the calibration curve and the peak area of the analyte. A response factor is determined from the calibration curve and used to calculate the concentration.

12.3.2 Mass Spectrometry/Gas Chromatograph Results

Qualitative identifications are determined by obtaining extracted ion current profiles (EICPs) for the primary ion mass to charge ratio (m/z) and the secondary masses for each analyte. Positive identification is based on the following criteria:

---

[8] This review assures that all required levels of laboratory review have been performed and that project requirements have been met. Problems with the analysis, deviations from methods, and/or client communications are reviewed and addressed in the case narrative.

- The retention time must fall within ± 30 seconds of the retention time of the daily calibration standard.
- The relative peak heights of the characteristic masses in the EICPs must fall within ± 20% of the relative intensities of these masses in a reference mass spectrum (standard analysis or reference library).

If a compound cannot be verified by all of the criteria above, yet in the technical judgement of the mass spectral interpretation specialist the identification is correct, the compound shall be reported.

The calculation for the concentration for the suspect peak is made using the RF for each analyte.

$$\text{Concentration} = \frac{(A_s)(C_{is})}{(A_{is})(RF)}$$

Where:

A_s = Area of characteristic m/z for the analyte to be measured.

A_{is} = Area of characteristic m/z for the internal standard

C_{is} = Concentration of the internal standard, in ug/L.

RF = Average response factor as calculated from the area formed on an intensity plot of the ion of interest.

12.3.3 Inductively Coupled Plasma

The purpose of the ICP is to measure concentrations of elements in a sample. This is accomplished by measuring the emission intensity produced when a sample containing these elements is aspirated into the plasma, exciting the electrons to a higher state. The measurement of intensity is performed by allowing the light leaving the plasma through each exit slit to fall on a photomultiplier tube. This tube converts light energy into an electrical current. At the end of the integration time, the total current produced is measured and is proportional to the intensity and the concentration of the element being analyzed. This total current value is sent to the computer for data reduction. The final calculations are done by the computer system by comparing the intensity of unknowns against the intensity of known standards.

Interelement correction is performed by measuring the light intensity of interfering elements and mathematically correcting for the additional emitted intensity.

12.3.4 Atomic Absorption Spectrophotometry

Photometric absorbance is governed by the relationship:

$$\text{Absorbance} = \log(100 / \%T) = 2 - \log \%T$$

Where:

% T = 100 - % absorption

Percent absorption is based on the amount of light of a particular wavelength absorbed by a specific metal. Its calculation is based on the loss of light of a particular wavelength as it is passed through a flame into which a solution containing metals of interest have been aspirated.

Calibration curves establishing the absorption relationship with concentration are generated at various concentrations. From these curves, a comparison is made with absorbance from the sample measurement. Since absorbance is directly related to concentration, a plot of the two parameters is linear in certain operable ranges and allows for determination of unknown concentrations in solutions (direct samples or extracts) after measurement of absorbance.

Atomic absorption spectrophotometry is based on the principle that when light of a resonance wavelength is passed through a graphite tube containing atoms of an element to be measured, part of the light is absorbed. The extent of the absorption is proportional to the number of atoms present in the atomized sample. Because of the sophistication of current instrumentation, the partial application of this technique for the measurement of metal concentration in liquids relies on a Beer's absorption law approach, comparing absorbance from an unknown against the linear correlation between absorbance and concentration in standards.

In many spectrophotometric measurements, interferences occur in the absorption of light confusing the Beer's law relationship between absorption and concentration. This is especially true for atomic absorption. To alleviate this problem, a technique known as the "method of standard additions" is used, whereby sequential, known amounts of the component for which the sample is being analyzed are added to a sample of unknown concentration. By making an initial absorbance measurement after each addition, for which the effects of interference present in the analytical matrix can be accounted.

12.4 Data Verification

The Project Officer and/or the Quality Control Officer then verify the data.

- Review of client chain-of-custody request vs. sample login.
- Review of Extraction Logs, Analytical Run Logs, etc.
- Review of performance indicators such as blanks, surrogate recoveries, LCS recoveries, and Matrix Spike results.
- Random calculation checks
- Review and approval of the final report.

12.5 Data Reporting

The data reporting process provides the final product to the clients. Hardcopy and/or Electronic Data Deliverables (EDD) are sent; details regarding report formats are included in the following SOPs: SWL-GA-132 "Data Reporting — Non-EPA"; SWL-IN-102, "Inorganic Data Package Assembly"; SWL-OS-301, "Organic Data Package Assembly", SWL-OS-400, "GC/MS Data Package Generation with Envision Processing Software"; SWL-OV-200, "GC/MS Data Package Generation with Envision Processing Software"; SWL-OP-102, "Gas Chromatography Laboratory Data Reduction";

13.0 HOLDING TIMES AND PRESERVATIVES

Table 13.1 and 13.2 list the recommended preservatives and holding times for the various analytes/parameters. When samples arrive, sampling dates are entered into the LIMS system upon log-in. The project officer is notified if a holding time might be exceeded and the project officer in turn notifies the client. A daily LIMS list is printed in the various sections detailing these parameters and samples approaching holding time deadlines (Fig. 13.3). This enables the laboratory personnel to set priorities to meet holding time requirements. In the event that holding times are exceeded, the Project Officer will notify the Field Sampling Manager or client and request a resampling or instructions for proceeding with the analysis. Details for samples outside of holding times are stated in the case narrative with the final report.

Table 13.1

Recommendation For Sampling And Preservation Of Samples According To Measurement(1)

Measurement	Vol. Req. (mL)	Holding Container[2]	Preservative[3,4]	Time[5]
Physical Properties				
Color	50	P, G	Cool, 4°C	48 Hrs.
Conductance	100	P, G	Cool, 4°C	28 days
Hardness	100	P	HNO_3 to pH <2	6 mos.
Odor	200	G only	Cool, 4°C	24 Hrs.
pH	2	P, G	None Required,	Analyze Immediately
Residue				
Filterable	100	P, G	Cool, 4°C	7 days
Non-Filterable	100	P, G	Cool, 4°C	7 days
Total	100	P, G	Cool, 4°C	7 days
Volatile	100	P, G	Cool, 4°C	7 days
Settleable Matter	1,000	P, G	Cool, 4°C	48 Hrs.
Temperature	1,000	P, G	None Req.	Analyze Immediately
Turbidity	100	P, G	Cool, 4°C	48 Hrs.
Metals				
Dissolved	200	P	Filter on site HNO_3 to pH <2	6 Mos.
Suspended	200		Filter on site	6 Mos.[8]
Total	100	P	HNO_3 to pH <2	6 Mos.
Chromium^{+6}	200	P	Cool, 4°C	24 Hrs.
Mercury (Dissolved)	100	P	Filter HNO_3 to pH <2	28 Days
Mercury (Total)	100	P	HNO_3 to pH <2	28 Days

(cont.)

Table 13.1

Recommendation For Sampling And Preservation Of Samples According To Measurement(1)

Measurement	Vol. Req. (mL)	Holding Container[2]	Preservative[3,4]	Time[5]
Inorganics, Non-Metallics				
Acidity	100	P, G	Cool, 4°C	14 Days
Alkalinity	100	P, G	Cool, 4°C	14 Days
Bromide	100	P, G	None Req.	28 Days
Chloride	50	P, G	None Req.	28 Days
Chlorine	200	P, G	None Req.	Analyze Immediately
Cyanides	500	P, G	Cool, 4°C NaOH to pH >12 0.6g ascorbic acid[6]	14 Days
Fluoride	300	P, G	None Req.	28 Days
Iodide	100	P, G	Cool, 4°C	24 Hrs.
Sulfate	50	P, G	Cool, 4°C	28 Days
Silica	50	P only	Cool, 4°C	28 Days
Sulfide	500	P, G	Cool, 4°C add 2 mL zinc acetate plus NaOH to pH >9	7 Days
Sulfite	50	P, G	None Req.	Analyze Immediately
Nitrogen				
Ammonia	400	P, G	Cool, 4°C H_2SO_4 to pH <2	28 Days
Kjeldahl, Total	500	P, G	Cool, 4°C H_2SO_4 to pH <2	28 Days
Nitrate plus Nitrite	100	P, G	Cool, 4°C H_2SO_4 to pH <2	28 Days
Nitrate	100	P, G	Cool, 4°C	48 Hrs.
Nitrite	50	P, G	Cool, 4°C	48 Hrs.
Dissolved Oxygen				
Probe	300	G bottle and top	None Req.	Analyze Immediately
Winkler	300	G bottle and top	Fix on site and store in dark	8 Hrs.

(cont.)

Table 13.1

Recommendation For Sampling And Preservation Of Samples According To Measurement(1)

Measurement	Vol. Req. (mL)	Holding Container[2]	Preservative[3,4]	Time[5]
Phosphorus				
Orthophosphate, Dissolved	50	P,G	Filter on site Cool, 4°C	48 Hrs.
Hydrolyzable	50	P,G	Cool, 4°C H_2SO_4 to pH <2	28 Days
Total	50	P,G	Cool, 4°C H_2SO_4 to pH <2	28 Days
Total, Dissolved	50	P,G	Filter on site	24 Hrs.
Organics				
BOD	1,000	P,G	Cool, 4°C	48 Hrs.
COD	50	P,G	Cool, 4°C H_2SO_4 to pH <2	28 Days
Oil & Grease	1,000	G only	Cool, 4°C H_2SO_4 or HCl to pH <2	28 Days
Organic Carbon	25	P,G	Cool, 4°C H_2SO_4 or HCl to pH <2	28 Days
Phenolics	500	G only	Cool, 4°C H_2SO_4 or HCl to pH <2	28 Days
MBAS	250	P,G	Cool, 4°C	48 Hrs.
NTA	50	P,G	Cool, 4°C	24 Hrs.
Purgeable Halocarbons (601)	40	G, Teflon-lined Septum	Cool, 4°C 0.008% $Na_2S_2O_3$[6]	14 Days
Purgeable Aromatic Hydrocarbons (602)	40	G, Teflon-lined Septum	Cool, 4°C, 0.008% $Na_2S_2O_3$[6], HCl to pH <2	10 Days[10]

(cont.)

Table 13.1

Recommendation For Sampling And Preservation Of Samples According To Measurement(1)

Measurement	Vol. Req. (mL)	Container[2]	Holding Preservative[3,4]	Time[5]
Organics (continued)				
Acrylonitrile & Acrolein (603)	40	G, Teflon-lined Septum	Cool, 4°C, 0.008% $Na_2S_2O_3$[6]; Adjust pH to 4-5[11]	14 Days
Phenols[12] EPA Method 604	1,000	G, Teflon-lined Cap	Cool, 4°C, 0.008% $Na_2S_2O_3$	7 Days until extraction, 40 days after extraction
Benzidines[12] EPA Method 605	1,000	G, Teflon-lined Cap	Cool, 4°C, 0.008% $Na_2S_2O_3$[6]; H_2SO_4 to pH 2-7[13]	7 days until extraction
Phthalate Esters[12] EPA Method 606	1,000	G, Teflon-lined Cap	Cool, 4°C	7 days until extraction, 40 days after extraction
Nitrosamines[12] EPA Method 607	1,000	G, Teflon-lined Cap	Cool, 4°C, store in dark, 0.008% $Na_2S_2O_3$[6]	7 days until extraction, 40 days after extraction
Organochlorine Pesticides/PCBs[12] EPA Method 608 8081A/8082	1,000	G, Teflon-lined Cap	Cool, 4°C, pH 5-9	7 days until extraction, 40 days after extraction
Nitroaromatics and Isophorone[12] EPA Method 609	1,000	G, Teflon-lined Cap	Cool, 4°C, 0.008% $Na_2S_2O_3$[6], store in dark	7 days until extraction, 40 days after extraction
Polynuclear Aromatic Hydrocarbons[12] EPA Method 610/8310	1,000	G, Teflon-lined Cap	Cool, 4°C, 0.008% $Na_2S_2O_3$[6] store in dark	7 days until extraction, 40 days after extraction

(cont.)

Table 13.1

Recommendation For Sampling And Preservation Of Samples According To Measurement(1)

		Vol .Req.	Holding	
Measurement	(mL)	Container[2]	Preservative[3,4]	Time[5]
Organics (continued)				
Haloethers[12] EPA Method 611	1,000	G, Teflon-lined Cap	Cool, 4°C, 0.008% $Na_2S_2O_3$	7 days until extraction, 40 days after extraction
Chlorinated Hydrocarbon[12] (612)	1,000	G, Teflon-lined Cap	Cool, 4°C	7 days until extraction, 40 days after extraction
TCDD[12] EPA Method 1613 8280A/8290	1,000	G, Teflon-lined Cap	Cool, 4°C, 0.008% $Na_2S_2O_3$[6]	7 days until extraction, 40 days after extraction
Purgeables EPA Method 624/601/602 8021B/8260B	2 x 40	G, Teflon-lined Septum	Cool, 4°C, 0.008% $Na_2S_2O_3$[6]	14 Days
Base/Neutrals Acids EPA Method 625/8270C	1,000	G, Teflon-lined Cap	Cool, 4°C, 0.008% $Na_2S_2O_3$[6]	7 days until extraction, 40 days after extraction
Radiochemistry				
Tritium	200	Glass	None	6 months
All others	1000	P,G	HNO_3 to pH < 2	6 months

Footnotes:

1 More specific instructions for preservation and sampling are found with procedures as detailed in EPA-600/4-79-020, revised March, 1983, and in the Federal Register, Vol. 49, No. 209, Oct. 26, 1984, EPA 40 CFR part 136.

2 Plastic (P) or glass (G). Only EPA certified pre-cleaned bottles are used. For metals, polyethylene with a polypropylene cap (no liner) is preferred.

3 Sample preservation should be performed immediately upon sample collection. For composite samples, each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then samples may be preserved by maintaining them at 4° C until compositing and sample splitting is completed.

4 When any sample is to be shipped by common carrier or sent through the US Mail, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR part 172). The person offering such material for transportation is responsible for ensuring such compliance. For the preservation requirements of Table 1, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: (1) Hydrochloric Acid (HCl) in water solutions at concentrations of % by weight or less (pH about 1.96 or greater). (2) Nitric Acid (HNO_3) in water solutions at concentrations of 0.35% by weight or less (pH about 1.15 or greater). (3) Sodium Hydroxide (NaOH) in water solutions at concentrations of 0.08 by weight or less (pH about 12.3 or less).

5 Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still considered valid. Samples may be held for longer periods only if the permittee, or monitoring laboratory, has data on file to show that the specific types of sample under study are stable for the longer time and has received a variance from the Regional Administrator. Some samples may not be stable for the maximum time period given in the table. A permittee, or monitoring laboratory, is obligated to hold the sample for a shorter time if knowledge exists to show that this is necessary to maintain sample stability.

6 Should only be used in the presence of residual chlorine.

7 Maximum holding time is 24 hours when sulfide is present; Optionally, all samples may be tested with lead acetate paper before the pH adjustment in order to determine if sulfide is present. If sulfide is present, it can be removed by the addition of cadmium nitrate powder until a negative spot test is obtained. The sample is filtered and then NaOH is added to pH 12.

8 Samples should be filtered immediately on-site before adding preservatives for dissolved metals.

9 For samples from non-chlorinated drinking water supplies concentrated H_2SO_4 should be added to lower sample pH to less than 2. The sample should be analyzed before 14 days. Samples receiving no pH adjustment must be analyzed within seven days of sampling.

10 The pH adjustment is not required if acrolein will not be measured. Samples for acrolein receiving no pH adjustment must be analyzed within 3 days of the sampling.

11 When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times should be observed for optimum safeguard of sample integrity. When the analytes of concern fall within two or more chemical categories, the sample may be preserved by cooling to 4° C, reducing residual chlorine with 0.008% sodium thiosulfate, storing in the dark, and adjusting the pH to 6 – 9. Samples preserved in this manner may be held for 7 days before extraction and 40 days after extraction. Exceptions to this optional preservation and holding time procedure are noted in footnote 6 (requirement for thiosulfate reduction of residual chlorine)..

12 If 1,2-Diphenylhydrazine is likely to be present, adjust the sample pH to 4.0 ± 0.2 to prevent *rearrangement to benzidine.*

TABLE 13.2

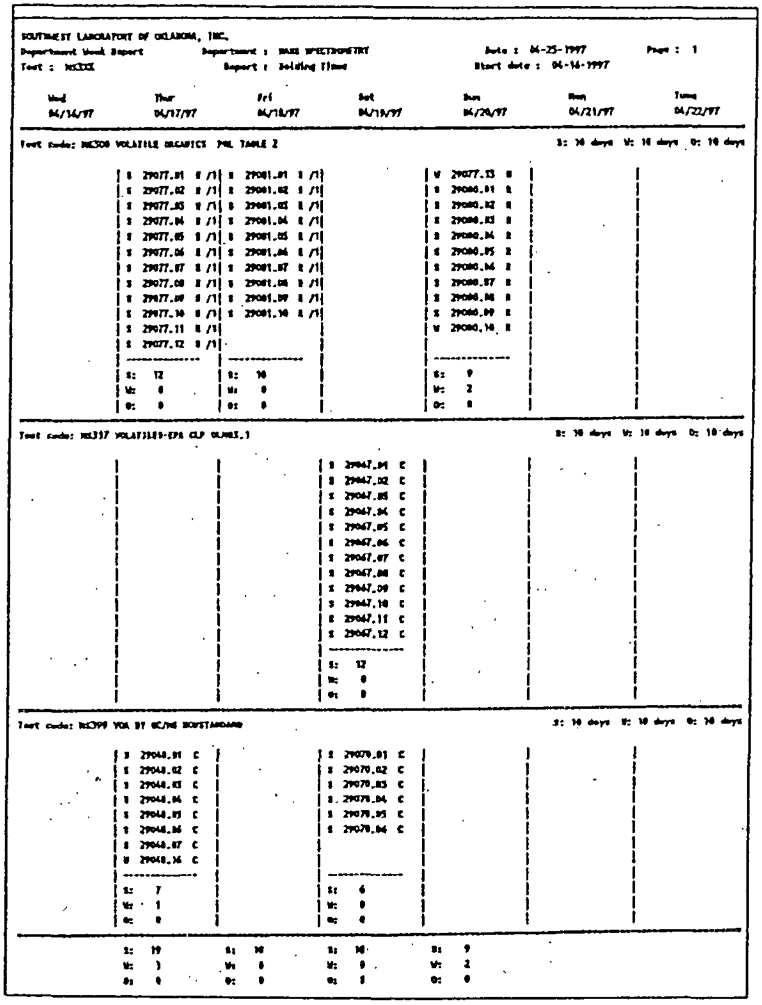
Recommendation For Sampling And Preservation Of Soil Samples According To Measurement[A]

Measurement	Container Size (oz)	Container	Holding Preservative	Time
Inorganics, Non-Metallics				
Petroleum Hydrocarbons	32	G	Cool, 4°C	28 days
Metals				
Total Recoverable	8	G	Cool, 4°C	6 months
Mercury (total)	8	G	Cool, 4°C	28 days
Extraction Procedure Toxicity	32	G	Cool, 4°C	6 months
Organics				
VOCs and Xylenes, EPA Method 8260B	2 x 4	G	Cool, 4°C	14 days
Extractable Priority Pollutants EPA Method 8270C	32	G	Cool, 4°C	14 days extraction 40 days analysis

[A] More specific instructions for preservation and sampling are found with procedures as detailed in SW846, "Test methods for Evaluating Solid Waste, Physical/Chemical Methods", 3rd Edition, Chapter 4.

Figure 13.3

Holding Time Report



SOUTHWEST LABORATORY OF OKLAHOMA, INC.
Department Week Report   Department : MASS SPECTROMETRY   Date : 04-25-1997   Page : 1
Test : MCXXX   Report : Holding Time   Start date : 04-16-1997

Wed	Thur	Fri	Sat	Sun	Mon	Tues
04/16/97	04/17/97	04/18/97	04/19/97	04/20/97	04/21/97	04/22/97

14.0 QUALITY ASSURANCE AUDITS/EXTERNAL AGENCY APPROVAL

14.1 Audit is defined as systematic check to determine the quality of operation of laboratory activities. It is comprised of the following:

- Performance audit
- System audit

14.1.1 Laboratory Performance Audit

Procedures used to assess the effectiveness of the quality control system are as follows:

- Internal Performance Audits.

  Internal performance audits are accomplished through the QAO who monitors that the requirements of the LQAP and SOPs are being met. The use of control samples, replicate measurements and reference materials also help to monitor the system's performance. Internal audits and yearly assessments are conducted as per SOP, SWL-GA-108, "Performance and Systems Audits". Performance Evaluation Samples are analyzed as typical samples without replicate testing.

Sample analysis systems for each laboratory area are conducted by the QA Officer and include the following:

- Verification of written procedures and analyst(s) understanding.
- Verification and documentation of procedures and documents.
- Review of analytical data and calculations.

The internal technical audits evaluate compliance with the QA Plan, the SOP and with method and client requirements. Internal technical audits (as well as system audits) are conducted as per a predetermined schedule and/or as per managerial request. Internal audit findings are tracked using the corrective action process discussed in SOP SWL-GA-105, "Laboratory Corrective Action". With the predetermined schedule the entire technical operation of the lab is reviewed annually.

14.1.2 Laboratory System Audit

Internal Systems Audits are performed by laboratory quality assurance personnel. The inspection reviews the laboratory quality control system including sample handling, sample analysis, record control, preventive maintenance, and proficiency testing. As with the technical audits, the system audits are conducted as per a predetermined schedule and/or as per managerial request. SWLOs entire Quality System is evaluated annually. Non-Conformance and/or Corrective Actions Identified are tracked as discussed in the SOP SWL-GA-105, "*Laboratory Corrective Action*".

14.1.3 Blind QC Program

Intra-laboratory check samples are analyzed on a quarterly basis for a full suite of organic and inorganic parameters. These samples are entered into the system as "blind" QC samples. Also, "blind" QC samples may be entered into the system in conjunction with external performance audits, or to check analyst proficiency. When the analysis is complete, laboratory performance is evaluated and any necessary corrective action is taken. The QAO monitors all results and maintains all QC performance sample data. The special processing of these blind QC checks and all PE samples is forbidden.

14.1.4 External Performance Audits

External performance audits are accomplished through inter-laboratory checks such as:

- Participation in various state laboratory evaluation programs.
- Participation in WP & WS studies from NSI/RTC and Accustandard.
- Analysis of split samples and comparing results with the other laboratory.
- Participation in the U.S. EPA CLP program.

- Participation in the U.S. Army Corps of Engineers DERA validation program.
- Participation in the U.S. Navy NFESC Program.

14.1.5 Audit Review

All audit and review findings and any corrective actions that arise from them shall be documented. The laboratory management shall ensure that these actions are discharged within the agreed time frame.

14.2 External Certifications and Approvals

The SWLO/AATS laboratory has participated in available certification programs pertaining to environmental chemistry. SWLO/AATS participates in numerous certification/approval programs (both state and federal). The federal programs are listed in Table 14.1 and the state programs are listed in Table 14.2.

TABLE 14.1

Program Participation

USEPA CLP (Contract Laboratory Program)

- Organics Analysis, Multi-Media, Multi Concentration, by GC/MS and GC/EC Techniques. *Note: Continuous Participation Since 1985.*
- Rapid Turn-Around Organics Analysis, Multi-Media, Multi Concentration, By GC/MS And GC/EC Techniques.
- Chemical Analytical Services For Multi-Media, Multi-Concentration Metals And Inorganics.

Environmental Resource Associates Analytical Products Group

- WP/WS Water Pollution/Water Supply Study Program.
- Soil P. T. — Studies
- Accu Standard WS • Studies (Dioxin)

U.S. Army Corps Of Engineers DERP Certification (Defense Environmental Restoration Program).

U.S. Air Force AFCEE IRP, Installation Restoration Program Participant, Analytical Services For AFB Projects.

U.S. Navy NFESC, Installation Restoration Program Participant, Analytical Services.

INEL, (Idaho National Engineering Lab.), Qualified By ERPSMO To Perform Analytical Services.

Aim Tech, Certified To Perform Analytical Services For Hazardous Waste Remedial Actions Program.

NRC License, Licensed To Perform Analysis Of Environmental Samples.
(License #35-27413-01)

STATE OF NEW YORK
DEPARTMENT OF HEALTH

Wadsworth Center The Governor Nelson A. Rockefeller Empire State Plaza P.O. Box 509 Albany, New York 12201-0509

Antonia C. Novello, M.D., M.P.H., Dr. P.H.
Commissioner

Dennis P. Whalen
Executive Deputy Commissioner

February 28, 2002

Dear Laboratory Director:

Please note that although your ELAP Certificate of Approval expires on 12:01 AM April 1, 2002, it is still valid until June 15, 2002, as per ELAP Certification Manual, No. 140, Page 13 of 42, dated 12/6/95, Part 55-2.4e NYCRR. "...during any extension or grace period permitted by this Subpart, a laboratory approval shall remain in force beyond the expiration date of the certificate of approval, unless such approval is specifically terminated or suspended in writing."

Further verification of your laboratory's approved ELAP status is available by calling the Program Office at (518) 485-5570.

Sincerely,

Linda L. Madlin

Linda L. Madlin
Administrative Assistant
Environmental Laboratory
Approval Program

LLM:mes

STATE OF NEW YORK
DEPARTMENT OF HEALTH

Wadsworth Center The Governor Nelson A. Rockefeller Empire State Plaza P.O. Box 509 Albany, New York 12201-0509

Antonia C. Novello, M.D., M.P.H., Dr. P.H.
Commissioner

Dennis P. Whalen
Executive Deputy Commissioner

Dear Laboratory Director:

Enclosed are the ELAP Certificate(s) of Approval for permit year 2001-2002 issued to your environmental laboratory. The Certificate(s) supersede any previously issued and are in effect through March 31, 2002. Please carefully examine the Certificate(s) to insure that the categories, subcategories, analytes and methods for which your laboratory is approved are listed correctly, as well as verifying your laboratory's name, address, director and identification number.

Please notify this office of any corrections required.

Sincerely,

Linda L. Madlin

Linda L. Madlin
Administrative Assistant
Environmental Laboratory
Approval Program

LLM:mes
Enclosure

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER
Antonia C. Novello, M.D., M.P.H., Dr.P.H. *Commissioner*

Expires 12:01 AM April 01, 2002
Issued August 18, 2001

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. ROBERT W. HARRIS
SOUTHWEST LAB OF OKLAHOMA
1700 W ALBANY
BROKEN ARROW OK 74012 USA

NY Lab Id No: 11672
EPA Lab Code: OK00006

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards for the category
ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Chlorinated Hydrocarbons

Hexachlorobenzene	EPA 625
Hexachlorobutadiene	EPA 625
Hexachlorocyclopentadiene	EPA 625
Hexachloroethane	EPA 625

[illegible]ins

[illegible]-8-Tetrachlorodibenzo-p-d	EPA 1613

[illegible]roaromatics and Isophorone

2,4-Dinitrotoluene	EPA 625
2,6-Dinitrotoluene	EPA 625
Isophorone	EPA 625

Polynuclear Aromatics

Acenaphthene	EPA 625
Anthracene	EPA 625
Benzo(a)anthracene	EPA 625
Benzo(a)pyrene	EPA 625
Benzo(b)fluoranthene	EPA 625
Benzo(ghi)perylene	EPA 625
Fluoranthene	EPA 625
Fluorene	EPA 625
Indeno(1,2,3-cd)pyrene	EPA 625
Naphthalene	EPA 625
Phenanthrene	EPA 625
Pyrene	EPA 625

Purgeable Halocarbons

1,1-Dichloroethane	EPA 601
	EPA 624
2-Chloroethylvinyl ether	EPA 601
	EPA 624
cis-1,3-Dichloropropene	EPA 601
	EPA 624
Dichlorodifluoromethane	EPA 601

Serial No.: 12708

[illegible] of the New York State Department of Health. Valid only at the address shown. [illegible] conspicuously posted. Valid certificates have a raised seal and may be [illegible]d by calling (518)485-5570.

3317 (3/97)

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Chlorinated Hydrocarbon Pesticides

4,4 -DDE	Method Not Specified
4,4 -DDT	Method Not Specified
4,4-DDD	Method Not Specified
Aldrin	Method Not Specified
[illegible]ta-BHC	Method Not Specified
[illegible]rdane Total	Method Not Specified
[illegible]	Method Not Specified
Heptachlor	Method Not Specified
Heptachlor epoxide	Method Not Specified

Nitroaromatics and Isophorone

Nitrobenzene	EPA 625

Phthalate Esters

Benzyl butyl phthalate	Method Not Specified

Polychlorinated Biphenyls

PCB-1248	Method Not Specified
PCB-1260	Method Not Specified

Polynuclear Aromatics

Acenaphthylene	EPA 625
Benzo(k)fluoranthene	EPA 625
Chrysene	EPA 625
Dibenzo(a,h)anthracene	EPA 625

Priority Pollutant Phenols

2-Methyl-4,6-dinitrophenol	Method Not Specified
4-Chloro-3-methylphenol	Method Not Specified

Purgeable Aromatics

1,2-Dichlorobenzene	Method Not Specified
1,3-Dichlorobenzene	Method Not Specified
1,4-Dichlorobenzene	Method Not Specified
Benzene	Method Not Specified
Ethyl benzene	Method Not Specified
Toluene	Method Not Specified

Purgeable Halocarbons

1,1,1-Trichloroethane	Method Not Specified
1,2-Dichloroethane	Method Not Specified
Bromodichloromethane	Method Not Specified
Bromoform	Method Not Specified
Carbon tetrachloride	Method Not Specified
Chloroform	Method Not Specified
Dibromochloromethane	Method Not Specified
Methylene chloride	Method Not Specified
Tetrachloroethene	Method Not Specified
Trichloroethene	Method Not Specified

Wastewater Metals I

Barium, Total	EPA 200.7
Cadmium, Total	EPA 200.7

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Wastewater Metals I

Calcium, Total	EPA 200.7
Chromium, Total	EPA 200.7
Copper, Total	EPA 200.7
Iron, Total	EPA 200.7
ead, Total	EPA 239.2
agnesium, Total	EPA 200.7
iese, Total	EPA 200.7
Nickel, Total	EPA 200.7
Potassium, Total	EPA 200.7
Silver, Total	EPA 200.7
Sodium, Total	EPA 200.7

Wastewater Metals II

Aluminum, Total	EPA 200.7
Antimony, Total	EPA 200.7
Arsenic, Total	Method Not Specified
Beryllium, Total	EPA 200.7
Mercury, Total	EPA 245.1
Selenium, Total	EPA 270.2
Vanadium, Total	EPA 200.7
Zinc, Total	EPA 200.7

Wastewater Metals III

Cobalt, Total	EPA 200.7
Molybdenum, Total	EPA 200.7

Wastewater Metals III

Thallium, Total	EPA 200.7
Titanium, Total	Method Not Specified

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All approved analytes are listed below:

Chlorinated Hydrocarbon Pesticides	
4,4 -DDE	SW-846 8081A
4,4 -DDT	SW-846 8081A
4,4-DDD	SW-846 8081A
Aldrin	SW-846 8081A
lpha-BHC	SW-846 8081A
ta-BHC	SW-846 8081A
n	SW-846 8081A
Endrin	SW-846 8081A
Heptachlor	SW-846 8081A
Heptachlor epoxide	SW-846 8081A
Lindane	SW-846 8081A
Methoxychlor	SW-846 8081A
Chlorinated Hydrocarbons	
1,2,4-Trichlorobenzene	SW-846 8270C
Hexachlorobenzene	SW-846 8270C
Hexachloroethane	SW-846 8270C
Metals I	
Barium, Total	SW-846 6010B
Lead, Total	SW-846 6010B
	SW-846 7421
Metals II	
Antimony, Total	SW-846 6010B
	SW846 7041

Metals II	
Arsenic, Total	SW-846 6010B
	SW846 7060A
Chromium VI	SW-846 7196A
Selenium, Total	SW-846 6010B
	SW-846 7740
Nitroaromatics and Isophorone	
2,4-Dinitrotoluene	SW-846 8270C
Isophorone	SW-846 8270C
Nitrobenzene	SW-846 8270C
Phthalate Esters	
Benzyl butyl phthalate	SW-846 8270C
Bis(2-ethylhexyl) phthalate	SW-846 8270C
Di-n-butyl phthalate	SW-846 8270C
Polynuclear Aromatic Hydrocarbons	
Acenaphthylene	SW-846 8270C
Anthracene	SW-846 8270C
	SW-846 8310
Benzo(a)anthracene	SW-846 8270C
	SW-846 8310
Benzo(a)pyrene	SW-846 8270C
	SW-846 8310
Benzo(b)fluoranthene	SW-846 8270C
Benzo(ghi)perylene	SW-846 8270C

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All approved analytes are listed below:

Polynuclear Aromatic Hydrocarbons	
Chrysene	SW-846 8270C
	SW-846 8310
Dibenzo(a,h)anthracene	SW-846 8270C
Naphthalene	SW-846 8270C
	SW-846 8310
[illegible]nanthrene	SW-846 8270C
	SW-846 8310
Pyrene	SW-846 8270C
	SW-846 8310
Priority Pollutant Phenols	
2,4,6-Trichlorophenol	SW-846 8270C
2,4-Dichlorophenol	SW-846 8270C
2-Chlorophenol	SW-846 8270C
4-Chloro-3-methylphenol	SW-846 8270C
Pentachlorophenol	SW-846 8270C
Phenol	SW-846 8270C
Purgeable Aromatics	
1,2-Dichlorobenzene	SW-846 8021B
	SW-846 8260B
1,3-Dichlorobenzene	SW-846 8021B
	SW-846 8260B
1,4-Dichlorobenzene	SW-846 8021B
	SW-846 8260B

Purgeable Aromatics	
Benzene	SW-846 8021B
	SW-846 8260B
Chlorobenzene	SW-846 8021B
	SW-846 8260B
Ethyl benzene	SW-846 8021B
	SW-846 8260B
Total Xylenes	SW-846 8260B
Purgeable Halocarbons	
1,1,1-Trichloroethane	SW-846 8021B
	SW-846 8260B
1,1,2,2-Tetrachloroethane	SW-846 8021B
	SW-846 8260B
1,1,2-Trichloroethane	SW-846 8021B
	SW-846 8260B
1,1-Dichloroethene	SW-846 8021B
	SW-846 8260B
1,2-Dichloroethane	SW-846 8021B
	SW-846 8260B
1,2-Dichloropropane	SW-846 8021B
	SW-846 8260B
2-Chloroethylvinyl ether	SW-846 8021B
	SW-846 8260B
Bromodichloromethane	SW-846 8021B

Serial No.: 12710

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All approved analytes are listed below:

Purgeable Halocarbons	
Bromodichloromethane	SW-846 8260B
Bromomethane	SW-846 8021B
	SW-846 8260B
Carbon tetrachloride	SW-846 8021B
	SW-846 8260B
[illegible]hloroethane	SW-846 8021B
	SW-846 8260B
Chloroform	SW-846 8021B
	SW-846 8260B
Chloromethane	SW-846 8021B
	SW-846 8260B
cis-1,3-Dichloropropene	SW-846 8021B
	SW-846 8260B
Dibromochloromethane	SW-846 8021B
	SW-846 8260B
Dichlorodifluoromethane	SW-846 8021B
	SW-846 8260B
Methylene chloride	SW-846 8021B
	SW-846 8260B
Tetrachloroethene	SW-846 8021B
	SW-846 8260B
trans-1,3-Dichloropropene	SW-846 8021B
	SW-846 8260B
Trichloroethene	SW-846 8021B

Purgeable Halocarbons	
Trichloroethene	SW-846 8260B
Trichlorofluoromethane	SW-846 8021B
	SW-846 8260B
Vinyl chloride	SW-846 8021B
	SW-846 8260B

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All approved subcategories and/or analytes are listed below:

Nitroaromatics and Isophorone

2,6-Dinitrotoluene	SW-846 8270C

Polynuclear Aromatic Hydrocarbons

Acenaphthene	SW-846 8270C
Fluoranthene	SW-846 8270C
[illegible]uorene	SW-846 8270C
[illegible](1,2,3-cd)pyrene	SW-846 8270C

[illegible]rgeable Aromatics

Toluene	Method Not Specified

Serial No.: 12711

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[illegible]-3317 (3/97)

№ 1156

STATE OF MARYLAND

DEPARTMENT OF HEALTH AND MENTAL HYGIENE
LABORATORIES ADMINISTRATION

Certifies That

SOUTHWEST LABORATORY OF OKLAHOMA, INC.
1700 West Albany, Broken Arrow, Oklahoma 74012

having duly met the requirements of the

Regulations Governing Laboratory Certification And Standards Of Performance In Accordance With The Annotated Code of Maryland,

is hereby approved as a

State Certified Water Quality Laboratory

To perform the analyses indicated on the Annual Certified Parameter List, which must accompany this certificate.

Approved Analyses: Arsenic, Barium, Beryllium, Cadmium, Chromium, Copper, Mercury; Inorganics 1,2,3,5; THM; VOC 1; SOC 2.

Certification # 274

Date Issued September 26, 2001

Expiration Date September 30, 2002
(Not Transferable)

Director, Laboratories Administration

This certification is subject to unannounced laboratory inspections

CONSPICUOUSLY DISPLAY IN THE LABORATORY WITH THE ANNUAL CERTIFIED PARAMETER LIST.

TABLE 14.2

State Certification

State	Certification Number	Department	Type	Expires	Evaluation Process
ALABAMA	40890	Department Of Environmental Management	DW	08/31/01	Reciprocity (OK)
ARIZONA	AZ0436	Environmental Lab, Dept. of Health	ENV, HW	09/24/01	On-Site, WP
ARKANSAS	N/A	Pollution Control & Ecology	ENV	09/15/01	WP
CALIFORNIA	1221	Department Of Health Services, Environmental Lab Program	ENV	06/30/02	On-Site, PE & WP
COLORADO	335	Department of Health, Drinking Water Parameters	DW	12/31/01	Reciprocity (OK)
CONNECTICUT	PH-0195	Bureau of Labs	DW,HW	09/30/01	Reciprocity (OK)
FLORIDA	87326	Department of Health and Rehabilitation	DW,ENV	06/30/01	On-Site, WP
FLORIDA	87376	Department of Health and Rehabilitation	DW,ENV	06/30/01	On-Site, WP
FLORIDA	87530	Department of Health and Rehabilitation	DW,ENV	06/30/01	On-Site, WP
GEORGIA	922	Environmental Protection Division	DW	08/31/01	Reciprocity (OK)
HAWAII	N/A	Hawaii Public Health	DW	10/31/01	Reciprocity (OK)
IDAHO	N/A	Idaho Dept. of Health and Welfare	DW	08/31/01	Reciprocity (OK)
INDIANA	C-OK-01	Indiana Dept. of Health	DW	08/31/01	Reciprocity (OK)
KANSAS	E-10155	Department of Health and Environment	HW	10/31/00	Reciprocity (OK)
ANSAS	E-10155	Department of Health and Environment	DW	10/31/01	Reciprocity (OK)
ANSAS	E-10155	Department of Health and Environment	WW	10/31/01	Reciprocity (OK)
KENTUCKY	90065	Department of Environmental Protection	DW	12/31/01	Reciprocity (OK)
LOUISIANA	93-19	Department of Health and Hospitals	ENV	12/31/01	Reciprocity (NELAC)
MARYLAND	274	Department of Health	DW	09/30/01	Reciprocity (OK)
MICHIGAN	N/A	Department of Public Health	DW	08/31/01	Reciprocity (OK)
MISSISSIPPI	N/A	Department of Public Health	DW	08/31/01	Reciprocity (OK)
NEW YORK	11672	Department of Health	ENV	06/30/01	Reciprocity (OK)
NORTH CAROLINA	404	Department of Environmental Health & Natural Resources	DW,HW	12/31/01	On-Site, PE & WP
NORTH DAKOTA	R-073	Department of Health and Conservation	HW,ENV	09/24/01	Reciprocity (AZ)
OKLAHOMA	8728	Water Resources Board	DW,ENV	08/31/01	On-Site, WS/WP
PENNSYLVANIA	EP-LAB-16	Department of Environmental Protection	DW		On-Site (WS)
SOUTH CAROLINA	79003	Department of Health and Environmental Control	HW, ENV	09/24/01	Reciprocity (OK)
TENNESSEE	02929	Department of Health and Environment	DW,UST	01/11/02	Reciprocity (OK)
TEXAS	TX210	Department of Health	DW	12/31/02	Reciprocity (OK)
UTAH	SWLO1	Department of Health	ENV, HW	01/31/02	Reciprocity (NELAC)
VIRGINIA	00322	Department of Drinking Water	DW	06/30/01	Reciprocity (OK)
WASHINGTON	N/A	Department of Health	UST,DW	09/05/01	Reciprocity (COE)

15.0 REFERENCES

- Naval Facilities Engineering Science Center, Interim Guidance Document, "Navy Installation Restoration Chemical Data Manual", September 1999.
- Department of Defense Quality Systems Manual for Environmental Laboratories, Version 1, October 2000.
- National Environmental Laboratory Accreditation Conference, :Quality Systems", Revision 4, January 3, 1997.
- Office of Nuclear Safety Policy and Standards, DOE Order 5700.6C: "Quality Assurance Program, A Management System, Revision 1, October, 1992.
- USEPA SW846, "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods", Revision 2, September, 1994, and Update III, December, 1996.
- USEPA Contract Laboratory Program, "Statement of Work for Organic Analysis, Multimedia, Multi-concentration", OLM03.2 & OLM04.2.
- USEPA 40CFR Part 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act; Final Rule and Interim Final Rule and Proposed Rule", October 26, 1984.
- USEPA Contract Laboratory Program, "Statement of Work for Inorganic Analysis, Multimedia, Multi-concentration", ILM04.0.
- USEPA "Methods for the Determination of Metals in Environmental Samples", EPA 600-91-010, June, 1991.
- USEPA "Methods for Chemical Analysis of Water and Wastes", EPA 600/4-79-020.
- "Standard Methods for the Examination of Water and Wastewater, 18th Edition.
- US Department of Energy, Oak Ridge Operations Office, Weldon Springs Site Remedial Action Project, "Scope of Work for Analytical Services", DOE/OR/21548-614.
- Air Force Center for Environmental Excellence, "Quality Assurance Project Plan", ver. 2.0.
- US Army Corp of Engineers, "Shell for Chemical Analytical Services – Draft, Rev. 4.2-1, August 1996.

16.0 DOCUMENT CONTROL AND STORAGE

Detailed instructions and guidelines for the preparation, review, approval and distribution control of documents affecting the quality and consistency of the work performed by SWLO/AATS are found in SOP, SWL-GA-101, "Preparation, Review, Revision and Control of Procedural Documents". Written documents are prepared and approved for all activities affecting the quality and consistency of work performed by SWLO/AATS. Activities include, and are not limited to, receipt, handling, preparation and analysis of samples; use and maintenance of standards; calibration and performance checks of measurement equipment; reduction, evaluation and reporting of data; the archival and retrieval of raw data, supporting documentation and electronic media generated during analysis; general laboratory practices which support these activities. In addition, procedures are written which conform to government regulations affecting worker health and safety, hazardous waste management, and radiation protection. These procedures are governed by the same controls as those affecting quality of work.

The policies and practices for the archival and retrieval of raw data are detailed in SOP, SWL-GA-106, "Archival and Retrieval of Sample Documentation". Policies and practices for electronic media are found in SOP, SWL-GA-102, "Information Systems Quality Assurance Plan". All systems are designed so that data, records, and documents can be stored and retrieved ten years after the date of generation.

In the case that the laboratory is sold, the purchasing company would be interested in being assigned existing contracts and maintaining existing certifications. It would be a condition of sale that all contract requirements, including storage and archiving of data, would be assigned to the new corporation.

In the event of the laboratory being forced to close, the likelihood of long-term storage of archived data would be remote. The plan would be to review the current archived records of data and contact those clients with existing data and give them a 60-day time period to either have the data shipped to them or have the data destroyed based upon their requirements.

17.0 MATERIALS AND SUBCONTRACTORS

The policies, procedures and practices for the procuring and approving of materials and equipment are detailed in SOP, SWL-GA-107, "Procurement of Materials and Equipment". Policies for the verification of the quality of standards are located in each departments' "Standards and Traceability" SOPs.

17.1 Procurement and Inventory

17.1.1 Southwest Laboratory of Oklahoma, Inc. has established a system to assure that products and services, purchased or contracted, shall meet at least the minimum standards required. Factors such as cost, volume of work, ease of operation, inherent accuracy, expected equipment lifetime, length and condition of warranties or service contracts, expected downtime and repair costs are considered during the selection process. The increased usage of electronic analytical instruments has improved the quality and quantity of data and has increased productivity.

17.1.2 Control of materials (e. g. reagents, standards, solvents) and glassware used in the analyses is maintained as part of the quality assurance program. Reagents and solvents are analyzed prior to use to verify purity, documentation of these analyses are maintained. Lot numbers are recorded on preparation logs to facilitate the tracking of these items. This will correlate the analytical reagent lot number to specific analytical batches. All reagents are dated as they are received and when they are opened to assure systematic use. The identity, purity, shelf-life, source, tests to be considered for quality and purity, storage and handling procedures, and replacement dates are factors that are considered in making purchase requisitions.

Before any purchases are made, the purchase requisition orders and requests are checked and verified by the appropriate laboratory supervisor. The authority for approval for such purchases is held by the laboratory supervisors and the Laboratory Director.

17.2 Equipment Management

17.2.1 Information on performance of the equipment is obtained before a purchase request is made. Service availability for installation specification and verification is considered in purchase negotiation. When the instrument/equipment is installed, an internal calibration is made on the instrument to meet manufacturers' and Reference Methods' specifications. Calibration checks are done by using analytical reference standards for qualitative and quantitative checks to verify instrument performance during the sample run. Routine preventive maintenance of the instruments or equipment is made on a regular basis. Section 8.0 discusses preventive maintenance employed by the different laboratory sections to ensure instrument/equipment working conditions.

17.3 Supplies Management

17.3.1 Materials, reagents, solvents and gases are carefully selected to meet specifications as prescribed by the method of analyses. Each new supply of these items is verified for performance capability based on the required certified assay/analysis of chemicals and freedom from impurities that would interfere with the analysis. Background levels are measured to check the degree of contamination through conformance of storage requirements according to the manufacturer's directions and/or individual method of analysis. Solvents used for extraction are pre-analyzed to determine impurities that might interfere with the analytes of interest. Standards and reagents are dated, initialed and labeled with the expiration date (if not manufacturer stated) upon receipt. This procedure establishes the order of use and eliminates the possibility of exceeding shelf life.

17.4 Source of Standard Reagents

17.4.1 Primary standards and/or stock standards are obtained from a reliable, certifiable source and are high purity. Standards are purchased from approved commercial vendors such as Chem Services, Fisher Scientific, Supelco, etc., for use in all analytical testing. Standards are protected from degradation, deterioration and contamination based on storage requirements (e.g. polyethylene containers for alkali solutions, glass containers for organics and brown glass for light-sensitive solutions: temperature storage and segregation of standards based on reactivity).

Stock and working standard solutions are prepared fresh as required by their stability, and are checked regularly for signs of deterioration, (e. g. discoloration, formation of precipitates, and changes in concentration). Standard solutions are labeled with lot number, expiration date, preparation date and preparer.

17.5 Glassware

17.5.1 Class A volumetric glassware is used by the laboratory for accurate measurements in both inorganic and organic analysis.

Laboratory contamination is minimized through implementation of a standard operating procedure (SOP) for glassware and labware cleaning. It is followed to ensure the removal of all traces of parameters of interest and contaminants that could interfere with analysis.

17.6 Reagents, Solvents and Gases

17.6.1 Chemical Reagents aside from the primary standard reagents, solvents and gases are carefully selected to conform to specifications defined in the method SOP. Selection is based on the required purity for parameters being measured, sensitivity of the method and specificity of the detection system (e. g. AA, ICAP, GC-ED, GC/MS).

17.6.2 Laboratory reagents obtained from approved commercial vendors shall meet ACS standards and are labeled indicating contents, date of receipt or preparation, and expiration date (where appropriate). Hazardous reagents are adequately labeled and stored segregated from the rest of the reagents to indicate type and degree of hazard. All solvents are dated upon receipt, and again upon opening, to ensure "first in – first out" usage. Solvent bottles are stored in a grounded flammable liquid storage cabinet.

17.6.3 Gases used in organic and inorganic analyses are of commercial grade or are laboratory-supplied gases. For organic analyses, the type of detection (e. g. GC-EC, Hall, GC-FID, GC/MS) used affects gas quality requirement. Molecular sieves, carrier-gas filters, and drying tubes are required on combustion gases to improve quality. Gas cylinders are immediately replaced when the pressure falls to 100-200 pounds per square inch (psi) to minimize detector contamination that will affect sensitivity of the detector.

17.7 Laboratory Reagent Water.

ASTM Type II water (by conductivity) is used in the laboratory for dilution, preparation of reagent solutions and final rinsing of glassware while ASTM Type I water is used for metals analysis. It is free from interferences and other contaminants. After passing through two ion exchange canisters and one carbon filter canister, conductivity is monitored and recorded daily and an indicator light, which (when out) alerts the analyst to have the tanks serviced.

17.8 Compressed Air

Compressed air is employed mainly in instruments using GC oven-door control and autosamplers. Absorption filters are installed between the outlets and the point of use to trap oil, moisture, and other contaminants entering the compressed air transfer lines. These lines are checked for the presence of moisture and contaminants and are replaced as soon as moisture is detected.

17.9 Hood System

An efficient hood system is necessary to remove the various toxic and hazardous fumes that may be generated when using organic solvents or that may be formed during an acid digestion step. It is also used to remove toxic gases that may be formed during atomic absorption analysis reactions. The laboratory fume hood face velocity is regularly checked every four months for optimum face velocity.

17.10 Electrical Services

The laboratory electrical system provides adequate and constant voltage, appropriate grounding, and efficient lighting which is required for satisfactory lighting, proper functioning of sensitive instruments and operation of high-current devices. A licensed electrical contractor provides repairs and services in the event of a power failure or electrical problems.

17.11 Subcontractors

In the event that subcontracted services are required, the procurement process shall be governed by SWL's "Small Business Contracting Plan." The plan includes a historical list of small businesses that have performed to specifications in the past. The plan also includes the utilization of sources provided by the Small Business Administration (SBA). The current plan is maintained by the laboratory's manager of the Contracts/Proposal Department. It is the responsibility of the Contracts/Proposals Manager to write a solicitation that includes all of the requirements provided by the Prime Contractor for whom the subcontracted work will be performed. The requirements of the solicitation, or Request for Proposal (RFP), may include, but is not limited to the following:

- Any required state and/or federal agency certifications, validations, and/or proof of the successful completion of Performance Evaluation (PE) samples and on-site audits.
- The applicable scope of work and quality assurance objections from the Prime Contractor's requirements of Southwest Laboratory of Oklahoma. In all cases, Southwest Laboratory must confirm that any subcontracted analytical/technical firm shall meet or exceed all requirements as specified by SWLO's Prime Contractor (see SWL-GA-107.)

18.0 QA REPORTS TO MANAGEMENT

18.1 Quality Assurance Reports to Management

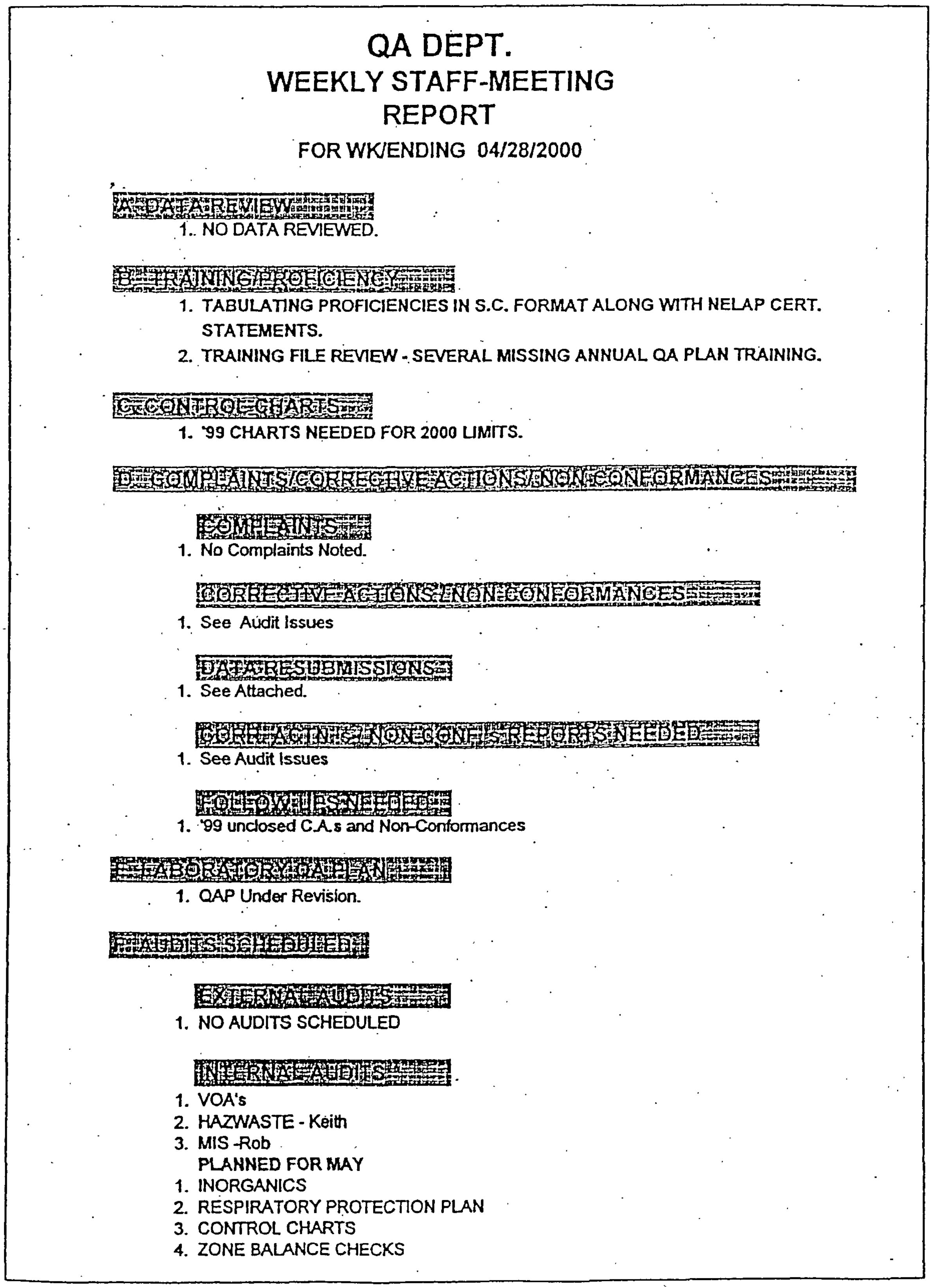
Weekly a Quality Assurance Report is produced for Management. This report covers results from internal and external audits, performance evaluation samples, data reviews, training, proficiency, certification, document control, non-conformances and corrective action issues. Figures 18.1 & 18.2 re examples of the weekly quality systems reports.

18.2 Managerial Review

The laboratory management conducts a weekly review of the quality system to ensure its continuing suitability and effectiveness and to introduce any necessary changes or improvements in the quality system and laboratory operations. The review shall take account of reports from QA, managerial and supervisory personnel, the outcome of recent internal audits, assessments by external bodies, the results of inter-laboratory comparisons or proficiency tests, any changes in the volume and type of work undertaken, feedback from clients, corrective actions and other relevant factors. More details of this review can be found in the Standard Operating Procedure SWL-GA-142, "*Management Assessment of the Quality Systems.*"

Figure 18.1

Weekly Staff Meeting Report



QA DEPT.
WEEKLY STAFF-MEETING
REPORT

FOR WK/ENDING 04/28/2000

A. DATA REVIEW

1. NO DATA REVIEWED.

B. TRAINING/PROFICIENCY

1. TABULATING PROFICIENCIES IN S.C. FORMAT ALONG WITH NELAP CERT. STATEMENTS.
2. TRAINING FILE REVIEW - SEVERAL MISSING ANNUAL QA PLAN TRAINING.

C. CONTROL CHARTS

1. '99 CHARTS NEEDED FOR 2000 LIMITS.

D. COMPLAINTS/CORRECTIVE ACTIONS/NON-CONFORMANCES

COMPLAINTS

1. No Complaints Noted.

CORRECTIVE ACTIONS/NON-CONFORMANCES

1. See Audit Issues

DATA RESUBMISSIONS

1. See Attached.

CORR. ACTN'S / NON-CONF'S REPORTS NEEDED

1. See Audit Issues

FOLLOW-UPS NEEDED

1. '99 unclosed C.A.s and Non-Conformances

E. LABORATORY QA PLAN

1. QAP Under Revision.

F. AUDITS SCHEDULED

EXTERNAL AUDITS

1. NO AUDITS SCHEDULED

INTERNAL AUDITS

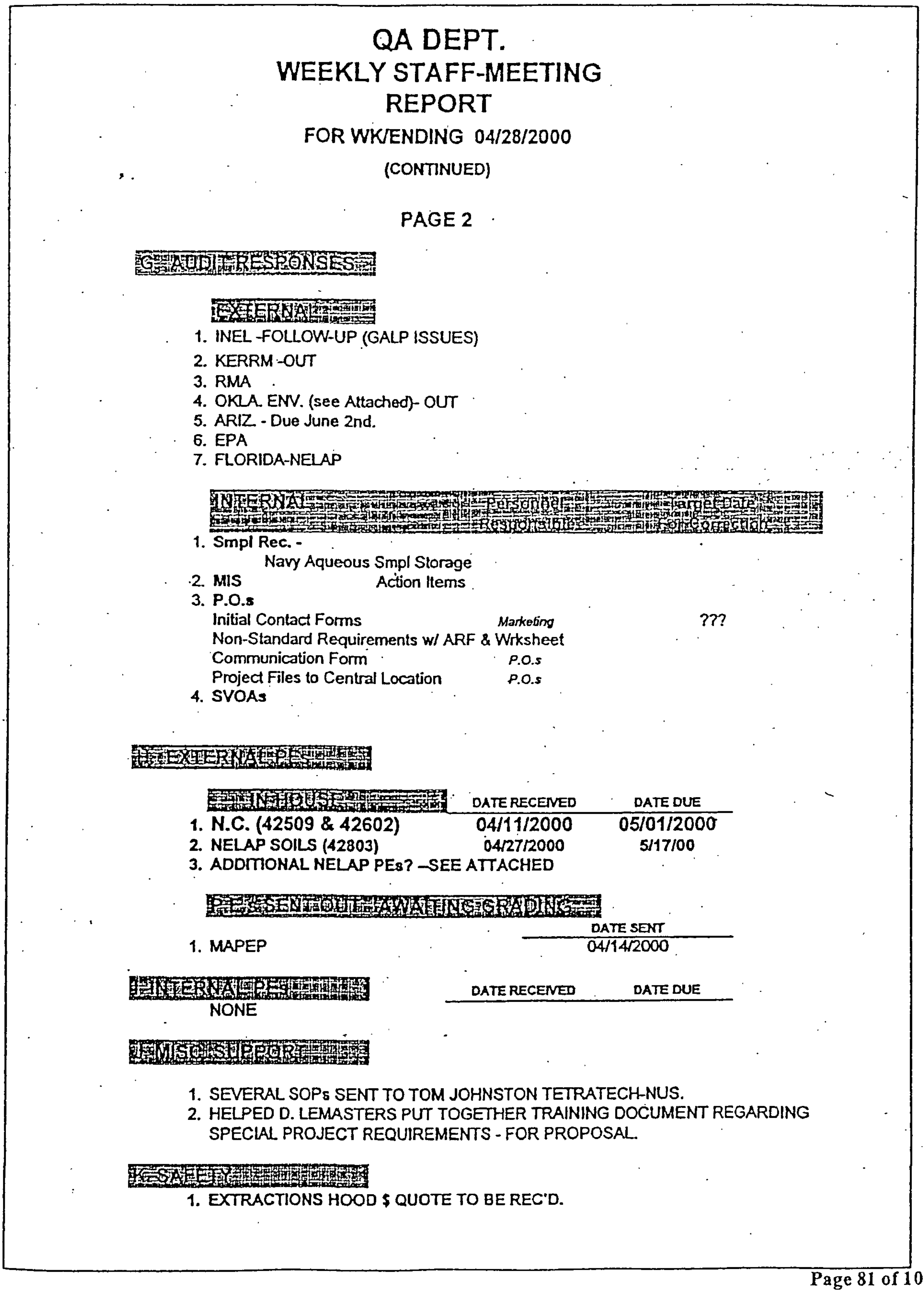
1. VOA's
2. HAZWASTE - Keith
3. MIS -Rob

PLANNED FOR MAY

1. INORGANICS
2. RESPIRATORY PROTECTION PLAN
3. CONTROL CHARTS
4. ZONE BALANCE CHECKS

(cont) Figure 18.1

Weekly Staff Meeting Report



QA DEPT.
WEEKLY STAFF-MEETING REPORT

FOR WK/ENDING 04/28/2000

(CONTINUED)

PAGE 2

G. AUDIT RESPONSES

EXTERNAL

1. INEL -FOLLOW-UP (GALP ISSUES)
2. KERRM -OUT
3. RMA
4. OKLA. ENV. (see Attached)- OUT
5. ARIZ. - Due June 2nd.
6. EPA
7. FLORIDA-NELAP

INTERNAL	Personnel Responsible	Target Date For Correction
1. Smpl Rec. - Navy Aqueous Smpl Storage		
2. MIS Action Items		
3. P.O.s		
Initial Contact Forms	*Marketing*	???
Non-Standard Requirements w/ ARF & Wrksheet		
Communication Form	*P.O.s*	
Project Files to Central Location	*P.O.s*	
4. SVOAs		

H. EXTERNAL PEs

IN-HOUSE	DATE RECEIVED	DATE DUE
1. N.C. (42509 & 42602)	04/11/2000	05/01/2000
2. NELAP SOILS (42803)	04/27/2000	5/17/00
3. ADDITIONAL NELAP PEs? –SEE ATTACHED		

PEs SENT OUT - AWAITING GRADING	DATE SENT
1. MAPEP	04/14/2000

I. INTERNAL PEs	DATE RECEIVED	DATE DUE
NONE		

J. MISC. SUPPORT

1. SEVERAL SOPs SENT TO TOM JOHNSTON TETRATECH-NUS.
2. HELPED D. LEMASTERS PUT TOGETHER TRAINING DOCUMENT REGARDING SPECIAL PROJECT REQUIREMENTS - FOR PROPOSAL.

K. SAFETY

1. EXTRACTIONS HOOD $ QUOTE TO BE REC'D.

Figure 18.2

QC Tracking Coversheet

QC Tracking Coversheet

I. Overdue SOP's

II. Two-month SOP Outlook

III. Outdated Redbook Entries

IV. In-House PE Samples

Appendix A-1

Personnel Experience

Key Personnel Resumes

ROBERT HARRIS

Laboratory Director

EDUCATION: Bachelor of Science Degree, Microbiology
Oklahoma State University, 1971

PROFESSIONAL EXPERIENCE:

7/1/83 to Present — **Southwest Laboratory of Oklahoma, Inc.**
Laboratory Directors

As the Laboratory Director of Southwest Laboratory of Oklahoma Mr. Harris directs all aspects of laboratory operation in the Company's facility, including scheduling and cost control, staffing, training, customer support, and business development. He holds a B.S. in Microbiology from Oklahoma State University and has over 15 years experience in management of commercial laboratories. Analytical services under his direction include hazardous waste, drinking water and ground water investigation sponsored by a wide variety of governmental and private clients including EPA (e.g.,CLP,RCRA) Corps of Engineers (DERA) and the Air force (OHEL/HSD).

Prior to joining SWL he managed a geochemisty laboratory for Williams Brothers Engineering which supported major oil companies. Mr.Harris has developed supplemental methods for the analysis of hazardous waste when there were no applicable ones available for specific project requirements. His experience in directing the operations of environmental laboratories is exemplified by successful participation in the EPA CLP, U.S. Army Corps of Engineers, and other federal and State certification and accreditation programs. As an analyst Mr. Harris is experienced in the application of analytical methods using SW846, CLP, ASTM, and Standard Methods for organic and inorganic samples.

1981 to 1983 — **Williams Brothers Engineering**, Tulsa, Oklahoma
Assistant Laboratory Director
1975 to 1981 — Senior Research Engineer

1971 to 1975 — **Kansas City Testing Laboratory**, Kansas City, Missouri
Laboratory Manager

Appendix A-2

Personnel Experience

STEVE MARKHAM

Operations Manager & Inorganic Program Manager

EDUCATION: Bachelor of Science Degree, Zoology
Oklahoma State University, Stillwater, OK, May 1977.

Fisheries Biology
Frostburg State College, Frostburg, Maryland, 1979.

Additional Education:

Atomic Absorption Training Course, Perkin-Elmer
Class II Wastewater Treatment Operators License, Virginia (1979)
Inductively Coupled Argon Plasma Course, Perkin-Elmer
Project Officer's Training - US Environmental Protection Agency.
ICAP-61 Training Course - Thermo Jarrell Ash

PROFESSIONAL EXPERIENCE:

- As the Operations Manager for Southwest Laboratory of Oklahoma, Mr. Markham assists the Laboratory Director in all aspects of laboratory operations, including scheduling, staffing, training and quality assurance.
- Mr. Markham is responsible for assuring that the laboratory has the personnel and support to deliver data of the highest quality and integrity.
- Mr Markham has eighteen years experience in the environmental profession and twelve years of management experience.

PROFESSIONAL EXPERIENCE:

1996 to Present — **Southwest Laboratory of Oklahoma, Inc.**
Operations Manager

1994 to 1996 — **Gulf States Analytical, Inc.**, Houston, Texas
Operations Manager

7/88 to 1993 — **Southwest Laboratory of Oklahoma, Inc.**
Inorganic Program Manager

1986 to 1988 — **Weston Corporation**, Stockton, California
Inorganics Section Manager.

1985 to 1986 — **U.S. Environmental Protection Agency, (Reg.III)**, Annapolis, Maryland
Environmental Scientist.

1983 to 1985 — **Water Pollution Control**, Arlington County, Virginia
Chief Chemist.

1979 to 1983 — **Lapteff Associates**, Woodbridge, Virginia

Appendix A-3

Personnel Experience

JAYANT SHRINGARPURE

Laboratory Technical Director

EDUCATION: Ph.D., Organic Chemistry
Indian Institute of Technology, Bombay, India

Master of Science, Environmental Management
University of San Francisco

Master of Science , Organic Chemistry
Indian Institute of Technology, Bombay, India.

Bachelor of Science, Chemistry
Bombay University, Bombay, India

PROJECT EXAMPLES:

- Project Manager for USEPA. Contract involving the rapid response (16 hour electronic data transmission) for the analyses of dioxins up to 100 samples per day by GC/MS.
- Program Manager for USEPA-CLP Organic Contract at SWLO.

PROFESSIONAL EXPERIENCE:

1985 to Present — **Southwest Laboratory of Oklahoma, Inc.**
Technical Director
Responsible for supervising the operations of the Extractions and GC/MS laboratories, including troubleshooting of instrument difficulties and final data review for GC/MS. Involved in ongoing work with the Research and Development laboratory conducting method developments and validation studies. Acts as client liaison on projects involving technical difficulties.

1985 to 1992 — **Organics Program Manager**
Program Manager for the organic department at SWL. Supervises work assignments, conducts method development and method validation. Supervises the operation of extraction GC and GC/MS Laboratory. Trains analysts on the use of instrumentation as well as trouble-shooting problems with the instruments. Reviews data for the GC/MS Laboratory.

1980 to 1985 — **EAL Corporation**
Supervisor — Responsible for the development of analytical methods for the analysis of organic compounds in the environment.

1978 to 1980 — **Columbia University**, New York
Research Associate — Specialized in the syntheses and purification of retinoids used against epithelial cancer.

1976 to 1978 — **Fordham University, New York**
Research Associate — Investigated intramolecular imino Diels-Adler reaction for the syntheses of idolizidine alkaloids.

1975 to 1976 — **Bakul Chemicals**
Senior Chemist

1969 to 1975 — **Indian Institute of Technology, India**
Reasearch Chemist

Appendix A-4

Personnel Experience

CHUCK HOOVER

Quality Assurance Officer

EDUCATION: Bachelor of Arts Degree in Biology
Minor in Chemistry
Wichita State University, 1976

PROJECT

- Experience with PCB analyses on transformer oils, Hydraulic fluids, soil/sediment, waters and fish flesh.
- Experience in EPA 600 series Methodologies, both extractions and analyses.
- Experience in Trihalomethane Studies on source and drinking water supplies.
- Experience in data review of analyses performed on samples from EPA's Superfund Sites; performed in various laboratories in the EPA's Contract Laboratory Program.
- Metal analysis using Flame/Furnace Atomic Absorption. Extraction/Clean-up of Dioxin/Furans using method 613.

PROFESSIONAL EXPERIENCE:

1987 to Present — **Southwest Laboratory of Oklahoma, Inc.**
QA/QC Officer

1985-1987 — **Lockheed Engineering and Management Services**, Las Vegas, Nevada
Technical Support Supervisor — Laboratory Performance Monitoring Section.

1983-1985 — **Southwest Laboratory Of Oklahoma, Inc.**
QA/QC Officer — Extractions Chemist — AA Operator

1982-1983 — **National Analytical Laboratories**, Tulsa, OK
Gas Chromatography/GC/MS Chemist

1980-1982 — **Williams Brothers Laboratories**, Tulsa, OK
Wet Chemistry Section Supervisor

1977-1980 — **Wichita Water Department, Water and Waste-water Laboratory**, Wichita, KS
Laboratory Technician

1976-Summer — **U.S. Department of Labor Occupational Health & Safety Administration** (OSHA), Kansas City, MO
Industrial Hygienist (Summer Merit)

Appendix A-5

Personnel Experience

HARRY M. BORG

Organic Program Mgr.

EDUCATION: Bachelor of Arts Degree, Chemistry, Minor: Physics, Math
Mount Marty College, Yankton, South Dakota

Additional Training

Hewlett Packard 5988 RTE - 6 System Mgr. Course, 9/97
Hewlett Packard 5987/88/96, Operators Course, 4/86

PROFESSIONAL EXPERIENCE:

2/92 to Present — **Southwest Laboratory of Oklahoma, Inc.**
Organic Program Manager — Responsible for day to day operations in the Organic department. Oversees performance for all GC and GC/MS operations including extractions, analyses, data review, and data management. Provides technical management for organic EPA contracts. Interviews prospects for organic personnel.

11/89 to 2/92 — **Cenref Labs**, Brighton, Colorado
Laboratory Manager — Management of an environmental production laboratory. Responsible for day to day operations and technical management, as well as evaluation and interpretation of analytical results. Responsible as client liaison and for coordination of laboratory projects.

11/88 to 11/89 — **Hager Laboratories**, Golden, Colorado
Technical Services Representative/Environmental Chemistry Manager — Responsible for management of day to day operations in an environmental production laboratory. Technical management, evaluation and interpretation of analytical results. Client liaison and project coordinator.

12/87 to 11/88 — **metaTRACE, Inc.**, Earth City, Missouri
Organic Section Supervisor — Responsible for hiring and scheduling of personnel, and Quality control and data review for GC and GC/MS depts.

12/83 to 11/87 — **Western Research Institute**, Laramie, Wyoming
Analytical Scientist II — Responsible for scheduling and training personnel. Analyst in the semivolatile and volatile GC/MS laboratories. Analyses included semivolatile extracts from water, soil, high concentration samples, Pesticide/PCBs by GC and GC/MS, Inorganic analyses of oil shale by-product waters by non-suppressed ion chromatography, separation and detection of sulfur anions by non-supressed ion chromatography (HPLC). Responsible for quality control of data. Utilized EPA 600 methods, SW846 methods, RCRA and EPA CLP protocols. Routine maintenance and troubleshooting of the HP59858 and HP5996 GC/MS systems with RTE-6 software and REV D/E.

3/80 to 11/83 — **Tosco Corporation**, Golden, Colorado & Martinez, Calif.
Chemist — Responsible for supervision of evening shift personnel during oil-shale project. Coordinated pilot plant ball test program. Coordinated personnel schedule to accommodate research refinery program.

Appendix A-10

Personnel Experience

DESMOND FOSTER

Extractions Laboratory Supervisor

EDUCATION: Tulsa Junior College — coursework includes Chemistry and Biology
Open Bible Institute, Trinidad — one year general coursework
Art Diploma — London University, London England
Basic Lab Skills Diploma — Hess Oil, U.S. Virgin Islands
Diploma — Trinidad High School (1964)

PROFESSIONAL EXPERIENCE:

1981 to Present — **Southwest Laboratory of Oklahoma, Inc.**
1988 to present — **Organic Extractions Laboratory Supervisor,**

Organic Extractions (12 years)
Supervision of 13 chemists in extractions of multiple matrices for organic chemical analyses. Methods used include the U.S. EPA SW-846 3500 Series, the U.S. EPA Contract Laboratory Program (CLP) Organic Statement of Work (SOW 3/90 & 2/88). Explosives, Herbicides, High Concentrations, Phenols and TPH's. Polychlorinated dibenzo-p-dioxins/dibenzofurans (PCDD/PCDF) extractions using 8280 and CLP Rapid Turnaround SOW. Multiple clean-up techniques including the Columbia Fishery (for Dioxins/Furans) and GPC (for semivolatiles and pesticides/PCBs).

Inorganics (5 years)
Wet chemistry work consisted of colorimetric and titrimetric procedures of chloride, fluoride, nitrate, nitrite, sulfates, COD, ammonia, and TKN. Other tests were pH, conductance, total dissolved solids, total solids, total suspended solids, hardness, acidity, and TOC.

Gas Chromatography (5 years)
Natural Gas Analysis

Field Sampling (5 years)
Sampled soils, monitoring water wells, and lysimeters.

Stack Sampling (2 years)
Collected SOX, NOX and particulate samples.

Hazardous Waste Supervisor
Maintained records and prepared reports as per 40CFR part 262. Filled out manifests and coordinated pick-up of drums by hazardous waste firms - ENSCO and APTUS. Inspected drum staging area to ensure proper storage and labeling of drums.

1979 to 1981 — **Hess Oil Company**, St. Croix, Virgin Islands
Petroleum Analyst — Gauged and sampled tanks, ships and refinery units for crude, JP4, JP54, gasoline, kerosene, benzene, toluene, xylene, napthas, #2 oil, #4 oil, #6 oil, etc. Laboratory tests performed were flash point (open cup and closed cup), cloud point, pour point, freeze point, sodium chloride in crude, D86 distillation, D286 distillation, D1160 distillation, true boiling point distillation, particulates in jet fuel, fuel system icing inhibitor, Reid Vapor Pressure, color ASTM, saybolt and Viscosities (SUS, SFS and kinematic).

Appendix A-13

Personnel Experience

JAMES WHITTAKER

GC/MS Volatiles Section Supervisor

EDUCATION: Bachelor of Science Degree in Biochemistry
University of California at Davis, 1990

Additional Training and Certifications:
U.S. EPA Drinking Water Laboratory Certification Officer, Chemistry, 1992
U.S. EPA Drinking Water Laboratory Certification Officer, Biochemistry, 1994
OSHA 40-Hour Hazardous Material Incident Response Training, 1993
24-Hour Laboratory Health and Safety Training, 1995
IATA Hazardous Material Shipping Training, 1995
Yale Lift Truck, Basic Operator Training, 1994, 1995

PROFESSIONAL EXPERIENCE:

10/00 to Present — **GC/MS Volatiles Laboratory Supervisor**
Southwest Laboratory of Oklahoma, Inc.
Supervises and coordinates the daily routine of the Volatiles Laboratory including workload assignments, holding time, meeting established deadlines, and data review. Conducts sample analysis and instrument troubleshooting.

08/96 to 10/00 — **GC/MS Operator**
Analysis of environmental samples using methods TO-1, TO-14, and TO-15 by GC/MS and other methods such as RSK SOP175, GC/FID for water, soil, and air matrices. Cleaning of canisters and Tenax tubes.

11/95 to 7/96 — **Analytical Chemist**, Environmental Science and Engineering
Analysis of ambient air and soil gas samples using an Entech 7000/Finnigan INCOS 50 combo, following TO14, TO15, CLP, AFCEE, and Army protocols. Analysis of water and soil samples for volatile organics by EPA methods 8010, 8020, 8240, and 8260, using HP Chemstation (HP 5972 GC/MS) and PE Nelson Turbochrom 4 data systems (Carlos Erba 5300.) Analysis of semivolatile organics by EPA method 8270, using an HP 5971 GC/MS. Development and debugging of data processing methods and procedures for the INCOS data system.

9/91 to 10/95 — **Chemist**, USEPA Region 9
Ambient air and soil gas analysis using an Entech 2000/Finnigan INCOS XL combo and an Entech 2000/HP 5972 combo. Drinking water laboratory certification audits for chemistry and microbiology. LAN and PC coordinator for the Region 9 Richmond Laboratory. These duties involved the maintenance and support of a 50-user/70-PC Novell 3/11 Token Ring LAN and a Labworks LIMS.

10/90 to 9/91 — **Organic Analytical Chemist**, ICF Technology
Organic extraction and sample preparation. TPH analysis using a Perking Elmer Sigma 2000 GC and Chromatographics 3 software. Organochlorine pesticide and PCB analysis using a Varian 3400 GC and Turbochrom III software following EPA CLP methodology.

4/98 to 6/90 — **Assistant II**, UC Davis, Chemistry Department
Student assistant in the chemistry department electronics shop. Duties included: Assisting the department technicians with repair and maintenance of lab equipment; maintenance of the physical inventory records for the Chemistry Department; and Installation of computer network hardware and cable for IBM system 3.X, Ethernet, and Appletalk networks.

Appendix A-15

Personnel Experience

MARK SMITH

Information Systems Manager

EDUCATION: Masters of Biomedical Science Program
Major: Pharmacology, 25 credit hrs.
Oral Roberts University, Tulsa, Oklahoma, 1985

Bachelor of Science, Chemistry
Minor, Computer Science
Oral Roberts University, Tulsa, Oklahoma, 1984

PROFESSIONAL EXPERIENCE:

9/91 to Present — **Southwest Laboratory of Oklahoma, Inc.**

11/96 to Present — **Information Systems Manager**
Direct the in-house hardware and software development computer personnel. Develop programs to automate data reduction, reporting in CLP or CLP-like format, and the transfer of data electronically within the laboratory. Develop programs to generate client requested electronic data deliverables. System administrator for the HP-UX UNIX systems.

9/91 to 11/96 — **Organics Data Manager**
Develop software programs and UNIX scripts to assist in the data processing for the GC/MS and GC sections of the laboratory. Train users on data reduction software. Review Organic data packages. System administrator for the HP-UX UNIX systems.

9/89 to 9/91 — **NET, Inc.**, Carrolton, Texas
GC/MS Supervisor
Responsible for the scheduling and analysis of all samples for volatiles and semivolatiles by GC/MS. Responsible for the operation and maintenance of four HP GC/MS systems. Duties include data reviews, standards preparation, methods development, SOP development, writing software automation software, employee training, and instrument operation.

3/86 to 9/89 — **Southwest Laboratory of Oklahoma, Inc.**

11/88 – 9/89 — **Volatile Organics Group Leader**
Directed the operations of the volatiles GC/MS laboratory. Responsible for the scheduling and analysis of samples, so that holding time deadlines and turnaround times were met. Review data for quality and completeness. Responsible for the maintenance of the GC/MS systems.

8/86 to 11/88 — **GC/MS Chemist**
Analyzed environmental samples for volatiles, semivolatiles, and dioxins in accordance with EPA CLP or SW846 Methods.

3/86 to 8/86 — **Extractions and Inorganics Chemist**
Prepared extracts for GC and GC/MS analysis. Performed analysis for total organic carbon, oil and grease, chemical oxidation demand, and ion chromatography.

Appendix A-16

Personnel Experience

KERT SURFACE

Nuclear Chemistry Manager/Project Officer

EDUCATION: B.S. Geology, Minor in Computer Science
Stephen F. Austin University, 1987

PROFESSIONAL EXPERIENCE:

3/95 to Present — **Southwest Laboratory of Oklahoma, Inc.**

Nuclear Chemistry Manager, Radiation Safety Officer, Project Officer

Manages Radiochemistry laboratory with emphasis on instrumentation and wet chemical separations. Oversees sample receipt screening for mixed waste samples. Responsible for all activities including sample flow, production, data compilation for data deliverables, and chemical analysis for naturally occurring and man-made radionuclides. Trains chemists and technicians. Maintains second-line quality checks and turnaround time assurance in the radiochemistry laboratory and enforces all operating procedures, as well as US Department of Energy's requirements and client-specific requirements. Monitors control charts and sample preparation documents. Conducts technical audit tours in radiochemistry and login/sample receiving departments.

1/95 to 3/95 — **Texas A & M University**

Radiochemistry Manager, Geochemical Environmental Research. Completed radiation safety training seminars.

1990 to 1995 — **SCIENTECH, Inc.**

1992 to 1995 — Radiochemistry Manager, Developed and/or adapted standard analysis procedures for radiochemistry. Developed transuranics procedure for the chemical separation of americium and plutonium with routine yields of 60 to 100 percent, respectively. Developed working standard operating procedures for the analyses and instrumentation in the radiochemistry laboratory.

1990 to 1992 — Safety Officer, Radiochemistry Group Leader, Developed safety manual for environmental laboratory.

1989 to 1990 — **Alpha Energy Laboratories, Inc.**

Radiochemist — Duties includes radiochemistry, information management, and quality control. Developed computerized radiochemistry data reporting format under US Department of Energy's "General Radiochemistry and Routine Analytical Services Protocol" for data package assembling and electronic deliverables, as well as other client specific protocols.

Appendix A-17

Personnel Experience

ANN WADE

GC/MS Operator/Group Leader

EDUCATION: Bachelor of Science, Environmental Health
Indiana State University, Terre Haute, Indiana, 1986

Additional Courses:

RTE-A GC/MS Operator Course, Analytical Ed. Center, Atlanta, GA, 10/90

Health & Safety Supervisors Courses, Psara Technologies, 48 hours, 6/90

Building Inspection & Mgmt. Planning, Univ. of Illinois at Chicago, 2/88

Sampling & Analysis of Airborne Asbestos, NIOSH, Cincinnati, OH, 7/87

PROFESSIONAL EXPERIENCE:

7/92 to Present — **Southwest Laboratory of Oklahoma, Inc.**
GC/MS Operator/Group Leader
Conduct organic analysis of semivolatile environmental samples using combined gas chromatography/mass spectrometry (GC/MS) following EPA/CLP protocol and previously determined computer format. Prepare internal standards and calibration standards according to contract specifications. Check data from runs to ensure it meets protocol requirements. Assemble initial reports. Perform instrument maintenance to assure instrument is operating at maximum efficiency.

11/87 to 7/92 — **Hayden Environmental Group, Inc.**, Miamisburg, Ohio
Senior Organics Laboratory Technician

12/90 to 7/92 — GC Laboratory Group Leader/Technician, Equipment and instrument operation and maintenance, training of additional operators, and GC/MS analysis. Certified by OEPA for volatile organic compounds, insecticides and herbicides for drinking water.

5/90 to 12/90 — GC/MS Analyst, Operation, maintenance, of an RTE-A 5970 GC/MS system for volatile and semivolatile priority pollutant analysis and interpretation. Utilized EPA methods and CLP QA/QC protocol. Identify and evaluate health and safety hazards as Health & Safety Coordinator. Disposal of hazardous waste as Hazardous Waste Manager.

5/88 to 5/90 — GC Operator, Analysis of Pesticides/PCBs, solvent identification of industrial hygiene samples. Sample preparation, analysis, data reduction, reporting of results, and maintenance of instrument.

11/87 to 5/88 — Industrial Hygiene Technician, Perform contractor surveillance and asbestos sampling at abatement sites. Asbestos analysis by polarized light microscopy.

1984 to 1987 — **Internship Experience**

7/87 to 9/87 — **Environmental Specialist**—Franklin Envir. Testing, Inc.,
3/87 to 7/87 — **Environmentalist**—Warren Cty. Combined Health Dist.
5/85 to 8/85 — **Environmental Intern**—Warren Cty. Combined Health Dist.
5/84 to 8/84 — **Sanitarian Intern**—Dekalb County Health Department

Internship experience included asbestos air monitoring/sampling; noise/ventilation surveys; analysis of organics and metals; water sampling; and health inspections.

Appendix A-18

Personnel Experience
(Technical Personnel Experience Summary)

	Total Years Experience												
	Total Experience in Laboratory Field	Current Position	GC/MS	Purge & Trap	Gas Chromatography	High Performance Liquid Chromatography	Sample Preparation	Data Review	Inductively Coupled Plasma	Inorganic Analysis	Atomic Absorption	Data Reporting	Nuclear Chemistry
Alexander, Sam GC/MS Analyst B.S. Chemistry	12	10	10	3	Also 2 years in Field Sampling 10	2	3	8			3		
Anderson, Doug GC/MS Analyst B.S. Natural Science	9	3	5	3			4						
Assefa, Senait Extractions Technician M.S. Biochemistry	4	1					1						
Bolding, Blaine GC/MS Analyst B.S. Biology	3	2	2				2						
Borg, Harry Organic Program Manager B.A. Chemistry/Physics	18	9	11	1	11	1.5	2	15		2.5	1.5		
Brown, Shauna Analyst B.S. Biology	6wk	6wk											
Chance, Danny Extractions Technician B.S. Microbiology	2	2			1	1	2						
Crovador, Maria Extractions Technician H.S Diploma	3	3					3						
Derouen, Chris Extraction Technician H.S. Diploma	5	4					4						
Ebardt, Amanda Laboratory Technician A.A. Liberal Arts	1.5	1					1.5	1		1	1	1	
Eisen, Michael ICP Operator B.S. Chemistry	2	1.5	1		3	1	2	1.5	2	1	2	2	
Fee, Rebecca GC/MS Analyst B.S. Chemistry	14	5	7	8	8	3		5		3			
Foster, Desmond Organic Extractions Supv. H.S. Diploma	21	15			Also 5 years field & stack sampling * 2	5	19	7		6			
Freeman, Jennifer GC Analyst B.S. Micro Biology	3.5	1.5			1	0.5	1.5	1.5					
Gibson, Randy Group Leader B.S. Chemistry	4	1	3mo	3mo	3mo		4	4	1		4		
Grovenstein, Sandy Senior Chemist B.S. Biology	19	3	13		17	4		13			2		
Harris, Robert Laboratory Director B.S. Microbiology	26		4	3	10		15	18	2		15		

	Total Years Experience												
	Total Experience In Laboratory Field	Current Position	GC/MS	Purge & Trap	Gas Chromatography	High Performance Liquid Chromatography	Sample Preparation	Data Review	Inductively Coupled Plasma	Inorganic Analysis	Atomic Absorption	Data Reporting	Nuclear Chemistry
Hayes, David RAD Chemistry Analyst B.S. Environmental Science	2	2					2	2					2
Hoke, Diana GC/MS Analyst B.A. Chemistry	14	7	13	6	13		3	11		2			
Hoover, Chuck QA/QC Officer B.A. Biology/Chemistry	22	11	2	2	5	Also 10 yrs Project Management	8	7		5	4		
KariKari, Joseph GC Analyst B.S. Biochemistry	13	3	2	10	9		3	11		1	1	10	
Kidd, Gary ICP Analyst H.S. Diploma	13	13					6	2	3	7	7		
Landtroop, Bryon GC Analyst High School Diploma	5	1		2	2		3	2					
Lynch, Ken Inorganic Wet Chemistry Analyst B.A. History/A.S. Chemistry	10	3						2		3			
Markham, Steve Laboratory Manager B.S. Zoology	22	2					13	13	10	13	3		
Martindale, Terry GC Chemist B.S. Chemistry	17	1	1	11	17	1.5	16	17	2	2	2		
Miller, Matthew Dioxin Analyst B.S. Chemistry/B.S. Biology	5	3	2		2		4	4		3.5		3.5	
Pavey, Seretha GC/MS Analyst B.S. Math, A.S. Chemistry	10	4	6	4	6			3				3	
Persons, Matt GC Analyst B.S. Biology	9	2	7	2	8	1	3	3				2	
Ralph, Curt Extractions Technician B.S. Environmental Science	1	1					1						
Rhoades, Sharon AA, Mercury CV Operator H.S. Diploma	10	8					7	7		7	7		
Sein, Gideon Inorganic Analyst MB.ChB. Medicine M.S. Biological Science	6	2	3		2	2	3	2		1		1	
Shringarpure, Jayant Technical Director Ph.D. Organic Chemistry	20	7	18	18	18	5	5	20					
Spriggs, Jason Sample Receiving Supervisor H. S. Diploma	2	2											
Staggs, Randy Project Officer B.S. Biology	18	10			3		5	14		15	5		

	Total Years Experience												
	Total Experience In Laboratory Field	Current Position	GC/MS	Purge & Trap	Gas Chromatography	High Performance Liquid Chromatography	Sample Preparation	Data Review	Inductively Coupled Plasma	Inorganic Analysis	Atomic Absorption	Data Reporting	Nuclear Chemistry
Surface, Kert Nuclear Chemistry Manager B.S. Geology	12	4					12	12	1	3	1	9	9
Swartz, Alan GC Chemist B.S. Chemistry	12	10		1	8		9	10		2	2		
Ta, David Analyst B.S. Biochemistry B.S. Chemical Engineering	3mo	3mo						3mo		3mo		3mo	
Wade, Ann GC/MS Analyst B.S. Environmental Health	13	7	9	2	Also 3 years of field sampling 13	2	4	10			1		
Whitaker, Jim GC/MS Analyst B.S. Biochemistry	9	3	9	1	8	1	8	9			1		
Williamson, Janet GC/MS Analyst M.S. Analytical Chemistry	19	3	8	6	11	3	6	6			2		

Appendix B

Logbook Standard Operating Procedures

Details of SWLO's logbook maintenance procedures are found in the following standard operating procedures:

Title	Document ID
Maintenance of Zone Logbooks	SWL-GA-128
Guide to Volatile GC/MS Standard Log	SWL-OV-109
Guide to Semivolatile GC/MS Standard Log	SWL-OS-109
Standards Receipt Traceability And Preparation	SWL-OP-202
Inorganic Tracability of Standards	SWL-IN-104
Guide to Volatile GC/MS Run Log	SWL-OV-102
Semivolatile Run Logbook Maintenance	SWL-OS-102
Digestion/Distillation Log	SWL-IN-105

Appendix C-1

Ethics Policy Letter

Southwest Laboratory of Oklahoma, Inc.

Jack Wright
President

December 8, 1995

To: All Employees

A major factor in the continuing growth and success of Southwest Laboratory of Oklahoma, Inc. and its affiliated Companies (SWL) is the standard of personal and professional integrity with which its men and women conduct themselves.

Policies and standard operating procedures have been in place for some time governing the way in which the Company conducts its business. In addition to these policies and standard operating procedures, the Company is adopting a Code of Business Conduct, a written guide to assist SWL employees in understanding the principals of conduct that must be adhered to in order to fulfill the legal, moral and ethical obligations that each assumes as an employee.

The Company is committed to conducting its business in accordance with the Code of Business Conduct and established policies and standard operating procedures. All employees are expected to conduct their activities in a manner that will promote the observance of these principals and guidelines.

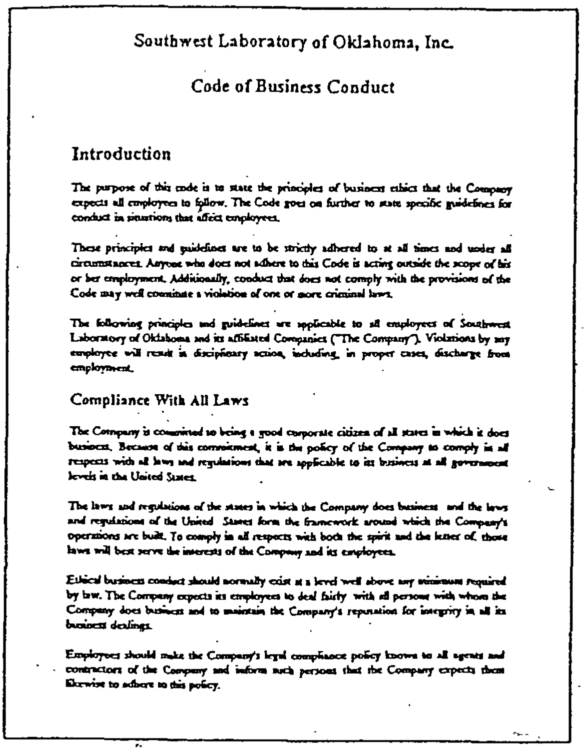
Very truly yours,

Jack W Wright

Jack Wright

Appendix C-2

Business Code of Conduct



Southwest Laboratory of Oklahoma, Inc.

Code of Business Conduct

Introduction

The purpose of this code is to state the principles of business ethics that the Company expects all employees to follow. The Code goes on further to state specific guidelines for conduct in situations that affect employees.

These principles and guidelines are to be strictly adhered to at all times and under all circumstances. Anyone who does not adhere to this Code is acting outside the scope of his or her employment. Additionally, conduct that does not comply with the provisions of the Code may well constitute a violation of one or more criminal laws.

The following principles and guidelines are applicable to all employees of Southwest Laboratory of Oklahoma and its affiliated Companies ("The Company"). Violations by any employee will result in disciplinary action, including, in proper cases, discharge from employment.

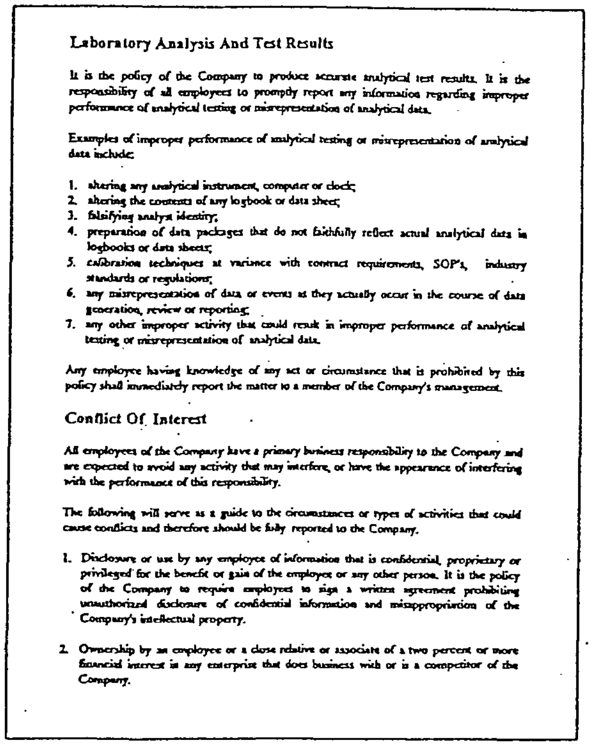
Compliance With All Laws

The Company is committed to being a good corporate citizen of all states in which it does business. Because of this commitment, it is the policy of the Company to comply in all respects with all laws and regulations that are applicable to its business at all government levels in the United States.

The laws and regulations of the states in which the Company does business and the laws and regulations of the United States form the framework around which the Company's operations are built. To comply in all respects with both the spirit and the letter of those laws will best serve the interests of the Company and its employees.

Ethical business conduct should normally exist at a level well above any minimum required by law. The Company expects its employees to deal fairly with all persons with whom the Company does business and to maintain the Company's reputation for integrity in all its business dealings.

Employees should make the Company's legal compliance policy known to all agents and contractors of the Company and inform such persons that the Company expects them likewise to adhere to this policy.



Laboratory Analysis And Test Results

It is the policy of the Company to produce accurate analytical test results. It is the responsibility of all employees to promptly report any information regarding improper performance of analytical testing or misrepresentation of analytical data.

Examples of improper performance of analytical testing or misrepresentation of analytical data include:

1. altering any analytical instrument, computer or clock;
2. altering the contents of any logbook or data sheet;
3. falsifying analyst identity;
4. preparation of data packages that do not faithfully reflect actual analytical data in logbooks or data sheets;
5. calibration techniques at variance with contract requirements, SOP's, industry standards or regulations;
6. any misrepresentation of data or events as they actually occur in the course of data generation, review or reporting;
7. any other improper activity that could result in improper performance of analytical testing or misrepresentation of analytical data.

Any employee having knowledge of any act or circumstance that is prohibited by this policy shall immediately report the matter to a member of the Company's management.

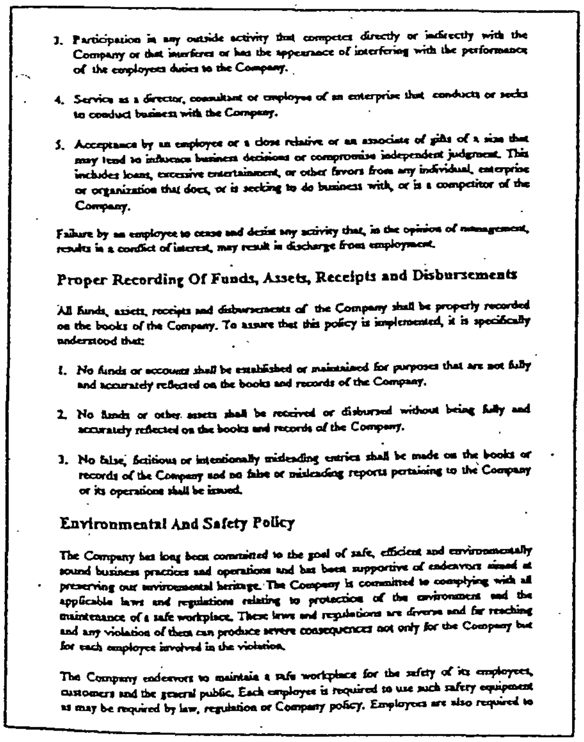
Conflict Of Interest

All employees of the Company have a primary business responsibility to the Company and are expected to avoid any activity that may interfere, or have the appearance of interfering with the performance of this responsibility.

The following will serve as a guide to the circumstances or types of activities that could cause conflicts and therefore should be fully reported to the Company.

1. Disclosure or use by any employee of information that is confidential, proprietary or privileged for the benefit or gain of the employee or any other person. It is the policy of the Company to require employees to sign a written agreement prohibiting unauthorized disclosure of confidential information and misappropriation of the Company's intellectual property.

2. Ownership by an employee or a close relative or associate of a two percent or more financial interest in any enterprise that does business with or is a competitor of the Company.



3. Participation in any outside activity that competes directly or indirectly with the Company or that interferes or has the appearance of interfering with the performance of the employees duties to the Company.

4. Service as a director, consultant or employee of an enterprise that conducts or seeks to conduct business with the Company.

5. Acceptance by an employee or a close relative or an associate of gifts of a size that may tend to influence business decisions or compromise independent judgment. This includes loans, excessive entertainment, or other favors from any individual, enterprise or organization that does, or is seeking to do business with, or is a competitor of the Company.

Failure by an employee to cease and desist any activity that, in the opinion of management, results in a conflict of interest, may result in discharge from employment.

Proper Recording Of Funds, Assets, Receipts and Disbursements

All funds, assets, receipts and disbursements of the Company shall be properly recorded on the books of the Company. To assure that this policy is implemented, it is specifically understood that:

1. No funds or accounts shall be established or maintained for purposes that are not fully and accurately reflected on the books and records of the Company.

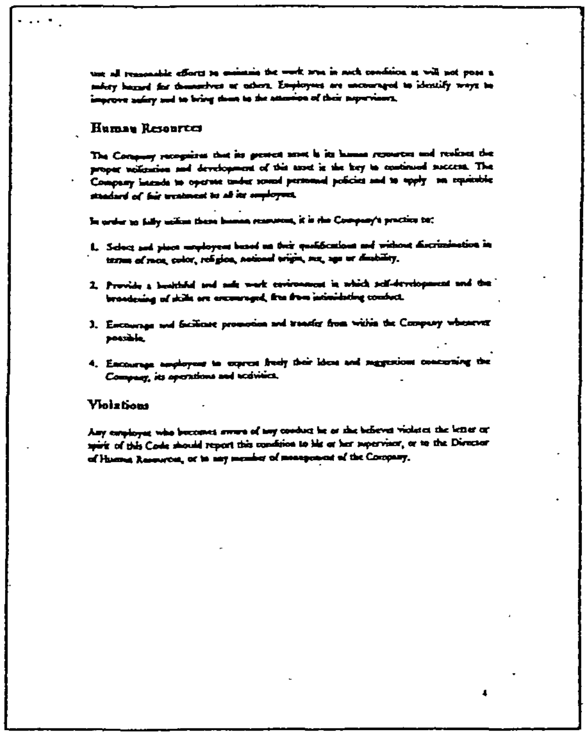
2. No funds or other assets shall be received or disbursed without being fully and accurately reflected on the books and records of the Company.

3. No false, fictitious or intentionally misleading entries shall be made on the books or records of the Company and no false or misleading reports pertaining to the Company or its operations shall be issued.

Environmental And Safety Policy

The Company has long been committed to the goal of safe, efficient and environmentally sound business practices and operations and has been supportive of endeavors aimed at preserving our environmental heritage. The Company is committed to complying with all applicable laws and regulations relating to protection of the environment and the maintenance of a safe workplace. These laws and regulations are diverse and far reaching and any violation of them can produce severe consequences not only for the Company but for each employee involved in the violation.

The Company endeavors to maintain a safe workplace for the safety of its employees, customers and the general public. Each employee is required to use such safety equipment as may be required by law, regulation or Company policy. Employees are also required to



use all reasonable efforts to maintain the work area in such condition as will not pose a safety hazard for themselves or others. Employees are encouraged to identify ways to improve safety and to bring them to the attention of their supervisors.

Human Resources

The Company recognizes that its greatest asset is its human resources and realizes the proper utilization and development of this asset is the key to continued success. The Company intends to operate under sound personnel policies and to apply an equitable standard of fair treatment to all its employees.

In order to fully utilize these human resources, it is the Company's practice to:

1. Select and place employees based on their qualifications and without discrimination in terms of race, color, religion, national origin, sex, age or disability.

2. Provide a healthful and safe work environment in which self-development and the broadening of skills are encouraged, free from intimidating conduct.

3. Encourage and facilitate promotion and transfer from within the Company whenever possible.

4. Encourage employees to express freely their ideas and suggestions concerning the Company, its operations and activities.

Violations

Any employee who becomes aware of any conduct he or she believes violates the letter or spirit of this Code should report this condition to his or her supervisor, or to the Director of Human Resources, or to any member of management of the Company.

Appendix C-3

Business Code of Conduct Acknowledgement Form

Southwest Laboratory of Oklahoma, Inc.

Code of Business Conduct

I have received the Company's Code of Business Conduct and have had an opportunity to review the Code and ask questions concerning the provisions of the Code.

I affirm the provisions of the Code and agree to adhere to the principles of conduct and guidelines therein.

As a Southwest Laboratory employee or as an employee of an affiliated Company, I understand that I have a responsibility to report to management any violation of the letter or the spirit of the Code of Business Conduct.

Employee Signature: ______________________________ Date:________

Appendix C-4

Confidential Information Agreement

Confidential Information Agreement

In consideration of my employment, or the continuation of same by Southwest Laboratory of Oklahoma, Inc. and its affiliated Companies, hereinafter collectively referred to as the "Company", I hereby agree as follows:

I will not without first obtaining the Company's written consent disclose to others, or use (except in performance of my duties for the Company), either during or after my employment, any information or date which pertains to the Company's business or interests and which is not freely available to persons not employed by the Company. Upon termination of my employment I will promptly turn over to the Company all then existing documents and copies thereof made or acquired by me during my employment which contains any such information or data.

Confidential information and trade secrets include, but are not limited to: customer or client lists; price lists; marketing and sales strategies and procedures; business plans and systems; quality control procedures and systems; special projects and technological research, including projects, research and reports for any government entity or client; client's plans and processes; client's manner of operation; trade secrets of clients; client's data; and any other records, data, files, drawing, inventions, discoveries, applications or processes which are not freely available to persons not employed by the Company.

I acknowledge that a remedy at law for any breach by me of any of the provisions of the confidentiality agreement will be inadequate and I hereby agree that the Company shall be entitled, where appropriate, to specific performance and/or injunctive relief in case of any breach thereof.

This agreement is not an employment contract and does not give any employee any right to be retained in the service of the Company.

In witness whereof, I have executed this agreement, intending to be legally bound, this ____________ day of ______________________, 19________.

______________________________ ______________________________
Printed Name Signature

Laboratory Quality Assurance Plan

Rev. 7.0 , 5/18/01

Changes:

Page	Sec. / Fig / Table	Comment
2	Fig. 1.1	*Map updated.*
7	Sec. 2.1.1	*President's job description added.*
12	Fig. 2.1	*Org Chart Updated*
16-17	Sec. 4.3	*Bottle Certification added*
22-35	Sec. 5.2	*Equipment List Updated / Inst. IDs added.*
43	Table 7.3	*Header revised*
48	Sec. 8.8	*Section Added.*
54	Tables 10.1 & 10.2	*Tables revised*
64-69	Tables 13.1 & 13.2	*Tables revised*
72-73	Tables 14.1 & 14.2	*Tables revised*
74	Sec. 15.0	*Added DOD QSM Reference*
83-95	Appendix A	*Updated Appendix*

Request for New, Revised, or Retired Documentation

GENERAL ADMINISTRATIVE

SOP SWL-GA-101, REV. # 2.0 FILE ID: GA101F1.doc

Document Title: Laboratory Quality Assurance Plan

Document No.: SWL-GA-100 *Existing* Rev. No. & Date 6.0 — 11/15/00

Submitted By *(if other than supervisor)*: ______ Date Submitted: 5/11/01

Approved by: ______ Date: ______

Program Manager/Section Supervisor

NEW Procedural Document *(Please attach hard-copy, and/or note below if file was e-mailed.)*

Author: ______

Justification for New Procedure:

REVISION *To Existing Procedural Documents, Including Forms & Logs*

[illegible]ason for Revision: ✓ **Annual Review** (✓ Changes / ___No Changes) ___**Other** (error found, etc.)

[illegible]r Minor Revisions, provide the following References:

Page ____ Section: ____.____; Subpart: ____ Page ____ Section: ____.____; Subpart: ____

Page ____ Section: ____.____; Subpart: ____ Page ____ Section: ____.____; Subpart: ____

Attachment No. ______ — Title: ______

Attachment No. ______ — Title: ______

Required — The following must be completed if revisions are necessary.

Description:

See Attached

RETIRED (*Circle One* — ***PROCEDURE*** or ***DOCUMENT***)

Circle "Procedure" if we no longer do the Method/Procedure discussed in the SOP.

Circle "Document" if the Method/Procedure is now included in another SOP. (Reference Other SOP's below)

Request for New, Revised, or Retired Documentation

GENERAL ADMINISTRATIVE

SOP SWL-GA-101, REV. # 2.0　　FILE ID: GA101F1.doc

Document Title: Laboratory Quality Assurance Plan

Document No.: SWL-GA-100　*Existing* Rev. No. & Date 6.0 – 11/15/00

Submitted By *(if other than supervisor)*: ____________　Date Submitted: 5/11/01

Approved by: ____________　Date: ____________

Program Manager/Section Supervisor

NEW Procedural Document *(Please attach hard-copy, and/or note below if file was e-mailed.)*

Author: ____________

Justification for New Procedure:

REVISION *To Existing Procedural Documents, Including Forms & Logs*

[illegible]son for Revision:　✓ **Annual Review** (✓ Changes / __ No Changes)　__ **Other** (error found, etc.)

[illegible]r Minor Revisions, provide the following References:

Page ____ Section: ____.____; Subpart: ____　Page ____ Section: ____.____; Subpart: ____

Page ____ Section: ____.____; Subpart: ____　Page ____ Section: ____.____; Subpart: ____

Attachment No. ______ — Title: ____________

Attachment No. ______ — Title: ____________

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Description:

See Attached

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Circle "Procedure" if we no longer do the Method/Procedure discussed in the SOP.

Circle "Document" if the Method/Procedure is now included in another SOP. (Reference Other SOP's below)

APPENDIX D

MINIMUM DETECTABLE CONCENTRATION TECHNICAL MEMORANDUM

1.0 OBJECTIVE

The specific objective of this technical memorandum is to estimate the scan and static minimum detectable concentration (MDC) for a 44-9 pancake G-M detector with ratemeter. The detection equipment will be used to scan soil cores along the length of the core and to provide static measurements at 0.5 foot intervals. It is important to note that this document is solely to be used to estimate scan and static MDCs prior to conducting surveys on the DuPont property. Actual field conditions and background rates will affect these estimates.

2.0 DETECTABILITY OF BETA PARTICLES IN SOIL CORES

2.1 Range of Detectable Beta Particles in Soil Cores

A G-M frisker consisting of a Ludlum Model 3 and 44-9 probe or equivalent will be used to make the desired measurements on the soil cores. The total active area of a 44-9 probe is 15 cm^2. This is equivalent to a disk diameter of approximately 1.7 inches. The soil core diameter is 2 inches resulting in the full coverage of the probe active area by the soil core containing potential radioactive contamination.

The response of the frisker to uranium and progeny in the soil is due primarily to the beta particles. The small gamma and bremsstrahlung component contributions to instrument response are ignored and the alpha particles have too small a range in soil to result in significant response. The average energy and range (density thickness) of the beta particles from the energetic Pa-234m is 0.825 MeV and 320 mg/cm^2. The average energy and the resultant range within the soil cores of the Th-234 and Th-231 beta particles are small (0.050 MeV and 0.085 MeV, respectively) and may be conservatively ignored for purposes of this calculation.

Assuming a density of the soil as 1.6 g/cm^3, the average range of a Pa-234m beta in soil is:

$$Linear\,Range = \frac{density thickness}{soil density} = \frac{320 mg/cm^2}{(1.6 g/cm^3)(1{,}000 mg/g)} = 0.2\,cm$$

2.2 Scan Volume of Soil Core Beta Particles Detected by 44-9 GM Probe

The average thickness of the soil core that has uranium beta particles capable of being detected by the 44-9 GM probe is 0.2 cm. It is assumed that beta particles more energetic than this average energy will be detected while those with lesser energy will have insufficient range to be detected.

This average range of the beta particles in the soil core results in the probe being able to detect uranium in a volume of soil equal to approximately the size of the probe active area times a thickness equal to the linear range of the average beta particle or:

$$\text{Volume of soil} = (\text{probe active area}) \times (\text{linear range of beta}) = (15\ cm^2) \times (0.2\ cm)$$
$$= 3\ cm^3\ \text{soil}$$

3.0 ESTIMATION OF MINIMUM DETECTABLE CONCENTRATION

3.1 MDCR Ludlum Model 44-9 or Equivalent

The scan minimum detectable count rate (MDCR) is dependent upon several factors including surveyor performance, instrument sensitivity, distribution of contamination, etc.

3.1.1 Determination of Number of Source Counts

The MDCR is calculated by obtaining the minimum detectable number of source counts (S_i) in a given time interval, *i*. S_i is calculated by using equation 6-8 in MARSSIM as:

$$S_i = d'\sqrt{b_i}$$

Where: d' = is the detectability value associated with the desired performance selected from Table 6-5 in MARSSIM

b_i = background counts during interval, i

The background counts will fluctuate with the background materials present at the site and in the soil core. Varying concentrations of naturally occurring radioactive materials are present in the soil. Based upon manufacturer specifications, it is also assumed that the response of the Ludlum Model 44-9 to ambient background radiation is 3,300 cpm/mR/hr. Based on various background rates, the following 44-9 count rates may be expected.

Table 1 Count Rates based on ambient gamma background

	Ambient Gamma Background Rate		
	5 uR/hr	**10 uR/hr**	**15 uR/hr**
Average 44-9 Count Rate (cpm)	17	33	50

It is assumed that during a typical scanning survey an elevated source of radioactivity will remain under the probe for one second. The diameter of the detector is 4.4 cm. Assume a scan speed of 1 cm per second. At this scan rate the majority of the activity in the soil viewed by the probe active area will be present for at least 1 second. This assumes that any elevated radioactivity is a point source. Further, it is conservatively assumed that the higher background rate of 15 uR/hr exists and this is doubled to 100 cpm to account for low levels of potassium-40 and other naturally occurring beta emitters in the soil. This results in background counts in the observation interval of one second when scanning the soil core as:

$$b_i = (100\,cpm)(1\,\mathrm{sec}\,ond)\left(\frac{\min ute}{60\,\mathrm{sec}\,onds}\right) = 1.67\,counts$$

The value of d' is selected from Table 6.5 in MARSSIM and is based upon the acceptable true and corresponding false positive proportions or rates during scanning. For example, if a 95% confidence level is placed on the ability to correctly detect the presence of radioactivity above background, then there is only a 5% chance that radioactivity above background will be missed. Further, if a 25% confidence level is placed on falsely identifying areas as containing radioactivity above background, 75% of the time areas not containing radioactivity above background will be correctly determined as background. For the purposes of the work plan, a 95% confidence level will be used for correctly detecting the presence of radioactivity, with an allowance for 60% false positive detection. Having a higher percentage of false positives does not require increased sampling, but rather further investigation by either slowing the scan speed in the location of interest or performing an integrated count. A higher false positive value is actually conservative because background locations are investigated as though they contained residual radioactivity. The ramification of increasing the false positive proportion is that survey scanning time is increased. The value for d' in Table 6-5 of MARSSIM for the confidence levels specified above is 1.38. Therefore, the minimum number of source counts, when scanning soil cores, is calculated as:

$$S_i = 1.38\sqrt{1.67} = 1.8\,counts$$

3.1.2 Calculation of MDCR

The MDCR is calculated by using equation 6-9 in MARSSIM.

$$MDCR = S_i \frac{60}{i}$$

As stated in Section 0, it is assumed that during a typical scanning survey an elevated source of radioactivity will remain under the probe for one second. Therefore, when scanning the soil core, the MDCR is calculated as:

$$MDCR = (1.8\,counts)\left(\frac{60\sec onds}{1\sec.\min.}\right) = 108\,cpm$$

3.1.3 Estimation of Scan MDC

The scan MDC is determined from the Minimum Detectable Count Rate (MDCR) by applying necessary conversion factors that account for surveyor performance, detector efficiency, probe area, etc. The scan MDC is calculated by using equation 6-10 in MARSSIM as:

$$Scan\,MDC(dpm/100\,cm^2) = \frac{MDCR}{\sqrt{p}\,\epsilon_i\epsilon_s\,\frac{probe\,area}{100\,cm^2}}$$

Where: MDCR = minimum detectable count rate

ε_i = instrument efficiency
ε_s = surface efficiency
p = surveyor efficiency

The Nuclear Regulatory Commission publication NUREG-1507 recommends surveyor efficiency values between 0.75 and 0.5. To be conservative, 0.5 is chosen. Based upon manufacturer specifications, the anticipated efficiency for the Model 44-9 probe for high energy betas such as protactinium 234m is 20%. This efficiency is assumed as the combined surface and instrument efficiency listed above. The probe area of the Model 44-9 is 15 square centimeters. The scan MDC for a soil core is calculated as:

$$Scan\,MDC = \frac{108\,cpm}{\sqrt{0.5}\left(0.2\frac{c}{d}\right)\left(\frac{15\,cm^2}{100\,cm^2}\right)} = 72\,pCi/g$$

Applying the volume of soil calculated in Section 3.2, and adjusting for the active area of the probe and soil density, the scan MDC may be expressed in terms of activity concentration:

$$Activity\,Scan\,MDC = \frac{\left(\frac{5{,}090\,dpm}{100\,cm^2}\right) x \left(\frac{15\,cm^2}{frisk}\right)}{\left(\frac{2.22\,dpm}{pCi}\right) x \left(\frac{1.6\,g}{cm^3}\right) x \left(3\,cm^3\right)} = 72\,pCi/g$$

4.0 ESTIMATION OF STATIC DIRECT MEASUREMENT SENSITIVITY

The static MDC or direct measurement sensitivity is dependent only upon the background rate.

4.1 Minimum Detectable Concentration Expression

The critical level (L_C) and the detection limit (L_D) for direct measurement sensitivity is given by MARSSIM equation 6-6. Based upon Type I and Type II errors set at 0.05, these expressions are:

$$L_c = 2.33\sqrt{B} \quad and$$

$$L_D = 3 + 4.65\sqrt{B}$$

Where,

L_C = critical level (counts)

L_D = detection limit (counts)

B = background counts that are expected while performing the actual measurement

4.2 Detection Equipment and Direct Measurement Sensitivity

A G-M pancake probe such as the Ludlum 44-9 or equivalent provides a highly sensitive detector for detecting beta emissions. It is also sensitive to gamma radiation but at a lower rate. L_C and L_D values are calculated as follows:

$$L_c = 2.33\sqrt{B} \quad = 2.33\sqrt{100} = 23\,counts$$

$$L_D = 3 + 4.65\sqrt{B} \quad = 3 + 4.65\sqrt{100} = 50\,counts$$

These values are somewhat higher than MARSSIM Table 6.4 estimates of beta survey instrumentation sensitivity due to conservative background estimates.

The MDC is calculated from equation 6-7 of MARSSIM:

$$MDC = C\,x\left(3+4.65\sqrt{B}\right)$$

Where, for a one minute count basis

C = total detection efficiency over the volume of soil core with detectable 44-9 probe counts, and

$$Activity\,MDC = \frac{\left(\frac{5\,dpm}{cpm}\right)}{\left(\frac{2.22\,dpm}{pCi}\right)}\,x\,\frac{\left(3+4.65\sqrt{100}\right)}{\left(4.8\,g\right)} = 23\,pCi/g$$

APPENDIX E

PATROON CREEK SAMPLING LOG, COLONIE FUSRAP

Shaw

Patroon Creek Sampling Log
Colonie FUSRAP

Sample Identification Matrix Sediment

Date of Sample Collection ________________

Time ________________

Weather ________________

Other ____

____

Sampled by ______________________________ (Print) ______________________________ (Signature)

In Situ Analysis Background ______________ 1.5 X Background = ______________

Result	________________	(0.5-1.0)	Result	________________	(5.0-5.5)
Result	________________	(1.0-1.5)	Result	________________	(5.5-6.0)
Result	________________	(1.5-2.0)	Result	________________	(6.0-6.5)
Result	________________	(2.0-2.5)	Result	________________	(6.5-7.0)
Result	________________	(2.5-3.0)	Result	________________	(7.0-7.5)
Result	________________	(3.0-3.5)	Result	________________	(7.5-8.0)
Result	________________	(3.5-4.0)	Result	________________	(8.0-8.5)
Result	________________	(4.0-4.5)	Result	________________	(8.5-9.0)
Result	________________	(4.5-5.0)			

Analyzed by ______________________________ (Print) ______________________________ (Signature)

On Site HPGe Analysis Date ________________ Time ________________

Result ________________

Analyzed by ______________________________ (Print) ______________________________ (Signature)

Sample Disposition (Check One) ________ On-Site Analysis Only ________ On-Site and Off-Site Analysis

Date Shipped (if applicable) ________________

COC # (if applicable) ________________

OCC 2003-10.042
PLANS

FILE COPY

Shaw Environmental, Inc.
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Edgewood, MD 21040-1037
410.612.6350
Fax 410.612.6351

Shaw™ Shaw Environmental, Inc.

October 14, 2003

Ms. Debra Ford
U.S. Army Corps of Engineers
10 South Howard Street
Baltimore, MD 21201

SUBJECT: Final Site Investigation Work Plan, Sampling and Analysis Plan, and Health and Safety Plan, Unnamed tributary of Patroon Creek, Patroon Creek, and Three Mile Reservoir, Colonie FUSRAP Site, Colonie, New York.

Dear Ms. Ford:

Enclosed please find three copies of the Final Site Investigation Work Plan, Sampling and Analysis Plan, and Health and Safety Plan. The final version incorporates comments received from the U.S. Army Corps of Engineers (USACE) on the draft final version of the above referenced documents. Also enclosed is an electronic copy of the above referenced documents on a CD.

Shaw Environmental, Inc. appreciates the opportunity to be of service to USACE. If you would like to discuss this report in more detail, or if I can be of further assistance, please feel free to contact me at (410) 612-6381.

Sincerely,

Shaw Environmental, Inc.

Mohammad Z. Iqbal, P.E., PMP
Work Plans Task Manager

Cc:
James Moore, CPG, USACE (1 copy and 1 CD)
Joseph Pierce, USACE (1 copy and 1 CD)
Anthony Sheeran, P.E., Shaw (2 copies)
David Stahl, P.E., Shaw (4 copies)