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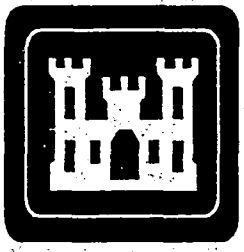
FINAL
USACE/OR/DACA62-1046

QUALITY ASSURANCE PROJECT PLAN FOR THE ST. LOUIS AIRPORT AND DOWNTOWN SITES

ST. LOUIS, MISSOURI

JUNE 1998



U.S. Army Corps of Engineers
St. Louis District Office
Formerly Utilized Sites Remedial Action Program

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QUALITY ASSURANCE PROJECT PLAN FOR THE ST. LOUIS AIRPORT AND DOWNTOWN SITES

ST. LOUIS, MISSOURI

JUNE 1998

prepared by
U.S. Army Corps of Engineers, St. Louis District Office, Formerly Utilized Sites Remedial Action Program

with technical assistance from
Science Applications International Corporation ESC-FUSRAP
under Contract No. DACA62-94-D-0029

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1.0 PROJECT DESCRIPTION

This portion of the Sampling and Analysis Plan presents the Quality Assurance Project Plan (QAPP) for activities to be performed during investigations at the FUSRAP St. Louis Airport Site (SLAPS) and the FUSRAP Saint Louis Downtown Site (SLDS) in St. Louis, Missouri. The United States Army Corps of Engineers (USACE) and the United States Environmental Protection Agency (EPA) require that all environmental monitoring and measurement efforts mandated or supported by these organizations participate in a centrally managed quality assurance (QA) program. Any party generating data for this project has the responsibility to implement minimum procedures to ensure that the precision, accuracy, completeness, and representativeness of its data are known and documented. To ensure that these responsibilities are met uniformly, each party must adhere to the QAPP.

This QAPP presents the organization, objectives, functional activities, and specific QA and quality control (QC) activities associated with the Sampling and Analysis Plan (SAP) for the SLAPS and SLDS investigations. It describes the specific protocols that will be followed for sampling, sample handling and storage, chain of custody, and laboratory analysis. This plan also presents details regarding data quality objectives for the project, sampling and preservation procedures for samples collected in the field, field and sample documentation, sample packaging and shipping, and laboratory analytical procedures for all media sampled. Analytical activities and methodologies associated with chemical testing of QA split samples to be performed by the government laboratory assigned to this project by the USACE are not addressed within this QAPP.

All QA/QC procedures will be in accordance with applicable professional technical standards, EPA requirements, government regulations and guidelines, and specific project goals and requirements. This QAPP is prepared by Science Applications International Corporation (SAIC) in accordance with EPA QAPP and USACE guidance documents, *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans* (EPA 1991), *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations* (EPA 1994a), and *Requirements for the Preparation of Sampling and Analysis Plans* (USACE 1994a).

The SAP contains the project description, site history and background information, along with past data collection activities and existing site data information. The SAP also contains the project scope and objectives. Sampling design, procedures, methods, and rationales are discussed in detail in the SAP. Planned sampling activities, sampling rationales, numbers of samples, frequency of QC samples, and types of analyses are presented in Tables 2-1 and 2-2 of the SAP. Primary project organization and responsibilities are presented in Section 2.0 of this QAPP.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The organizational chart shown in Figure 2-1 outlines the management structure that will be used to implement the project. Science Applications International Corporation (SAIC) is the designated United States Army Corp of Engineers (USACE) contractor responsible for conducting these investigations. The functional responsibilities of key personnel are described in the following parts of this section. The assignment of personnel to each project position will be based on a combinations of (1) experience in the type of work to be performed, (2) experience working with USACE personnel and procedures, (3) a demonstrated commitment to high quality and timely job performance, and (4) staff availability.

2.1 SAIC PROGRAM MANAGER

The SAIC Program Manager ensures the overall management and quality of all SAIC Formerly Utilized Sites Remedial Action Program (FUSRAP) projects performed under USACE contracts. This individual will ensure that all project goals and objectives are met in a high-quality and timely manner. Quality assurance (QA) and nonconformance issues will be addressed by this individual, in coordination with the SAIC Project Manager, for corrective action.

2.2 SAIC SLAPS OR SLDS TECHNICAL PROJECT MANAGER

The SAIC SLAPS and SLDS Technical Project Managers have direct responsibility for implementing the SAP, including all phases of work plan development, field activities, data management, and report preparation. These individuals will also provide the overall management of the projects, and serve as the technical leads and points of contact with the USACE Project Managers. These activities will involve coordinating all personnel working on the projects, interfacing with USACE personnel, and tracking project budgets and schedules. The SAIC Project Managers will also develop, monitor, and fill project staffing needs, delegate specific responsibilities to project team members, and coordinate with administrative staff to maintain a coordinated and timely flow of all project activities.

2.3 SAIC QA/QC OFFICER

The SAIC QA/QC Officer is responsible for the project QA/QC in accordance with the requirements of the project Quality Assurance Project Plan (QAPP), other work plan documentation, and appropriate management guidance. This individual, in coordination with the SAIC Chemical Quality Control (CQC) Representative, will be responsible for participating in the project field activity readiness review; approving variances during field activities before work continues; approving, evaluating, and documenting the disposition of Nonconformance Reports (NCRs); overseeing and approving any required project training; and designing audit/surveillance plans followed by supervision

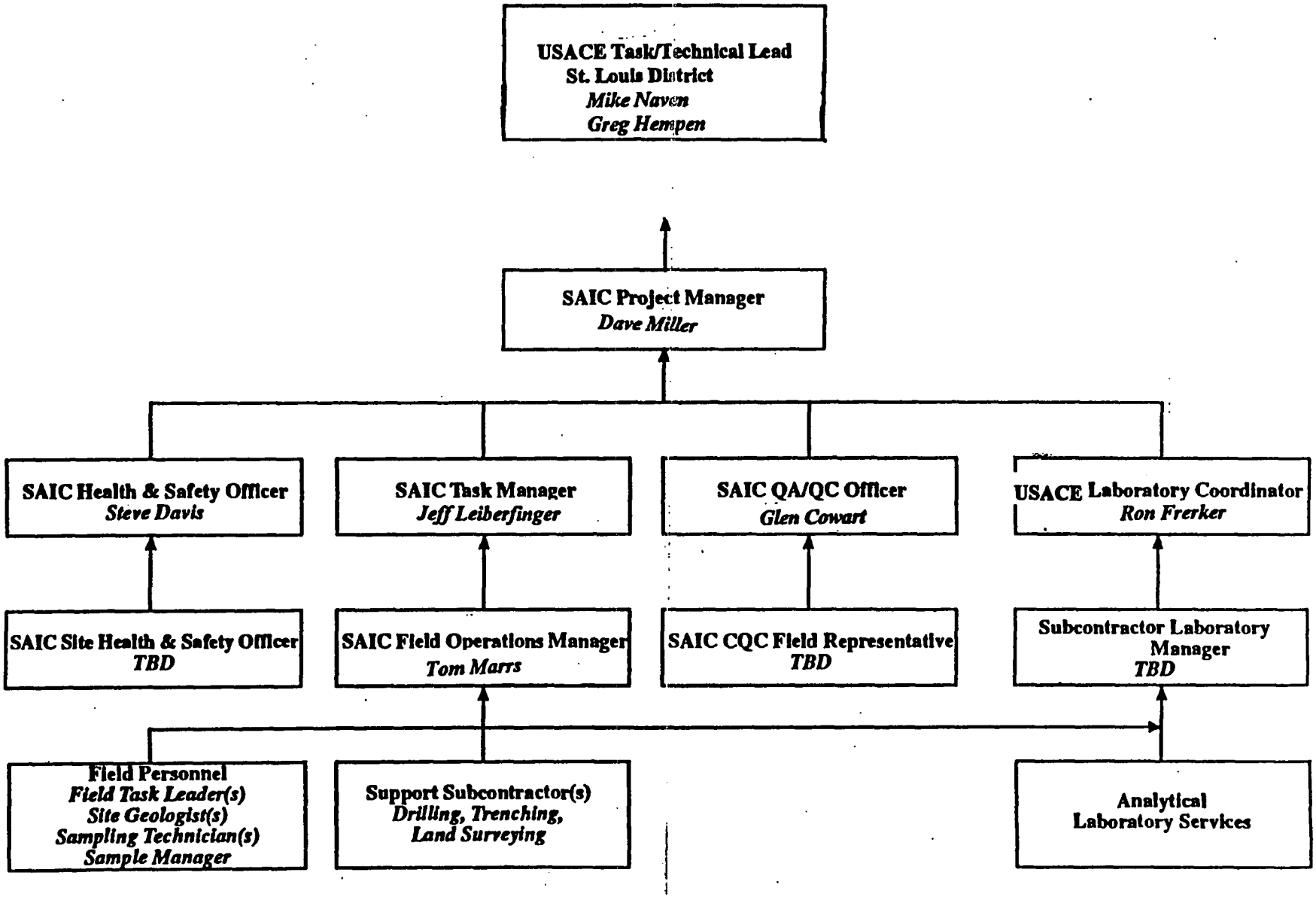

Figure 2-1. Project Organizational Chart for SLAPS Investigations

of these activities. The SAIC QA/QC Officer reports directly to the SAIC Program and Project Managers.

2.4 SAIC CHEMICAL QUALITY CONTROL REPRESENTATIVE

The SAIC CQC Representative is responsible for implementation and documentation of all project QA/QC protocols during field activities. In this capacity they will direct and implement the various components of the Contractor Chemical Quality Control (CCQC) program as identified in EM200-1-3. This will include but not be limited to: documentation of QAPP instructions to field personnel; oversight of field sampling and analytical activities; documentation of field QC activities; and completion of Daily Chemical Quality Control Reports (DCQCRs). The SAIC CQC Representative reports directly to the SAIC QA/QC Officer, but will inform the SAIC Project Manager of all information and decisions reported.

2.5 USACE QA LABORATORY

The USACE QA Laboratory for this project is the USACE Hazardous, Toxic, and Radioactive Waste (HTRW) Center of Excellence (CX), Omaha, NE. The point of contact is Douglas Taggart, 402-444-4300. The shipping address is:

Attn: CECM-QAL
420 South 18th Street
Omaha, NE 68102

2.6 SAIC HEALTH AND SAFETY OFFICER

The SAIC Health and Safety Officer is responsible for ensuring that health and safety procedures designed to protect personnel are maintained throughout the field activities. This will be accomplished by strict adherence to the project Site Safety and Health Plan (SSHP), which has been prepared as a separate document for this project. This individual, in conjunction with the SAIC Site Safety and Health Officer (SSHO), will have the authority to halt field work if health or safety issues arise that are not immediately resolvable in accordance with the project SSHP. The SAIC Health and Safety Officer and SSHO report directly to the SAIC Program and Project Managers.

2.7 SAIC LABORATORY COORDINATOR

The SAIC Laboratory Coordinator is responsible for coordination of sample shipment to the laboratory(s), and subsequent chemical and radiochemical analysis and reporting performed by the subcontract laboratories, in accordance with the requirement defined in the QAPP. This individual will also coordinate the shipment of samples to the USACE QA Laboratory, which has been designated as the government QA laboratory for the project. This individual will be responsible for

obtaining required sample containers from the laboratories for use during field sample collection, resolving questions the laboratory may have regarding QAPP requirements and deliverables, and coordination of data reduction, validation, and documentation activities related to sample data package deliverables received from the laboratories. The SAIC Laboratory Coordinator reports directly to the SAIC Project Manager.

2.8 SAIC FIELD OPERATIONS MANAGER

The SAIC Field Operations Manager (FOM) is responsible for implementing all field activities in accordance with the SAP and the QAPP. This individual is responsible for ensuring proper technical performance of drilling operations and field sampling activities, adherence to required sample custody and other related QA/QC field procedures, coordination of field personnel activities, management of investigative-derived wastes, checks of all field documentation, and preparation of Field Change Orders (FCOs) if required. The SAIC FOM reports directly to the SAIC Project Manager except in regard to QA/QC matters that are reported directly to the SAIC QA/QC Officer.

2.9 SAIC FIELD PERSONNEL

In addition to the SAIC FOM, other SAIC field personnel participating in the implementation of field activities are anticipated to be site geologists and sampling technicians. These individuals, in coordination with field subcontractor personnel, will be responsible for performance of drilling operations, collection of soil, groundwater, surface water, etc. and preparation of field logbooks and other required documentation. These individuals will be responsible for performing all field activities in accordance with the SAP and QAPP, and will report directly to the SAIC FOM.

2.10 SUBCONTRACTOR FIELD PERSONNEL

Subcontractor field personnel, under the supervision of the SAIC FOM, will be responsible for performing their specific scopes of work that have been derived from the SAP. These individuals will be required to review applicable sections of the SAP, QAPP, and the entire SSHP, prior to field mobilization. All subcontractor field personnel report directly to the SAIC FOM who will be responsible for ensuring that all subcontractor activities comply with project requirements.

2.11 SUBCONTRACTED LABORATORY SUPPORT

Analytical laboratory support specific to these investigations will be obtained from the Hazelwood Interim Storage Site (HISS) On-Site Radiological Laboratory and Quanterra Environmental Services, Earth City, MO. Chemical and radiochemical laboratory support for these investigations will be designated to these subcontractors based on their capacities and capabilities. These selected subcontract laboratories will be validated by the USACE Hazardous, Toxic, and Radioactive Waste (HTRW) Center of Expertise (CX), Omaha, Nebraska. Relevant QA Manual,

laboratory qualification statements, certifications, and license documentation will be made available upon request. Geotechnical laboratory support will be designated to a separate subcontractor and will follow the same concept as identified.

Organization charts outlining the key laboratory personnel and organization will be identified in their QA Plans. The responsibilities of key personnel are described in the following paragraphs. The assignment of personnel to each position will be based on a combination of (1) experience in the type of work being performed, (2) experience working with USACE personnel and procedures, and (3) a demonstrated commitment to high quality and timely job performance.

Prior to commencement of field activities for the project, SAIC will send a complete copy of the work plan including this QAPP to all subcontracted laboratories.

2.11.1 Laboratory Quality Assurance/Quality Control Manager

The subcontractor Laboratory QA/QC Manager is responsible for the laboratory QA/QC in accordance with the requirements of this QAPP in conjunction with the established laboratory QA Program. In coordination with the SAIC Laboratory Coordinator, this individual will be responsible for documenting that samples received by the laboratory are analyzed in accordance with required methodologies, that instrument calibration is performed properly and documented, that field and internal laboratory QC samples are analyzed and documented, and that all analytical results for both field and QC samples are reported to SAIC in the format required in the laboratory scope of work and QAPP. This individual is also responsible for processing laboratory NCRs in a timely manner and for implementing Corrective Action Report recommendations and requirements. The Subcontractor Laboratory QA/QC Manager reports directly to the SAIC Laboratory Coordinator for issues related to this project.

2.11.2 Laboratory Project Manager

The responsibilities of each laboratory Project Manager include the following: initiation and maintenance of contact with SAIC on individual job tasks; preparation of all laboratory-associated work plans, schedules, and manpower allocations; initiation of all laboratory-associated procurement for the project; provision of day-to-day direction of the laboratory project team including analytical department managers, supervisors, QA personnel, and data management personnel; coordination of all laboratory related financial and contractual aspects of the project; provision of formatting and technical review for all laboratory reports; provision of day-to-day communication with SAIC; provision of final review and approval on all laboratory analytical reports to SAIC; and response to all post project inquires.

2.11.3 Laboratory Manager

The responsibilities of each laboratory's Laboratory Manager include the following: coordination of all analytical production activities conducted within the analytical departments; working with the Laboratory Project Manager to ensure all project objectives are met; provision of

guidance to analytical department managers; and facilitation of transfer of data produced by the analytical departments to the report preparation and review staff for final delivery to the client.

2.11.4 Laboratory Section Heads, Department Managers, and Technical Leads

The responsibilities of each laboratory section or department include the following: coordination of all analytical functions related to specific analytical areas; provision of technical information to and oversight of all analysis being performed; review and approve all analytical results produced by their specific analytical area of expertise; and maintenance all analytical records and information pertaining to the analysis being performed.

3.0 DATA QUALITY OBJECTIVES

The overall project objective is to develop and implement procedures for field sampling, chain of custody (COC), laboratory analysis, and reporting, which will provide information for site evaluation and assessment leading to remediation. Data must be technically sound and legally defensible. Procedures for sampling, COC, laboratory instrument calibration, laboratory analysis, reporting of data, internal QC, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP. The purpose of this section is to address the objectives for data accuracy, precision, completeness, representativeness, and comparability. The SAP identifies specific task objectives as they relate to site action levels and remediation.

Data Quality Objectives (DQOs) are qualitative and quantitative statements that specify the quality of data required to support decisions made during investigation activities, and are based on the end uses of the data being collected.

3.1 PROJECT OBJECTIVES

General objectives are as follows:

(1) To provide data of sufficient quality and quantity to support ongoing remedial efforts, define the constituents of concern, supplement the FS, and develop a ROD for the site.

(2) To provide data of sufficient quality to meet applicable State of Missouri and Federal concerns.

(3) To ensure samples are collected using approved techniques and are representative of existing site conditions.

(4) To specify QA/QC procedures for both field and laboratory methodology to meet the USACE and other applicable guidance document requirements.

3.2 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

An analytical DQO summary for these investigations is presented in Tables 3-1 and 3-2. All QC parameters stated in the specific SW-846 methods (i.e., percent recoveries) will be adhered to for each chemical listed. When a laboratory has been selected for this project, it will be required to submit all lab method SOPs and references, and the actual method detection limits to be achieved in all analyses.

As per the EPA guidance (1993a) a combination of Screening Level and Definitive Level data will be required for this project.

Table 3-1. Surface Soil/Subsurface Soil DQO[1] Summary for SLAPS Investigations

Data Use	Sample Type	Analytical Method	Precision Field Dups	(RPD[2]) Lab Dups	Accuracy (LCS[3]/MS)	Completeness[4]
Screening for sample site selection	Discrete	FID/PID Volatile Organics	+/- comparison	NA	+/- 0.1 ppm	95%
		Radiological monitoring	+/- cpm	NA	NA	95%
Confirmation of contamination extent	Discrete	SW-8260B Volatile Org.	<50 RPD	<35 RPD	50-150% recovery	90%
	Discrete or Composite	SW-8270C Semivolatile Organics	<50 RPD	<35 RPD	30-140% recovery	90%
		SW-8080 Pesticides/PCBs	<50 RPD	<35 RPD	35-135% recovery	90%
		SW-8150 Herbicides	<50 RPD	<35 RPD	35-135% recovery	90%
		SW-6010A/6020/ 7000 Metals	<50 RPD	<35 RPD	75-125% recovery	90%
		Radiochemical various	<50 RPD	<35 RPD	75-125% recovery	90%
Determination of Waste Characteristics	Discrete or Composite	Waste Characteristics	NA RPD	<40	50-150% recovery	90%
		Physical Testing	NA	<40 RPD	NA	90%

1 These DQOs will also apply to waste, IDW, air filter, soil gas absorbent, and other solid sample media.

2 RPD = Relative Percent Difference, at values within five times the reporting level comparison is acceptable when values are plus or minus three times the reporting level.

3 Goals include having 90% of the measurements within the recovery and RPD criteria for LCS and duplicate samples.

4 Critical samples will be identified in the SAP, where 100% completeness is required.

cpm = counts per minute

Table 3-2. Water and Field QC Investigative DQO Summary for SLAPS Investigations

Data Use	Sample Type	Analytical Method	Precision Field Dups	(RPD[1]) Lab Dups	Accuracy (LCS[2]/MS)	Completeness[4]
Screening for sample site selection	Discrete	FID/PID Volatile Organics	NA	NA	+/- 0.1 ppm	95%
Determination of basic water characteristics	Discrete	EPA-120.1 Conductivity	<10 RPD	NA	+/- 10 μmhos/cm	95%
		EPA-150.1 pH	<10 RPD	NA	+/- 0.1 s.u.	95%
		EPA-170.1 Temperature	<10 RPD	NA	NA	95%
		EPA-180.1 Turbidity	<10 RPD	NA	+/- 2 NTU	95%
Confirmation of contamination extent	Discrete	SW-8260B Volatile Organics	<25 RPD	<20 RPD	50-150% recovery	90%
	Discrete or Composite	SW-8270C Semivolatile Organics	<25 RPD	<20 RPD	30-140% recovery	90%
		SW-8080 Pesticides/PCBs	<25 RPD	<20 RPD	35-135% recovery	90%
		SW-8150 Herbicides	<25 RPD	<20 RPD	35-135% recovery	90%
		SW-6010A/6020/ 7000 Metals	<30 RPD	<20 RPD	75-125% recovery	90%
		Anions and other water quality parameters various	<30 RPD	<20 RPD	75-125% recovery	90%
		Radiochemical various	<30 RPD	<20 RPD	75-125% recovery	90%

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

2 Goals include having 90% of the measurements within the recovery and RPD criteria for LCS and duplicate samples.

3 Critical samples will be identified in the SAP, where 100% completeness is required.

Definitive data represent data generated under laboratory conditions using EPA-approved procedures. Data of this type, both qualitative and quantitative, are used for determination of source, extent, or characterization and to support evaluation of remedial technologies and preliminary assessment memorandum.

3.2.1 Level of Quality Control Effort

To assess whether QA objectives have been achieved, analyses of specific field and laboratory QC samples will be required. These QC samples include field trip blanks, field duplicates, laboratory method blanks, laboratory control samples, laboratory duplicates, rinsate blanks, field blanks, and matrix spike/matrix spike duplicate (MS/MSD) samples.

Trip blanks, rinsate blanks, and field blanks will be submitted for analysis along with field duplicate samples to provide a means to assess the quality of the data resulting from the field sampling program. Trip blanks (employed for VOC analysis only) are used to assess the potential for contamination of samples due to contaminant migration during sample shipment and storage. Rinsate blanks are used to assess the effectiveness of field decontamination processes in conjunction with field blanks of the site potable water source used for decontamination. Criteria and evaluation of blank determinations are provided in Table 3-3 and Section 8.3. Field duplicate samples are analyzed to determine sample heterogeneity and sampling methodology reproducibility.

Laboratory method blanks and laboratory control samples are employed to determine the accuracy and precision of the analytical method implemented by the laboratory. Matrix spikes provide information about the effect of the sample matrix on the measurement methodology. Laboratory sample duplicates and MSDs assist in determining the analytical reproducibility and precision of the analysis for the samples of interest.

The general level of QC effort will be at least one field duplicate for every twenty investigative samples and at least one per matrix if there are less than 20 samples collected for a given matrix. One volatile organic compound (VOC) analysis trip blank consisting of analyte-free water will be included along with each shipment of VOC water samples.

MS/MSD samples are investigative samples. Soil MS/MSD samples require no extra volume for SVOCs, metals, or radionuclides. However, soil VOC samples will require additional samples to be collected for these purposes. Aqueous MS/MSD samples must be collected at triple the volume for SVOC, Pesticide/PCB, metals, and radionuclide parameters. One MS/MSD sample will be designated in the field and collected for at least every 20 investigative samples per sample matrix (i.e. groundwater, soil).

The goal is to provide a level of QC effort in conformance with the protocols of the EPA Contract Laboratory Program (CLP) for Routine Analytical Services (RAS) parameters. The level of QC effort for testing and analysis of parameters beyond the scope of the CLP protocols will conform to accepted methods, such as EPA SW-846 protocols (EPA 1993b), American Society for Testing and Materials (ASTM) protocols, and National Institute for Occupational Safety and Health (NIOSH) protocols. The QC effort for in-field measurements, including temperature, conductivity,

pH, organic vapor concentrations, and radiation levels, will include daily calibration of instruments using traceable standards and documented instrument manufacturer procedures. Daily calibration will also be done on all radiation detection field meters. Field instruments and their method of calibration are discussed further in Section 7 of this QAPP.

3.2.2 Accuracy, Precision, and Sensitivity of Analysis

The fundamental QA objectives for accuracy, precision, and sensitivity of laboratory analytical data are the QC acceptance criteria of the analytical protocols. The accuracy and precision required for the specified analytical parameters are incorporated in Tables 3-1 and 3-2 and are consistent with the analytical protocols. The sensitivities required for the analyses are identified in Tables 3-3 and 3-4.

Accuracy and precision goals for field measurements of pH, conductivity, temperature, turbidity, and organic vapor concentration are listed in Table 3-2.

Analytical accuracy is expressed as the percent recovery of an analyte that has been added to a blank sample or environmental sample at a known concentration before analysis. Accuracy will be determined in the laboratory through the use of MS analyses, laboratory control sample (LCS) analyses, and blank spike analyses. The percent recoveries for specific target analytes will be calculated and used as an indication of the accuracy of the analyses performed.

Precision will be determined through the use of spike analyses conducted on duplicate pairs of environmental samples (MS/MSD) or comparison of positive duplicate pair responses. The relative percent difference (RPD) between the two results will be calculated and used as an indication of the precision of the analyses performed.

Sample collection precision will be measured in the laboratory by the analyses of field duplicates. Precision will be reported as the RPD for two measurements.

3.2.3 Completeness, Representativeness, and Comparability

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount expected to be obtained under normal conditions. It is expected that laboratories will provide data meeting QC acceptance criteria for all samples tested. Overall project completeness goals are identified in Tables 3-1 and 3-2.

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative parameter that depends upon the proper design of the sampling program and proper laboratory protocol. The sampling network was designed to provide data representative of site conditions. During development of this plan, consideration was given to site history, past waste disposal practices, existing analytical data, physical setting and processes, and constraints inherent to this investigation. The rationale of the sampling design is discussed in detail in the SAP.

Table 3-3. Analytical/Methods, Parameters, and Project Quantitation Limits for the St. Louis Airport Site Investigations

Parameters	Analytical Methods		Project Quantitation Levels[a]	
	Water	Soil/Sediment	Water	Soil/Sediment
Volatile Organic Compounds (VOC)	SW 846-5030/8260B	SW 846-5030/8260B	(µg/L)	(µg/Kg)
Chloromethane			10	10
Bromomethane			10	10
Vinyl Chloride			2	2
Chloroethane			10	10
Methylene Chloride (dichloromethane) (PCOC)			5	5
Acetone			10	10
Carbon disulfide			5	5
1,1-Dichloroethene			5	5
1,1-Dichloroethane			5	5
1,2-Dichloroethene (total) (PCOC)			5	5
Chloroform			5	5
1,2-Dichloroethane			5	5
2-Butanone			10	10
1,1,-Trichloroethane			5	5
Carbon tetrachloride			5	5
Bromodichloromethane			5	5
1,2-Dichloropropane			5	5
cis-1,3-Dichloropropene			5	5
Trichloroethene (PCOC)			5	5
Dibromochloromethane			5	5
1,1,2-Trichloroethane			5	5
Benzene			5	5
trans-1,3-Dichloropropene			5	5
Tribromomethane			5	5
4-Methyl-2-pentanone			10	10
2-Hexanone			10	10
Tetrachloroethene			5	5
Toluene (PCOC)			2	2
1,1,2,2-Tetrachloroethane			5	5
Chlorobenzene			5	5
Ethylbenzene			5	5
Styrene			5	5
Xylenes (total)			5	5

Table 3-3. Analytical/Methods, Parameters, and Project Quantitation Limits for the St. Louis Airport Site Investigations (continued)

Parameters	Analytical Methods		Project Quantitation Levels[a]	
	Water	Soil/Sediment	Water	Soil/Sediment
Semivolatile Organic Compounds (SVOCs)	SW 846-3520/8270C[b]	SW 846-3550/8270C[b]	(µg/L)	(µg/Kg)
Phenol			10	330
bis(2-Chloroethyl) ether			10	330
2-Chlorophenol			10	330
1,3-Dichlorobenzene			10	330
1,4-Dichlorobenzene			10	330
1,2-Dichlorobenzene			10	330
2-Methylphenol			10	330
2,2'- oxybis(1-Chloropropane)			10	330
4-Methylphenol			10	330
N-nitroso-di-n-dipropylamine			10	330
Hexachloroethane			10	330
Nitrobenzene			10	330
Isophorone			10	330
2-Nitrophenol			10	330
2,4-Dimethylphenol			10	330
bis(2-chloroethoxy) methane			10	330
2,4-Dichlorophenol			10	330
1,2,4-Trichlorobenzene			10	330
Naphthalene			10	330
4-Chloroaniline			10	330
Hexachlorobutadiene			10	330
4-chloro-3-methylphenol			10	330
2-Methylnaphthalene			10	330
Hexachlorocyclopentadiene			10	330
2,4,6-Trichlorophenol			10	330
2,4,5-Trichlorophenol			25	800
2-Chloronaphthalene			10	330
2-Nitroaniline			25	800
Dimethylphthalate			10	330
Acenaphthylene			10	330
2,6-Dinitrotoluene			10	330
3-Nitroaniline			25	800
Acenaphthene			10	330
2,4-Dinitrophenol			25	800
4-Nitrophenol			25	800

Table 3-3. Analytical/Methods, Parameters, and Project Quantitation Limits for the St. Louis Airport Site Investigations (continued)

Parameters	Analytical Methods		Project Quantitation Levels[a]	
	Water	Soil/Sediment	Water	Soil/Sediment
Dibenzofuran			10	330
2,4-Dinitrotoluene			10	330
Diethylphthalate			10	330
4-Chlorophenyl-phenyl ether			10	330
Fluorene			10	330
4-Nitroaniline			25	800
4,6-Dinitro-2-methylphenol			25	800
N-nitrosodiphenylamine			10	330
4-bromophenyl-phenylether			10	330
Hexachlorobenzene			10	330
Pentachlorophenol (PCOC)			25	800
Phenanthrene			10	330
Anthracene			10	330
Carbazole			10	330
Di-n-butylphthalate			10	330
Fluoranthene			10	330
Pyrene			10	330
Butylbenzylphthalate			10	330
3,3'-Dichlorobenzidine			10	330
Benzo(a)anthracene			10	330
Chrysene			10	330
bis(2-Ethylhexyl)phthalate			10	330
Di-n-octylphthalate			10	330
Benzo(b)fluoranthene			10	330
Benzo(k)fluoranthene			10	330
Benzo(a)pyrene			10	330
Indeno(1,2,3-cd)pyrene			10	330
Dibenzo(a,h)anthracene			10	330
Benzo(g,h,i)perylene			10	330
Pesticides/PCBs	SW 846-3520/8080[b]	SW 846-3550/8080[b]	(µg/L)	(µg/Kg)
alpha-BHC			0.05	1.7
beta-BHC			0.05	1.7
delta-BHC			0.05	1.7
gamma-BHC (Lindane)			0.05	1.7
Heptachlor (PCOC)			0.05	1.7
Aldrin			0.05	1.7

Table 3-3. Analytical/Methods, Parameters, and Project Quantitation Limits for the St. Louis Airport Site Investigations (continued)

Parameters	Analytical Methods		Project Quantitation Levels[a]	
	Water	Soil/Sediment	Water	Soil/Sediment
Heptachlor epoxide			0.05	1.7
Endosulfan I			0.05	1.7
Dieldrin			0.1	3.3
4,4'-DDE			0.1	3.3
Endrin			0.1	3.3
Endosulfan II			0.1	3.3
4,4'-DDD			0.1	3.3
Endosulfan sulfate			0.1	3.3
4,4'-DDT			0.1	3.3
Methoxychlor			0.50	17
Endrin ketone			0.1	3.3
Endrin aldehyde			0.1	3.3
alpha-Chlordane			0.05	1.7
gamma-Chlordane			0.05	1.7
Toxaphene			5.0	170
Arochlor-1016 (PCOC)			0.5	33
Arochlor-1221 (PCOC)			0.5	67
Arochlor-1232 (PCOC)			0.5	33
Arochlor-1242 (PCOC)			0.5	33
Arochlor-1248 (PCOC)			0.5	33
Arochlor-1254 (PCOC)			0.5	33
Arochlor-1260 (PCOC)			0.5	33
Herbicides	SW 846-8150	SW 846-8150	(µg/L)	(µg/Kg)
2,4-D			1	20
Dalapon			2	40
2,4-DB			1	20
Dicamba			0.2	4
Dichlorprop			1	20
Dinoseb			0.2	4
MCPA			1	20
MCPP			1	20
2,4,5-TP (Silvex)			0.5	10
2,4,5-T			0.5	10
Metals (Target Analyte List) plus	SW 846-3010A/ 6010B, 6020A, or 7000 series[b]	SW 846-3050A/ 6010B, 6020A, or 7000 series[b]	(µg/L)	(mg/Kg)[c]
Aluminum			50	5

Table 3-3. Analytical/Methods, Parameters, and Project Quantitation Limits for the St. Louis Airport Site Investigations (continued)

Parameters	Analytical Methods		Project Quantitation Levels[a]	
	Water	Soil/Sediment	Water	Soil/Sediment
Antimony			5	0.5
Arsenic			5	0.5
Barium			5	0.5
Beryllium			1	0.1
Cadmium			1	0.1
Calcium			50	5
Chromium			5	0.5
Cobalt			5	0.5
Copper			5	0.5
Iron			10	1.0
Lead			3	0.3
Magnesium			50	5
Manganese			5	0.5
Mercury (CVAA)	SW 846-7470	SW 846-7471	0.2	0.2
Nickel			10	1.0
Potassium			50	5
Selenium			5	0.5
Silver			5	0.5
Sodium			50	5
Thallium			2	0.2
Vanadium			10	1.0
Zinc			5	0.5
Additional Elements				
Boron			50	100
Molybdenum			50	5
Lithium			50	5
Strontium			5	0.5
Titanium			50	5
Uranium			5	0.5
Miscellaneous Analytes			(mg/L)	
Cyanide		SW 846-9011/9010 or 9012		1.0
Sulfate	EPA 300.0	Soil Methods	0.5	TBD
Ammonia, nitrogen	EPA 350.1		0.5	
Nitrate, nitrogen	EPA 352.1	Soil Methods	0.5	TBD
Nitrite, nitrogen	EPA 354.1	Soil Methods	0.5	TBD
Fluoride	EPA 300.0		0.5	

Table 3-3. Analytical/Methods, Parameters, and Project Quantitation Limits for the St. Louis Airport Site Investigations (continued)

Parameters	Analytical Methods		Project Quantitation Levels[a]	
	Water	Soil/Sediment	Water	Soil/Sediment
Chloride	EPA 300.0		0.5	
Phosphorous, total	EPA 365.1		0.5	
Alkalinity (CO_3,HCO_3)	EPA 310.1	Soil Methods	1.0	TBD
Hardness	EPA 130.1/.2		1.0	
Total suspended soilds (TSS)	EPA 160.2		4	
Total dissolved solids (TDS)	EPA 160.1		10	
Total organic carbon (TOC)	EPA 415.2		1.0	
Radiochemical Parameters			(pCi/L)	(pCi/g)
Gamma Spectral Scan		Gamma Spec.[e]		NA
Iso-Uranium 234, 235, 238	Alpha Spec.[e]	Gamma Spec/ Alpha Spec.[e]	1 ea.	1 ea.
Iso-Thorium 228, 230, 232	Alpha Spec.[e]	Alpha Spec.[e,f]	1 ea.	1 ea.
Radium 226, 228	Alpha Spec[e]	Gamma Spec/ Alpha Spec.[e]	1 ea.	1 ea.
Protactinium 231		Gamma Spec.[e]		3
Actinium 227		Gamma Spec/ Alpha Spec.[e]		1

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

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

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

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

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

f If the sample contains greater than 500 pCi/g of Th-230, based on gamma spectroscopy scan, then alpha spectroscopy will not be conducted and the results will be quantified by gamma spectroscopy.

Table 3-4. Analytical/Methods, Parameters, and Project Quantitation Limits for St Louis Site Investigations Waste Characteristics

Parameters	Analytical Methods	Project Quantitation Levels[a]
	Soil/Sediment Waste	
Volatile Organic Compounds (VOCs) (TCLP Analyte List)	SW 846-1311 (zero headspace ext.) SW 846-5030/8260B[b]	Leachate (µg/L)[c]
Vinyl chloride		20[d]
1,1-Dichloroethene		7
Chloroform		60
1,2-Dichloroethane		5
2-Butanone		2000
Carbon tetrachloride		5
Trichloroethene		5
Benzene		5
Tetrachloroethene		7
Chlorobenzene		1000
Semivolatile Organic Compounds (SVOCs) (TCLP Analyte List)	SW 846-1311 (extraction) SW 846-3520/8270C[b]	Leachate (µg/L)[c]
1,4-Dichlorobenzene'		75
2-Methylphenol (o-cresol)		2000
3-Methylphenol (m-cresol)		2000
4-Methylphenol (p-cresol)		2000
Hexachloroethane		30
Nitrobenzene		20
Hexachlorobutadiene		50[d]
2,4,6-Trichlorophenol		20
2,4,5-Trichlorophenol		4000
2,4-Dinitrotoluene		13[d]
Hexachlorobenzene		13[d]
Pentachlorophenol		1000
Pyridine		5000[d]
Pesticides (TCLP Analyte List)	SW 846-1311 (extraction) SW 846-3520/8081A or 8080[b]	Leachate (µg/L)
gamma-BHC (Lindane)		4.0
Heptachlor		0.08
Heptachlor epoxide		0.08
Endrin		0.2
Methoxychlor		100
Chlordane (alpha & gamma)		0.3 ea
Toxaphene		5.0

Table 3-4. Analytical/Methods, Parameters, and Project Quantitation Limits for St Louis Site Investigations Waste Characteristics (continued)

Parameters	Analytical Methods	Project Quantitation Levels[a]
	Soil/Sediment Waste	
icide Compounds .P Analyte List)	SW 846-1311 (extraction) SW 846-8150[b]	Leachate (µg/L)
)		100
-TP (silvex)		10
ls .P Analyte List plus Cu and Zn)	SW 846-1311 (extraction) 3010A/6010A, 3020A, or 7000 series[b]	Leachate (µg/L)
nic		50
um		100
nium		10
mium		50
per		50
		30
cury (CVAA)	SW 846-7470[b]	20
nium		40
er		50
		50
-Metals (total)		
ride	SW 846-9056 Mod.[c]	0.1%
ogen	ASA Methods of Soil Analysis	0.1%
ur	SW 846-9030 Mod.[c]	0.1%
3 Total	SW 846-8080[b]	0.5 mg/kg
ste Characteristics		
	SW 846-9045[b]	NA
t Filter Liquid Test (free liquids)	SW 846-9095[b]	0.1%
nide Reactivity	SW 846-Chapter 7[b]	2.5 mg/kg
ide Reactivity	SW 846-Chapter 7[b]	25 mg/kg
tablity	SW 846-1010[b]	NA
al Petroleum Hydrocarbons (TPH)	EPA 418.1	10 mg/kg
ractable Organic Halides (EOX)	SW 846-9020[b]	20 mg/Kg
sical Testing		
l Hydraulic Conductivity	ASTM D-5084-90	NA
osity	ASTM E-1294	NA
me y	ASTM D-698-91	NA
sticity	ASTM D-4318-84	NA

Table 3-4. Analytical/Methods, Parameters, and Project Quantitation Limits for St Louis Site Investigations Waste Characteristics (continued)

Parameters	Analytical Methods	Project Quantitation Levels[a]
	Soil/Sediment Waste	
Particle Size	ASTM D-422-63	NA
Moisture Content	ASTM D-2216-90[f]	NA
Bulk Density	ASTM D-5057[f]	NA

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

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

c Quantitation goals are set below regulatory levels at those normally provided by the assigned project laboratory.

e Preparation by bomb digestion ASTM D240.

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

Representativeness will be satisfied by ensuring that the SAP is followed, proper sampling techniques are used, proper analytical procedures are followed, and holding times of the samples are not exceeded. Representativeness will be determined by assessing the combined aspects of the QA program, QC measures, and data evaluations.

Comparability expresses the confidence with which one data set can be compared with another. The extent to which existing and planned analytical data will be comparable depends upon the similarity of sampling and analytical methods. The procedures used to obtain the planned analytical data are expected to provide comparable data. These new analytical data, however, may not be directly comparable to existing data because of differences in procedures and QA objectives.

4.0 SAMPLING LOCATIONS AND PROCEDURES

It is anticipated that investigations performed at SLAPS will produce soil gas, surface soil, subsurface soil, surface water, groundwater, air filter, surface swipe, and investigation-derivedwaste (IDW) samples for analyses. Additional samples will be collected to complete field QC duplicate, field blank, and QA split sample analyses. Specific numbers of samples (including parameters and methods) are incorporated into the SAPs. Investigation samples will require VOC, SVOC, pesticide/ PCB, metal, radionuclide, and other general determinations, as represented in Tables 3-1 through 3-4. Sampling procedures for the various media under investigation are discussed in the SAP.

Identification of the primary field equipment and supporting materials to be used for these investigations is presented throughout the SAP. Several different types of field measurements will be performed during these investigations. Soil field measurements may determine soil classification and characteristics or volatile organic headspace gas concentrations. Groundwater field measurements may determine groundwater characteristics (pH, specific conductance, and temperature, etc.) and static groundwater levels. A description of the field instruments and associated calibration requirements and performance checks to be used for field measurements is presented in the SAP and Section 7.0 of this QAPP.

The locations of the sampling stations and sample media to be collected during these investigations, and the rationales for the selection of these stations, are presented in the SAP.

4.1 GENERAL INFORMATION AND DEFINITIONS

Contractor Laboratory

The laboratories subcontracted to perform analysis of samples have been selected through the Army Corp procurement and review process prior to field mobilization.

QA and QC Samples

These samples are analyzed for the purpose of assessing the quality of the sampling effort and of the reported analytical data. QA and QC samples to be used for this project are duplicates, equipment rinsate blanks, trip blanks, field blanks, and split samples.

Field Duplicate QC Samples

These samples are collected by the sampling team for analysis by the on-site laboratory or contract laboratory. The identity of duplicate QC samples is held blind to the analysts and the purpose of these samples is to provide site-specific, field-originated information regarding the homogeneity of the sampled matrix and the consistency of the sampling effort. These samples are collected concurrently with the primary environmental samples and equally represent the medium

at a given time and location. Duplicate samples will be collected from each media addressed by this project and be submitted to the contractor laboratory for analysis.

USACE QA Split Samples

These samples are collected by the sampling team and sent to a USACE QA laboratory for analysis to provide an independent assessment of SAIC and contractor laboratory performance. SAIC will coordinate with the designated QA laboratory not less than 48 hours before sampling to ensure that the laboratory is alerted to receive the QA samples and process them within the time limits specified by applicable regulations and guidelines.

Trip Blank Samples

These samples consist of containers of organic-free reagent water that are kept with the field sample containers from the time they leave the laboratory until the time they are returned for analysis. The purpose of trip blanks is to determine whether samples are being contaminated during transit or sample collection. For this project, one trip blank will be placed into each cooler used to store and ship water samples designated for volatile organic analysis.

Equipment Rinsate Blanks

These samples will be taken from the water rinsate collected from equipment decontamination activities. They will comprise samples of analyte-free water which have been rinsed over decontaminated sampling equipment, collected, and submitted for analysis of the parameters of interest. They are employed to assess the effectiveness of the decontamination process, the potential for cross contamination between sampling locations, and incidental field contamination.

Field Blanks

A sample from the site water supply used for equipment decontamination, well development, and other activities will be acquired and submitted for analysis with the primary samples. In addition, samples of on-site analyte-free water sources may also be submitted for analysis.

4.2 SAMPLE CONTAINERS, PRESERVATION PROCEDURES, AND HOLDING TIMES

Sample containers, chemical preservation techniques, and holding times for soils and waters collected during these investigations are described in Tables 4-1 and 4-2. The specific number of containers required for this study will be estimated and supplied by the analytical facilities. Additional sample volumes will be collected and provided, when necessary, for the express purpose of performing associated laboratory QC (laboratory duplicates, MS/MSD).

All sample containers will be provided by the analytical support laboratories, which will also provide the required types and volumes of preservatives with containers as they are delivered to SAIC. Temperature preservation will be maintained at 4°C (±2°C) immediately after collection and

Table 4-1. Container Requirements for Soil Samples for SLAPS Investigations

Analyte Group	Container	Minimum Sample Size	Preservative	Holding Time
Volatile Organic Compounds	1 - 4 oz glass jar with Teflon®-lined cap	5 g	Cool, 4°C	14 d
Semivolatile Organic Compounds	1 - 8 oz glass jar with Teflon®-lined cap	90 g	Cool, 4°C	14 d (extraction) 40 d (analysis)
Pesticides/PCBs	use same container as SVOCs	90 g	Cool, 4°C	14 d (extraction) 40 d (analysis)
Metals	1 - 4 oz wide mouth plastic or glass jar	20 g	Cool, 4°C	180 d, Hg at 28 d
Leachable Anions	use same container as metals	10 g	Cool, 4°C	28 d
Radiochemical Parameters	1 - 16 oz wide mouth glass jar with Teflon®-lined cap	500 g	None	180 d
Geotechnical Parameters	Shelby tube	NA	None	None
Waste Characteristics	1 - 16 oz wide mouth glass jar with Teflon®-lined cap	1000 g	Cool, 4°C	general 14 d

Table 4-2. Container Requirements for Water Samples for SLAPS Investigations

Analyte Group	Container	Minimum Sample Size	Preservative	Holding Time
Volatile Organic Compounds	2 - 40 mL glass vials with Teflon®-lined septum (no headspace)	40 mL	HCL to pH <2 Cool, 4°C	14 d
Semivolatile Organic Compounds	2 - 1L amber glass bottle with Teflon®-lined lid[1]	1000 mL	Cool, 4°C	7 d (extraction) 40 d (analysis)
Pesticides/PCBs and Herbicides	3 - 1L amber glass bottle with Teflon®-lined lid[1]	1000 mL	Cool, 4°C	7 d (extraction) 40 d (analysis)
Metals	1 - L polybottle	500 mL, metals 200 mL, Hg	HNO_3 to pH <2 Cool, 4°C	180 d, metals 28 d, Hg
Nitrate- Nitrite, Ammonia, Phosphate	500 mL polybottle	100 mL each	H_2SO_4 to pH <2 Cool, 4°C	28 d
TOC	125 mL polybottle	50 mL	H_2SO_4 to pH <2 Cool, 4°C	28 d
Sulfide	500 mL polybottle	200 mL	zinc acetate plus NaOH to pH >9 Cool, 4°C	7 d
Cyanide	1 - L polybottle	500 mL	NaOH to pH >10 Cool, 4°C	14 d
TRPH	1 - L glass bottle	1000 mL	H_2SO_4 to pH <2 Cool, 4°C	28 d
Alkalinity/TSS/TDS	1 - L polybottle	100 mL ea.	Cool, 4°C	7 d
Radiochemical Parameters	2 - 1 gal plastic containers[1]	4 L	HNO_3 to pH <2	180 d

[1] One investigative water sample in twenty will require an additional volume for the laboratory to perform appropriate laboratory QC analysis. (i.e., MS/MSD).

will be maintained at this temperature until the samples are analyzed. In the event that sample integrity, such as holding times, cooler temperatures, etc., is compromised, re-sampling will occur as directed by the USACE Project Manager. Any affected data will be flagged and qualified per data validation instructions and guidance.

4.3 FIELD DOCUMENTATION

4.3.1 Field Logbooks

Sufficient information will be recorded in the logbooks to permit reconstruction of all drilling and sampling activities conducted. Information recorded on other project documents will not be repeated in the logbooks except in summary form where determined necessary. All field logbooks will be kept in the possession of field personnel responsible for completing the logbooks, or in a secure place when not being used during field work. Upon completion of the field activities, all logbooks will be submitted to USACE to become part of the final project file.

4.3.2 Sample Numbering System

A unique sample numbering scheme will be used to identify each sample designated for laboratory analysis. The purpose of this numbering scheme is to provide a tracking system for the retrieval of analytical and field data on each sample. Sample identification numbers will be used on all sample labels or tags, field data sheets or logbooks, COC records, and all other applicable documentation used during the project. A listing of all sample identification numbers will be maintained in the field logbook. The project database will be pre-populated with sample numbers and information consistent with instructions found in the Data Management Plan (DMP), Appendix B.

The sample numbering scheme used for field samples will be employed for duplicate samples and other field QC such that they will not be readily discernable by the laboratory. A summary of the sample numbering scheme to be used for the project is presented in Table 4-3.

4.3.3 Documentation Procedures

Labels will be affixed to all sample containers during sampling activities. Information will be recorded on each sample container label at the time of sample collection. The information to be recorded on the labels will be as follows:

- contractor name,
- sample identification number,
- sample type (discrete or composite),
- site name and sample station number,
- analysis to be performed,
- type of chemical preservative present in container,
- date and time of sample collection, and
- sampler's name and initials.

Table 4-3. Sample ID System for all St. Louis Sites

XXX-AAAmmNNNNn-##### – to be used for data base reporting

XXX##### – to be used for sample collection and delivery to lab

XXX = Site Designator
St. Louis Downtown Site = SLD
St. Louis Airport Site = SLA
Hazelwood Interim Storage Site = HIS
Coldwater Creek Watershed = CCW

AAA = Area Designator
Investigation Area 1 = IA1 (for IA1–IA9, then A10–A99, or others as identified)
Background = BKG
etc. (can include designators for Site vicinity properties)

mm = Media
Surface Soil = SS
Subsurface Soil Boring = SB
Sediment = SD
Ground Water = GW
Surface Water = SW
Storm Water = ST
Aquatic Biota = AB
Terrestrial Biota = TB
Air Filter = AF
Radon Detector = RD
TLDs = TD
Quality Control = QC
etc. (as new media types are identified)

NNNN = Station Number
Unique station identifier

n = Sample Type

Regular = 0	Trip Blank = 3
Duplicate = 1	Equipment Rinsate = 4
Split = 2	Site Source Water Blank = 5

= Sequential Sample Number
Unique to each site

Sample logbooks and COC records will contain the same information as the labels affixed to the containers. These records will be maintained and record all information related to the sampling effort and the process employed. The tracking procedure to be used for documentation of all samples collected during the project will involve the steps outlined in the DMP, Appendix B.

4.4 FIELD VARIANCE SYSTEM

Procedures cannot fully encompass all conditions encountered during a field investigation. Variances from the operating procedures, field sampling plan, and/or safety and health plan may occur. All variances that occur during the field investigation will be documented on a field change request (FCR) form or a nonconformance report (NCR) and will be noted in the appropriate field logbooks. Examples of the FCR (Figure 4-1) and NCR (Figure 10-1) forms to be used for these investigations are presented in this QAPP. If a variance is anticipated (e.g., because of a change in the field instrumentation), the applicable procedure will be modified and the change noted in the field logbooks.

Field Change Request (FCR)

FCR NO._____ DATE INITIATED_____

PROJECT_____

CONTRACT NO._____

REQUESTOR IDENTIFICATION

NAME_____ ORGANIZATION_____

PHONE_____

TITLE_____ SIGNATURE_____

BASELINE IDENTIFICATION

BASELINE(S) AFFECTED ☐ Cost ☐ Scope ☐ Milestone ☐ Method of Accomplishment
AFFECTED DOCUMENT (TITLE, NUMBER AND SECTION) _____
DESCRIPTION OF CHANGE:

JUSTIFICATION:

IMPACT OF NOT IMPLEMENTING REQUEST:

PARTICIPANTS AFFECTED BY IMPLEMENTING REQUEST:

COST ESTIMATE ($)_____ ESTIMATOR SIGNATURE _____
PHONE_____ DATE_____

PREVIOUS FCR AFFECTED ☐ YES ☐ NO; IF YES, FCR NO. _____

CLIENT PROJECT MANAGER _____ DATE_____
CLIENT QA SPECIALIST _____ DATE_____
SAIC H&S MANAGER SIGNATURE (IF APPLICABLE) _____ DATE_____

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Figure 4-1. Example of a Field Change Request Form

5.0 SAMPLE CUSTODY AND HOLDING TIMES

It is the policy of SAIC and will be the intent of this investigation to follow EPA policy regarding sample custody and COC protocols as described in *NEIC Policies and Procedures* (EPA 1985). This custody is in three parts: sample collection, laboratory analysis, and final evidence files. Final evidence files, including originals of laboratory reports and electronic files, are maintained under document control in a secure area. A sample or evidence file is under your custody when it is:

- in your possession;
- in your view, after being in your possession;
- in your possession and you place them in a secured location; or
- in a designated secure area.

5.1 SAMPLE DOCUMENTATION

The sample packaging and shipment procedures summarized below will ensure that samples will arrive at the laboratory with the COC intact. The protocol for specific sample numbering using case numbers and traffic report numbers (if applicable) and other sample designations will be followed.

5.1.1 Field Procedures

The field sampler is responsible for the care and custody of the samples until they are transferred or properly dispatched. As few people as possible should handle the samples. Each sample container will be labeled with a sample number, date and time of collection, sampler, and sampling location. Sample labels are to be completed for each sample. The SAIC Project Manager, in conjunction with the USACE, will review all field activities to determine whether proper custody procedures were followed during the field work and to decide if additional samples are required.

5.1.2 Field Logbooks/Documentation

Samples will be collected following the sampling procedures documented in the SAP. When a sample is collected or a measurement is made, a detailed description of the location shall be recorded. The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, volume, and number of containers. A sample identification number will be assigned before sample collection. Field duplicate samples and QA split samples, which will receive an entirely separate sample identification number, will be noted under sample description. Equipment employed to make field measurements will be identified along with their calibration dates.

5.1.3 Transfer of Custody and Shipment Procedures

Samples are accompanied by a properly completed COC form. The sample numbers and locations will be listed on the COC form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record will document transfer of custody of samples from the sampler to another person, to a mobile laboratory, to the permanent laboratory, or to/from a secure storage area. An example of the COC form to be used for these investigations is illustrated in Figure 5-1.

All shipments will be accompanied by the COC record identifying the contents. The original record will accompany the shipment, and copies will be retained by the sampler for return to project management and the project file. Whenever co-located or split samples are collected for comparison analysis by the USACE QA Laboratory or a government agency, a separate COC is prepared for those samples and marked to indicate with whom the samples are being split.

All shipments will be in compliance with applicable U.S. Department of Transportation (DOT) regulations for environmental samples. SAIC will discourage the shipping of samples on Fridays unless it is absolutely necessary, and the laboratory has assured SAIC that personnel will be present on Saturdays to receive and effect any necessary processing within the analytical holding times.

5.2 LABORATORY COC PROCEDURES

Custody procedures along with the holding time and sample preservative requirements for samples will be described in laboratory QA Plans. These documents will identify the laboratory custody procedures for sample receipt and log-in, sample storage, tracking during sample preparation and analysis, and laboratory storage of data.

5.2.1 Cooler Receipt Checklist

The condition of shipping coolers and enclosed sample containers will be documented upon receipt at the analytical laboratory. This documentation will be accomplished using the cooler receipt checklist presented in Figure 5-2. One of these checklists will be placed into each shipping cooler along with the completed COC form or provided to the laboratory at the start of the project. A copy of the checklist will be faxed to the SAIC Project Manager immediately after it has been completed at the laboratory. The original completed checklist will be transmitted with the final analytical results from the laboratory.

5.2.2 Letter of Receipt

The laboratory will confirm sample receipt and log-in information through transmission of a Letter-of-Receipt (LOR) to SAIC. This will include returning a copy of the completed COC, a copy of the cooler receipt checklist, and confirmation of the analytical log-in indicating laboratory sample and sample delivery group numbers.

An Employee Owned Company
A Applicable International Corporation
800 [illegible] Turnpike, Oak Ridge, TN 37831 (423) 481-4900

CHAIN OF CUSTODY RECORD

COC NO.:

PROJECT NAME:	REQUESTED PARAMETERS	LABORATORY NAME:
PROJECT NUMBER:		LABORATORY ADDRESS:
PROJECT MANAGER:		PHONE NO:
Sampler (Signature) (Printed Name)		

Sample ID	Date Collected	Time Collected	Matrix	No. of Bottles/Vials:	OVA SCREENING	OBSERVATIONS, COMMENTS, SPECIAL INSTRUCTIONS

RELINQUISHED BY:	Date/Time	RECEIVED BY:	Date/Time	TOTAL NUMBER OF CONTAINERS:	Cooler Temperature:
COMPANY NAME:		COMPANY NAME:		Cooler ID:	
RECEIVED BY:	Date/Time	RELINQUISHED BY:	Date/Time		
COMPANY NAME:		COMPANY NAME:			
RELINQUISHED BY:	Date/Time	RECEIVED BY:	Date/Time		
COMPANY NAME:		COMPANY NAME:			

Figure 5-1. Example of a Chain-of-Custody Form

COOLER RECEIPT CHECKLIST

LIMS number _____ Chain-of-Custody No. _____

Project: _____ Date received: _____

A. Preliminary Examination Phase Date cooler(s) opened: _____

by (print) _____ (signature) _____

Circle response below as appropriate

1. Did cooler(s) come with a shipping slip (airbill, etc.)?	Yes	No	NA
If YES, enter courier name & airbill number here: _____			
2. Were custody seals on outside of cooler(s)?	Yes	No	NA
How many & where: _____ Seal date: _____ Seal name: _____			
3. Were custody seals unbroken and intact at the date and time of arrival?	Yes	No	NA
4. Did you screen samples for radioactivity using a Geiger Counter?	Yes	No	NA
5. Were custody papers sealed in a plastic bag & taped inside the cooler lid?	Yes	No	NA
6. Were custody papers filled out properly (ink, signed, etc.)?	Yes	No	NA
7. Did you sign custody papers in the appropriate place for acceptance of custody?	Yes	No	NA
8. Was project identifiable from custody papers?	Yes	No	NA
9. If required, was enough ice present in the cooler(s)?	Yes	No	NA
Identify type of ice used in cooler and temperature reading upon receipt: _____			
Source of temperature reading (check one): Temperature Vial ( ) Sample Material ( )			
10. Initial and date this form to acknowledge receipt of cooler(s): (initial) _____ (date) _____			
B. Log-In-Phase Date samples were logged in: _____			
by (print) _____ (signature) _____			
11. Describe type of packing in cooler(s): _____			
12. Were all bottles sealed in separate plastic bags?	Yes	No	NA
13. Did all bottles arrive unbroken & were labels in good condition?	Yes	No	NA
14. Was all required bottle label information complete?	Yes	No	NA
15. Did all bottle labels agree with custody papers?	Yes	No	NA
16. Were correct containers used for the analyses indicated:	Yes	No	NA
17. Were correct preservatives placed into the sample containers?	Yes	No	NA
18. Was a sufficient amount of sample sent for the analyses required?	Yes	No	NA
19. Were bubbles absent in VOA vials?	Yes	No	NA
If no, list by sample number: _____			
20. Has a copy of this Cooler Receipt Checklist been faxed to the SAIC Laboratory Coordinator?	Yes	No	NA

Figure 5-2. Example of a Cooler Receipt Checklist

5.3 FINAL EVIDENCE FILES CUSTODY PROCEDURES

SAIC is the custodian of the evidence file and will maintain the contents of evidence files for this investigation, including all relevant records, reports, logs, field notebooks, pictures, subcontractor reports, correspondence, laboratory logbooks, and COC forms. The evidence file will be stored in a secure, limited-access area and under custody of the SAIC Project Manager.

Analytical laboratories will retain all original raw data information (both hard copy and electronic) in a secure, limited-access area and under custody of the Laboratory Project Manager.

6.0 ANALYTICAL PROCEDURES

All samples collected during the investigation activities will be analyzed by laboratories reviewed and validated by the USACE HTRW CX, Omaha, Nebraska. QA samples shall be collected of groundwater and soil and analyzed by the designated USACE QA Laboratory. Each laboratory supporting this work shall provide statements of qualifications including organizational structure, QA Manual, and standard operating procedures (SOPs).

6.1 LABORATORY ANALYSIS

Samples collected during the project will be analyzed by EPA SW-846 methods and other documented EPA or nationally recognized methods. Laboratory standard operating procedures are based on the methods as published by the EPA in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods SW846*, Third Edition (November 1986; Revision 1, July 1992; Revision 2, November 1992; and Updates 1, 2, and 3). Analytical parameters, methods, and quantitation or detection limits are listed in Tables 3-3 and 3-4.

Principal laboratory facilities will not subcontract or transfer any portion of this work to another facility, unless expressly permitted to do so in writing by SAIC and the USACE Project Manager.

If contaminant concentrations are high, or for matrices other than normal waters and soils, analytical protocols may be inadequate. In these cases, sample analysis may require modifications to defined methodology. Any proposed changes to analytical methods specified require written approval from SAIC and USACE. All analytical method variations will be identified in investigation-specific addenda. These may be submitted for regulatory review and approval when directed by the USACE Project Manager.

These SOPs must be adapted from and reference standard EPA SW-846 methods and thereby specify:

- procedures for sample preparation,
- instrument start-up and performance check,
- procedures to establish the actual and required detection limits for each parameter,
- initial and continuing calibration check requirements,
- specific methods for each sample matrix type, and
- required analyses and QC requirements.

6.2 FIELD SCREENING ANALYTICAL PROTOCOLS

Procedures for field measurement of pH, specific conductivity, temperature, beta/gamma activity are described in Section 7.0 of this QAPP. Tabulation of the methodologies appears in Tables 3-1 and 3-2.

7.0 CALIBRATION PROCEDURES AND FREQUENCY

This section describes procedures for maintaining the accuracy of all the instruments and measuring equipment that are used for conducting field tests and laboratory analyses. These instruments and equipment shall be calibrated before each use or on a scheduled, periodic basis according to manufacturer instructions.

7.1 FIELD INSTRUMENTS/EQUIPMENT

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. All field instruments for this purpose will have unique identifiers and each instrument will be logged in the Measuring and Testing Equipment (M&TE) Log Book before use in the field. The site safety and health officer or his/her designate will be responsible for performing and documenting daily calibration/checkout records for instruments used in the field.

Equipment to be used during the field sampling will be examined to certify that it is in operating condition. This will include checking the manufacturer's operating manual and instructions for each instrument to ensure that all maintenance requirements are being observed. Field notes from previous sampling trips will be reviewed so that the notation on any prior equipment problems will not be overlooked, and all necessary repairs to equipment will be carried out. Spare parts or duplication of equipment will be available to the sampling effort.

Calibration of field instruments is governed by the specific SOP for the applicable field analysis method, and it will be performed at the intervals specified in the SOP. If no SOP is available, calibration of field instruments will be performed at intervals specified by the manufacturer or more frequently as conditions dictate. Calibration procedures and frequency will be recorded in a field logbook.

Field instruments will include a pH meter, temperature probe, specific conductivity meter, hand held scintillation detectors for radioactivity screening levels, photoionization detectors (PID) for organic vapor detection, and geophysical equipment. If an internally calibrated field instrument fails to meet calibration/checkoutprocedures, it will be returned to the manufacturer for service and a back-up instrument will be calibrated and used in its place. Field instrument uses, detection levels, and calibration are summarized in Table 7-1.

Detailed instructions on the proper calibration and use of each field instrument follow the guidelines established by the manufacturer. The technical procedures for each instrument used on this project include the manufacturer's instructions detailing the proper use and calibration of each instrument.

Table 7-1. Field Instrument Uses, Detection Limits, and Calibration

Instrument	Uses	Detection limits	Calibration	Comments
Total organic vapor meters	Sample screening for VOCs	PID - 0.2 ppm benzene or	1 point - PID benzene daily	Action level must be stated in Health and Safety Plan
	Health and safety screening	FID - 1.0 ppm methane	1 point - FID methane daily	Instrument cannot differentiate naturally occurring compounds from contaminants
			Verification check every 20 samples	PID cannot detect compounds with ionization potentials > 11 eV
Radiological monitoring	Monitoring of beta-gamma surface, gross gamma, alpha surface contamination levels	Daily calibration check varies by equipment	Daily source check per manufacturer	Validation labels include minimum and maximum acceptable levels
pH meters	Field screening of waters	N/A	2 point with standards at pH 7.0 and 4.0 or pH 7.0 and 10.0 daily	Accuracy is to ± 0.5 pH units
Temperature (in-line)	Determining water temperature	N/A	To manufacturer instructions	
Conductivity meter	Determining conductivity of water	N/A	I point in KCL solution	Calculations and acceptance criteria must be available in the field
Membrane electrode meter	Determining dissolved oxygen levels	N/A	1 point using calculated value for water at ATP at least once every 3 hours	Accuracy is ± 0.01 ppm

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

7.1.1 pH Meter Calibration

The pH meter will be calibrated according to the manufacturer's instructions using traceable standard buffer solutions before work in the field. Calibration will follow these steps:

- Temperature of sample and buffer should be the same.
- Connect pH electrode into pH meter and turn on pH meter.
- Adjust temperature setting based on the temperature of buffer; place electrode in first buffer solution.
- After reading has stabilized, adjust "CALIB" knob to display correct value.
- Repeat procedure for second buffer solution.
- Place pH electrode in the sample and record the pH as displayed.
- Remove pH electrode from sample and rinse off with distilled water.
- Recalibrate the pH meter every time it is turned off and turned back on, or if it starts giving erratic results.

Before use in the field, calibration of the pH meter will be checked against two standard buffer solutions. Calibration procedures, lot numbers of buffer solutions, and other pertinent calibration or checkout information will be recorded in the M&TE Log Book for the project. The calibrations performed, standard used, and sample pH values are to be recorded in the field notebook. Appropriate new batteries will be purchased and kept with the meters to facilitate immediate replacement in the field as necessary.

7.1.2 Temperature Calibration

Temperature measurements are carried out using a temperature probe. Mercury thermometers must be inspected before use to ensure that there is no mercury separation. Thermometers should be rechecked in the field before and after each use to see if the readings are logical and the mercury is still intact. All temperature probes should be checked biannually for calibration by immersing them in a bath of known temperature until equilibrium is reached. Temperature probes should be replaced if found to have more than 10 percent error. The reference thermometer used for bath calibration should be National Institute of Standards and Testing (NIST) traceable. Temperatures will be recorded in the M&TE Log Book, the Sample Log Book, or the Cooler Log Book, as appropriate.

7.1.3 Conductivity Meter Calibration

The conductivity cells of the specific conductivity meter will be cleaned according to manufacturer's recommendations and specifications and checked against known conductivity standard

solutions before each sampling event. The instrument will be checked daily with NIST-traceable standard solutions. If the instrument is more than 10 percent out of calibration when compared with standard solutions, the instrument will be recalibrated. If this cannot be done in the field, the instrument will be returned to the manufacturer or supplier for recalibration and a back-up instrument will be used in its place. Daily calibration readings and other relevant information will be recorded daily in the M&TE Log Book.

Daily checks should be as follows:

- Fill a sample cup with the conductivity calibration standard solution.
- Set temperature knob for temperature of standard solution.
- Turn to appropriate scale and set the instrument for the value of calibration standard.
- Rinse out the cup with distilled water.

7.1.4 Organic Vapor Detection

Organic vapor detectors will be checked daily according to the manufacturer's instructions. FIDs will be checked daily by using the internal calibration mechanism. PIDs will be calibrated daily with a gas of known concentration. All daily calibration information will be recorded in the M&TE Log Book.

7.1.5 Radiation Monitoring

Scintillation detectors will be checked daily according to the manufacturer's instructions. Meters will be checked daily by using sealed calibration source checks. Meters will be calibrated routinely, with calibration dates clearly identified on each instrument. All daily calibration check information will be recorded in the M&TE Log Book.

7.2 LABORATORY INSTRUMENTS

Calibration of laboratory equipment will be based on approved written procedures. Records of calibration, repairs, or replacement will be filed and maintained by laboratory personnel performing QC activities. These records will be filed at the location where the work is performed and will be subject to QA audit. Procedures and records of calibration will follow USACE and SAIC-reviewed laboratory-specific QA Plans.

In all cases where analyses are conducted according to the EPA CLP or SW 846 protocols, the calibration procedures and frequencies specified in the applicable CLP RAS Statement of Work (SOW) or SW 846 methods will be followed exactly. For analyses governed by SOPs, refer to the appropriate SOP for the required calibration procedures and frequencies.

Records of calibration will be kept as follows:

- Each instrument will have a record of calibration with an assigned record number.

- A label will be affixed to each instrument showing identification numbers, manufacturer, model numbers, date of last calibration, signature of calibrating analyst, and due date of next calibration. Reports and compensation or correction figures will be maintained with instrument.

- A written step-wise calibration procedure will be available for each piece of test and measurement equipment.

- Any instrument that is not calibrated to the manufacturer's original specification will display a warning tag to alert the analyst that the device carries only a "Limited Calibration."

8.0 INTERNAL QUALITY CONTROL CHECKS

8.1 FIELD SAMPLE COLLECTION

The assessment of field sampling precision and accuracy will be made by collecting field duplicates and trip blanks in accordance with the procedures described in the project SAP.

8.2 FIELD MEASUREMENT

QC procedures for most field measurements (i.e., pH, conductivity, temperature, activity levels, headspace, etc.) are limited to checking the reproducibility of the measurement by obtaining multiple readings on a single sample or standard and by calibrating the instruments. Refer to Section 7 of this QAPP for more detail regarding these measurements.

8.3 LABORATORY ANALYSIS

Analytical QC procedures for these investigations are specified in the individual method descriptions. These specifications include the types of QC checks normally required; method blanks, LCS, MS, MSD, calibration standards, internal standards, surrogate standards, tracer standards, calibration check standards, and laboratory duplicate analysis. Calibration compounds and concentrations to be used and the method of QC acceptance criteria for these parameters have been identified.

To ensure the production of analytical data of known and documented quality, laboratories associated with these investigations will implement all method QA and QC checks.

8.3.1 QA Program

All subcontracted analytical laboratories will have a written QA program that provides rules and guidelines to ensure the reliability and validity of work conducted at the laboratory. Compliance with the QA program is coordinated and monitored by the laboratory's QA department, which is independent of the operating departments. For these investigations selected support laboratory Quality Assurance Plans will be referenced and implemented in their entirety.

The stated objectives of the laboratory QA program are to:

- properly collect, preserve, and store all samples;
- maintain adequate custody records from sample collection through reporting and archiving of results;

- use properly trained analysts to analyze all samples by approved methods within holding times;

- produce defensible data with associated documentation to show that each system was calibrated and operating within precision and accuracy control limits;

- accurately calculate, check, report, and archive all data using the Laboratory Information Management System; and

- document all the above activities so that all data can be independently validated.

All laboratory procedures are documented in writing as SOPs, which are edited and controlled by the QA department. Internal QC measures for analysis will be conducted with their SOPs and the individual method requirements specified.

External QA shall be provided by the USACE QA Laboratory. The external QA laboratory shall receive the identified QA sample splits.

8.3.2 QC Checks

Implementation of QC procedures during sample collection, analysis, and reporting ensures that the data obtained are consistent with its intended use. Both field QC and laboratory QC checks are performed throughout the work effort to generate data confidence. Analytical QC measures are used to determine if the analytical process is in control, as well as to determine the sample matrix effects on the data being generated.

Specifications include the types of QC required (duplicates, sample spikes, surrogate spikes, reference samples, controls, blanks, etc.), the frequency for implementation of each QC measure, compounds to be used for sample spikes and surrogate spikes, and the acceptance criteria for this QC.

Laboratories will provide documentation in each data package that both initial and ongoing instrument and analytical QC functions have been met. Any non-conforming analysis will be reanalyzed by the laboratory, if sufficient sample volume is available. It is expected that sufficient sample volumes will be collected to provide for reanalyses, if required.

8.3.2.1 Analytical Process QC

Method Blanks

A method blank is a sample of a noncontaminated substance of the matrix of interest (usually distilled/de-ionized water or silica sand) that is then subjected to all of the sample preparation (digestion, distillation, extraction) and analytical methodology applied to the samples. The purpose of the method blank is to check for contamination from within the laboratory that might be

introduced during sample preparation and analysis that would adversely affect analytical results. A method blank must be analyzed with each analytical sample batch.

Analytical sensitivity goals are identified in Table 3-3 as practical quantitation limits. Method blank levels should be below these levels for all analytes, criteria are established at 2× these levels.

Laboratory Control Samples

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

8.3.2.2 Matrix and Sample-Specific QC

Laboratory Duplicates

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

Surrogate Spikes

A surrogate spike is prepared by adding a pure compound to a sample before extraction. The compound in the surrogate spike should be of a similar type to that being assayed in the sample. The purpose of a surrogate spike is to determine the efficiency of recovery of analytes in the sample preparation and analysis. The percent of recovery of the surrogate spike is then used to gauge the total accuracy of the analytical method for that sample.

Isotopic Tracers

An isotopic tracer is prepared by adding a unique isotope of the same or similar element to a sample before preparation and analysis. The purpose of this isotopic tracer is to determine the efficiency of recovery of the targeted isotope or isotopes in the sample preparation and analysis. The percent of recovery of the tracer is then used to gauge the total accuracy of the analytical method for that sample and to compensate for the quantification of the analyte of interest.

Matrix Spikes and Matrix Spike Duplicates

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

Method-Specific QC

The laboratory must follow specific quality processes as defined by the method. These will include measures such as calibration verification samples, instrument blank analysis, internal standards implementation, tracer analysis, method of standard additions utilization, serial dilution analysis, post-digestion spike analysis, chemical carrier evaluation, etc.

9.0 CALCULATION OF DATA QUALITY INDICATORS

9.1 FIELD MEASUREMENTS DATA

Field data will be assessed by the site Chemical QC (CQC) Representative. The site CQC Representative will review the field results for compliance with the established QC criteria that are specified in the QAPP and FSP. Accuracy of the field measurements will be assessed using daily instrument calibration, calibration check, and analysis of blanks. Precision will be assessed on the basis of reproducibility by multiple reading of a single sample.

Field data completeness will be calculated using Equations (1a) and (1b).

Sample Collection (1a):

$$\text{Completeness} = \frac{\text{Number of Sample Points Sampled}}{\text{Number of Sample Points Planned}} \times 100\% \qquad \textbf{(1a)}$$

Field Measurements (1b):

$$\text{Completeness} = \frac{\text{Number of Valid Field Measurements Made}}{\text{Number of Field Measurements Planned}} \times 100\% \qquad \textbf{(1b)}$$

9.2 LABORATORY DATA

Laboratory results will be assessed for compliance with required precision, accuracy, completeness, and sensitivity as follows.

9.2.1 Precision

The precision of the laboratory analytical process will be determined through evaluation of LCS analyses. The standard deviation of these measurements over time will provide confidence that implementation of the analytical protocols was consistent and acceptable. These measurements will establish the precision of the laboratory analytical process.

Investigative sample matrix precision will be assessed by comparing the analytical results between MS/MSD for organic analysis and laboratory duplicate analyses for inorganic analysis. The RPD will be calculated for each pair of duplicate analysis using Equation (2) and produce an absolute value for RPD. This precision measurement will include variables associated with the analytical process, influences related to sample matrix interferences, and sample heterogeneity.

$$RPD = \frac{S - D}{\frac{(S + D)}{2}} \times 100, \qquad \textbf{(3)}$$

where

S = first sample value (original or MS value),
D = second sample value (duplicate or MSD value).

9.2.2 Accuracy

The accuracy of the laboratory analytical measurement process will be determined by comparing the percent recovery for the LCS versus its documented true value.

Investigative sample accuracy will be assessed for compliance with the established QC criteria that are described in Section 3.0 of this QAPP using the analytical results of method blanks, reagent/preparation blank, MS/MSD samples, field blank, and bottle blanks. The percent recovery (%R) of MS samples will be calculated using Equation (3). This accuracy will include variables associated with the analytical process, influences related to sample matrix interferences, and sample heterogeneity.

$$\%R = \frac{A - B}{C} \times 100, \qquad (3)$$

where

A = the analyte concentration determined experimentally from the spiked sample,
B = the background level determined by a separate analysis of the unspiked sample,
C = the amount of the spike added.

9.2.3 Completeness

Data completeness of laboratory analyses will be assessed for compliance with the amount of data required for decision making. The completeness is calculated using Equation (4).

$$\text{Completeness} = \frac{\text{Number of Valid Laboratory Measurements Made}}{\text{Number of Laboratory Measurements Planned}} \times 100\% \qquad (4)$$

9.2.4 Sensitivity

Achieving method detection limits depends on sample preparation techniques, instrumental sensitivity, and matrix effects. Therefore, it is important to determine actual method detection limits (MDLs) through the procedures outlined in 40 CFR 136, Appendix C. MDLs should be established for each major matrix under investigation (i.e., water, soil) through multiple determinations, leading to a statistical evaluation of the MDL.

It is important to monitor instrument sensitivity through calibration blanks and low concentration standards to ensure consistent instrument performance. It is also critical to monitor

the analytical method sensitivity through analysis of method blanks, calibration check samples, and LCSs, etc.

9.3 PROJECT COMPLETENESS

Project completeness will be determined by evaluating the planned versus actual data. Consideration will be given for project changes and alterations during implementation. All data not flagged as rejected by the review, verification, validation, or assessment processes will be considered valid. Overall, the project completeness will be assessed relative to media, analyte, and area of investigation. Completeness objectives are listed in Table 3-1 (soil) and Table 3-2 (water).

9.4 REPRESENTATIVENESS/COMPARABILITY

Representativeness expresses the degree to which data accurately reflect the analyte or parameter of interest for the environmental media examined at the site. It is a qualitative term most concerned with the proper design of the sampling program. Factors that affect the representativeness of analytical data include appropriate sample population definitions, proper sample collection and preservation techniques, analytical holding times, use of standard analytical methods, and determination of matrix or analyte interferences. Sample collection, preservation, analytical holding time, analytical method application, and matrix interferences will be evaluated by reviewing project documentation and QC analyses.

Comparability, like representativeness, is a qualitative term relative to a project data set as an individual. These investigations will employ narrowly defined sampling methodologies, site audits/surveillances, use of standard sampling devices, uniform training, documentation of sampling, standard analytical protocols/procedures, QC checks with standard control limits, and universally accepted data reporting units to ensure comparability to other data sets. Through proper implementation and documentation of these standard practices, the project will establish confidence that data will be comparable to other project and programmatic information.

Additional input to determine representativeness and comparability may be gained through statistical evaluation of data populations, chemical charge balances, compound evaluations, or dual measurement comparisons.

10.0 CORRECTIVE ACTIONS

Corrective actions may be required for two major types of problems: analytical/equipment problems and noncompliance with criteria. Analytical and equipment problems may occur during sampling, sample handling, sample preparation, laboratory instrumental analysis, and data review.

Noncompliance with specified criteria and analytical/equipment problems will be documented through a formal corrective action program at the time the problem is identified. The person identifying the problem is responsible for notifying the SAIC Project Manager and the USACE Project Manager. When the problem is analytical in nature, information on these problems will be promptly communicated to the SAIC Analytical Laboratory Coordinator. Implementation of corrective action will be confirmed in writing.

Any nonconformance with the established QC procedures in the QAPP or SAP will be identified and corrected in accordance with the QAPP. The SAIC Project Manager or his/her designee will issue an NCR for each nonconforming condition, Figure 10-1.

Corrective actions will be implemented and documented in the field record book. No staff member will initiate corrective action without prior communication of findings through the proper channels. If corrective actions are deemed insufficient, work may be stopped through a stop-work order issued by the SAIC Project Manager and the USACE Project Manager.

10.1 SAMPLE COLLECTION/FIELD MEASUREMENTS

Technical staff and project personnel will be responsible for reporting all suspected technical and QA nonconformances or suspected deficiencies of any activity or issued document by reporting the situation to the SAIC Project Manager or his/her designee. The manager will be responsible for assessing the suspected problems in consultation with the SAIC Project QA Manager to make a decision based on the potential for the situation to impact the quality of the data. When it is determined that the situation warrants a reportable nonconformance and corrective action, then an NCR will be initiated by the manager.

The manager will be responsible for ensuring that corrective actions for nonconformances are initiated by:

- evaluating all reported nonconformances,
- controlling additional work on nonconforming items,
- determining disposition or action to be taken,
- maintaining a log of nonconformances,
- reviewing NCRs and corrective actions taken, and
- ensuring that NCRs are included in the final site documentation project files.

NONCONFORMANCE REPORT

DATE OF NCR | NCR NUMBER

LOCATION OF NONCONFORMANCE | PAGE ____ OF ____

INITIATOR (NAME/ORGANIZATION/PHONE) | FOUND BY | DATE FOUND

RESPONSIBLE ORGANIZATION/INDIVIDUAL | PROGRAM | PROJECT

DESCRIPTION OF NONCONFORMANCE | CATEGORY: ____ ____ ____ ____ ____

A

INITIATOR ____ DATE ____ QA/QC OFFICER ____ DATE ____ YES ☐ NO ☐ CAR REQ'D

B

DISPOSITION:

PROBABLE CAUSE:

ACTIONS TAKEN TO PREVENT RECURRENCE:

PROPOSED BY: ____ NAME ____ DATE

C

JUSTIFICATION FOR ACCEPTANCE

INITIATOR: ____ NAME ____ DATE

D

VERIFICATION OF DISPOSITION AND CLOSURE APPROVAL

REINSPECTION/RETEST REQUIRED YES ☐ NO ☐ IF YES: ____ RESULT ____ DATE

QUALITY ASSURANCE: ____ NAME ____ DATE

Figure 10-1. Example of a Nonconformance Form

If appropriate, the SAIC Project Manager will ensure that no additional work dependent on the nonconforming activity is performed until the corrective actions are completed.

Corrective action for field measurements may include:

- repeating the measurement to check the error,
- checking for all proper adjustments for ambient conditions such as temperature,
- checking the batteries,
- re-calibrating equipment,
- checking the calibration,
- modifying the analytical method including documentation and notification (i.e., standard additions),
- replacing the instrument or measurement devices, and
- stopping work (if necessary).

The SAIC Project Manager or his/her designee is responsible for all site activities. In this role, he/she may at times be required to adjust the site activities to accommodate site-specific needs. When it becomes necessary to modify a program, the responsible person notifies the SAIC Project Manager of the anticipated change and implements the necessary changes after obtaining the approval of the SAIC Project Manager and the USACE Project Manager. All changes in the program will be documented on the FCO that will be signed by the initiators and the SAIC Project Manager. The FCO for each document will be numbered serially as required. The FCO shall be attached to the file copy of the affected document. The SAIC Project Manager must approve the change in writing or verbally before field implementation. If unacceptable, the action taken during the period of deviation will be evaluated in order to determine the significance of any departure from established program practices and action taken.

The SAIC Project Manager for the site is responsible for the controlling, tracking, and implementation of the identified changes. Reports on all changes will be distributed to all affected parties, including the USACE Project Manager. The USACE will be notified whenever program changes in the field are made.

10.2 LABORATORY ANALYSES

Each project investigation laboratory QA plan provides systematic procedures to identify out-of-control situations and corrective actions. Corrective actions shall be implemented to resolve

problems and restore malfunctioning analytical systems. Laboratory personnel have received QA training and are aware that corrective actions are necessary when:

- QC data are outside warning or control windows for precision and accuracy.
- Blanks contain target analytes above acceptable levels and must be investigated.
- Undesirable trends are detected in spike recoveries or RPD between duplicates.
- There are unusual changes in detection limits.
- Deficiencies are detected by internal audits, external audits, or from performance evaluation samples results.
- Inquiries concerning data quality are received.

Corrective action procedures are often handled at the bench level by the analyst who reviews the preparation or extraction procedure for possible errors, checks the instrument calibration, spike and calibration mixes, instrument sensitivity, and so on. If the problem persists or cannot be identified, the matter is referred to the Laboratory Supervisor, Manager, and/or QA Department for further investigation. Once resolved, full documentation of the corrective action procedure is filed with project records and the QA Department, and the information is summarized within case narratives.

Corrective actions may include:

- re-analyzing the samples, if holding time criteria permit;
- evaluating blank contaminant sources, elimination of these sources, and reanalysis;
- modifying the analytical method (i.e., standard additions) with appropriate notification and documentation;
- re-sampling and analyzing;
- evaluating and amending sampling procedures; or
- accepting data and acknowledging the level of uncertainty.

If re-sampling is deemed necessary due to laboratory problems, the SAIC Project Manager will identify the necessary cost recovery approach to implement the additional sampling effort.

The following corrective action procedures will be required:

- Problems noted during sample receipt will be documented in the appropriate laboratory LOR. SAIC and USACE will be contacted immediately to determine problem resolution. All corrective actions will be thoroughly documented.

- When sample extraction/digestion or analytical holding times are not within method required specifications, SAIC and USACE will be notified immediately to determine problem resolution. All corrective actions will be thoroughly documented.

- All initial and continuing calibration sequences that do not meet method requirements will result in a review of the calibration. When appropriate, re-analysis of the standards or re-analysis of the affected samples back to the previous acceptable calibration check is warranted.

- All appropriate measures will be taken to prepare and clean up samples in an attempt to achieve the practical quantitation limits as stated. When difficulties arise in achieving these limits, the laboratory will notify SAIC and the USACE to determine problem resolution. All corrective actions will be thoroughly documented.

- Any dilutions impacting the practical quantitation limits will be documented in case narratives along with revised quantitation limits for those analytes affected. Analytes detected above the method detection limits, but below the practical quantitation limits, will be reported as estimated values.

- Failure of method-required QC to meet the requirements specified in this project QAPP shall result in review of all affected data. Resulting corrective actions may encompass those identified earlier. SAIC and USACE will be notified as soon as possible to discuss possible corrective actions, particularly when unusual or difficult sample matrices are encountered.

- When calculation and reporting errors are noted within any given data package, reports will be reissued with applicable corrections. Case narratives will clearly state the reasons for reissuance of reports.

11.0 DATA REDUCTION, VALIDATION, AND REPORTING

11.1 DATA REDUCTION

11.1.1 Field Measurements and Sample Collection

Raw data from field measurements and sample collection activities will be appropriately recorded in field logbooks. Data to be used in project reports will be reduced and summarized. The methods of data reduction will be documented.

The SAIC Project Manager or his/her designee is responsible for data review of all field-generated data. This includes verifying that all field descriptive data are recorded properly, that all field instrument calibration requirements have been met, that all field QC data have met frequency and criteria goals, and that field data are entered accurately in all logbooks and worksheets.

11.1.2 Laboratory Services

All samples collected for these investigations will be sent to USACE HTRW CX qualified laboratories. Data reduction, evaluation, and reporting for samples analyzed by the laboratory will be performed according to specifications outlined in the laboratory's QA plan. Laboratory reports will include documentation verifying analytical holding time compliance.

Laboratories will perform in-house analytical data reduction under the direction of the Laboratory QA Officer. The Laboratory QA Officer is responsible for assessing data quality and informing SAIC and USACE of any data which are considered "unacceptable" or require caution on the part of the data user in terms of its reliability. Data will be reduced, evaluated, and reported as described in the laboratory QA plan. Data reduction, review, and reporting by the laboratory will be conducted as follows:

- Raw data are produced by the analyst who has primary responsibility for the correctness and completeness of the data. All data will be generated and reduced following the QAPP defined methods and implementing laboratory SOP protocols.

- Level 1 technical data review is completed relative to an established set of guidelines by a peer analyst. The review shall ensure the completeness and correctness of the data while assuring all method QC measures have been implemented and were within appropriate criteria.

- Level 2 technical review is completed by the area supervisor or data review specialist. This reviews the data for attainment of QC criteria as outlined in the established methods and for overall reasonableness. It will ensure all calibration and QC data are in compliance and check at least 10 percent of the data calculations. This review shall document that the data package is complete and ready for reporting and archival.

- Upon acceptance of the raw data by the area supervisor, the report is generated and sent to the Laboratory Project Manager for Level 3 administrative data review. This review will ensure consistency and compliance with all laboratory instructions, the laboratory QA plan, the project laboratory SOW, and the project QAPP.

- The Laboratory Project Manager will complete a thorough review of all reports.

- Final reports will be generated and signed by the Laboratory Project Manager.

- Data will then be delivered to SAIC for data validation.

The data review process will include identification of any out-of-control data points and data omissions, as well as interactions with the laboratory to correct data deficiencies. Decisions to repeat sample collection and analyses may be made by the Project Manager based on the extent of the deficiencies and their importance in the overall context of the project. The laboratory will provide flagged data to include such items as: (1) concentration below required detection limit, (2) estimated concentration due to poor spike recovery, and (3) concentration of chemical also found in laboratory blank.

Laboratories will prepare and retain full analytical and QC documentation for the project. Such retained documentation will be both hard (paper) copy and electronic storage media (e.g., magnetic tape) as dictated by the analytical methodologies employed. As needed, laboratories will supply hard copies of the retained information.

Laboratories will provide the following information to SAIC in each analytical data package submitted:

- cover sheets listing the samples included in the report and narrative comments describing problems encountered in analysis;

- tabulated results of inorganic, organic, radionuclide, and miscellaneous parameters identified and quantified;

- analytical results for QC sample spikes, sample duplicates, initial and continuous calibration verifications of standards and blanks, standard procedural blanks, LCSs and other deliverables as identified in Section 11.3; and

- tabulation of instrument detection limits determined in pure water.

11.2 DATA VALIDATION

11.2.1 Data Validation Approach

A systematic process for data verification and validation will be performed to ensure that the precision and accuracy of the analytical data are adequate for their intended use. The greatest uncertainty in a measurement is often a result of the sampling process and inherent variability in the environmental media rather than the analytical measurement. Therefore, analytical data validation will be performed only to the level necessary to minimize the potential of using false positive or false negative results in the decision-making process (i.e., to ensure accurate identification of detected versus non-detected compounds). This approach is consistent with the DQOs for the project, with the analytical methods, and for determining contaminants of concern and calculating risk.

Samples will be analyzed through implementation of "definitive" analytical methods. "Definitive data" will be reported consistent with the deliverables identified in Section 11.3, Tables 11-1 and 11-2. This report content is consistent with what is understood as an EPA Level III deliverable (data forms including laboratory QC and calibration information). This "Definitive data" will then be validated through the review process presented in Section 11.2.2. DQOs identified in Section 3.0 and method-specified criteria will be validated. Comprehensive analytical information will be retained by the subcontract laboratory.

Validation will be accomplished by comparing the contents of the data packages and QA/QC results to requirements contained in the requested analytical methods. The SAIC validation support staff will be responsible for these activities. The protocol for analyte data validation is presented in:

- SAIC Quality Assurance Technical Procedures (SAIC 1995);
- EPA CLP National Functional Guidelines for Organic Data Review (EPA 1994b); and
- EPA CLP National Functional Guidelines for Inorganic Data Review (EPA 1994c).

SAIC validation support staff will conduct a systematic review of the data for compliance with the established QC criteria based on the following categories:

- holding times,
- blanks,
- LCSs,
- surrogate recovery (organic methods),
- internal standards (primarily organic methods),
- isotopic tracers (radionuclide methods),
- ICP or atomic absorption QC,
- calibration,
- sample reanalysis,
- secondary dilutions, and
- laboratory case narrative.

Table 11-1. Summary of Analytical Hard-copy Data Deliverables

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

Table 11-1. Summary of Analytical Hard-copy Data Deliverables (continued)

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

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

Table 11-2. Standard Electronic Data Deliverables

Column Position	Length	Field Description
		Header Record
1-20	20	SAIC Project Number
21-28	8	Data Submission Date (MM/DD/YY)
29-33	6	Number of Records (Rows) in the file including header and terminating records
34-74	40	Submitting Laboratory Name
		Detail Record
1-20	20	SAIC Sample Identification Number
21-28	8	Date of Sample Collection (MM/DD/YY)
29-33	5	Time of Sample Collection (HH:MM military format)
34-48	15	Laboratory Analytical Batch/Sample Delivery Group (SDG) Number
49-56	8	Sample Matrix
57-76	20	Laboratory Sample Identification Number
77-84	8	Sample Extraction/Preparation Date (MM/DD/YY)
85-92	8	Sample Analysis Date (MM/DD/YY)
93-97	5	Sample Analysis Time (HH:MM military format)
98-100	3	Analysis/Result Type - This field is used to designate the type of analysis performed. Valid values are as follows: REG = Regular Sample Analysis DUP = Laboratory Duplicate Analysis DIL = Secondary Dilution Analysis REn = Re-analysis where "n" is a sequential number
101-112	12	Chemical Abstract Services (CAS) Number
113-142	30	Analysis Name
143-157	15	Analysis Method (Method numbers shall be the EPA, SW-846, NIOSH, etc. method number)
158-167	10	Result (Report detection limit if not detected)
168-172	5	Result Qualifier (U, J, etc.)
173-180	8	Unit of measure
181-190	10	Instrument Detection Limit
191-195	5	Percent Solids (Report "0" for water matrices)
196-200	5	Sample Weight/Volume
201-202	2	Sample Weight/Volume Units
203-207	5	Dilution
		Termination Record
1-3	3	$$$

Electronic deliverables must have file structure defined in this table. The deliverable file may be either an ASCII text file, a dBASE compatible file (.DBF file extension), or an Excel spread sheet file (.XLS file extension). All fields must be presented. Fields that are not applicable for the reported method shall be reported as blank.

Consistent with the data quality requirements as defined in the DQOs, all project data and associated QC will be evaluated on these categories and qualified as per the outcome of the review. Information gathered during this validation process will be consistent with the information demonstrated by the USACE Data Validation Form (Figure 11-1). Either these forms or SAIC validation forms containing equivalent documentation will be completed and presented with the Quality Control Summary Report (QCSR).

11.2.2 Primary Analytical Data Validation Categories

11.2.2.1 Holding Times

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

11.2.2.2 Blanks

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

Blanks will be evaluated against quantitation limit goals as specified in Table 3-3. Analytical method blanks should be below 2× these levels. Field, trip, and equipment rinsate blanks will be evaluated against 5× these levels for most analytes and 10× these levels for common laboratory solvent analytes.

11.2.2.3 Laboratory Control Samples

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

11.2.2.4 Surrogate Recovery

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

FIGURE 11-1. DATA VALIDATION FORM, USACE

DATE: _____

REVIEWER NAME: _____

SIGNATURE: _____

TITLE: _____

DATA VALIDATION CHECKLIST

PROJECT NAME:	
PROJECT NUMBER:	
SAMPLE ID (NUMBERS):	
SAMPLING TEAM:	
SAMPLE MATRIX:	
ANALYSES PERFORMED:	
CESAS DATA REPORTING LEVEL	

FIELD DATA DOCUMENTATION:

FIELD SAMPLING LOGS:	REPORTED		ACCEPTABLE		NOT REQUIRED
	NO	YES	NO	YES	
1. SAMPLING DATES NOTED					
2. SAMPLING TEAM INDICATED					
3. SAMPLE ID TRACEABLE TO LOCATION					
4. SAMPLE LOCATION					
5. SAMPLE DEPTHS FOR SOILS					
6. COLLECTION TECHNIQUE (BAILER, PUMP, ETC.)					
7. SAMPLE TYPE (GRAB, COMPOSITE)					
8. SAMPLE CONTAINER					
9. SAMPLE PRESERVATION					
10. CHAIN OF CUSTODY FORM COMPLETED					
11. REQUIRED ANALYTICAL METHODS					
12. FIELD WATER AND SOIL SAMPLE LOGS					
13. NUMBER OF QA & QC SAMPLES COLLECTED					
14. FIELD EQUIPMENT CALIBRATION					
15. FIELD EQUIPMENT DECONTAMINATION					
16. SAMPLE SHIPPING					

COMMENTS:

_____

_____

_____

_____

FIGURE 11-1. DATA VALIDATION FORM, USACE (continued)

LABORATORY DATA VALIDATION:	REPORTED		ACCEPTABLE		NOT REQUIRED
	NO	YES	NO	YES	
1. SAMPLING RESULTS					
2. PARAMETERS ANALYZED					
3. ANALYTICAL METHOD					
4. SAMPLE RECEIPT DATE					
5. SAMPLE PREPARATION DATE					
6. HOLDING TIMES					
7. CALIBRATION					
8. MS/MSD RPD OR SAMPLE LD RPD					
9. SURROGATE SPIKE RESULTS					
10. BLANKS					
A. RINSATES					
B. FIELD BLANKS					
C. TRIP BLANKS					
11. SAMPLE pH					
12. SAMPLE TEMPERATURE					
13. DETECTION LIMITS					
14. QC DATA					
A. INORGANIC					
B. ORGANIC					

ANALYTE: _____

FLAG: _____

REMARKS: _____

_____

_____

_____

OVERALL COMMENTS: _____

_____

_____

DEFINITIONS:

U	Analyte not detected
J	Analyte identified, concentration is estimated value
UJ	Analyte not detected above estimated detection limits
B	Blank contaminated
R	Rejected value, presence or absence of analyte cannot be verified
UR	Rejected detection limits
MS	Matrix Spike
MSD	Matrix Spike Duplicate
RPD	Relative Percent Difference
LD	Laboratory Duplicate

11.2.2.5 Internal Standards

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

11.2.2.6 Isotopic Tracers

Isotopic tracers are utilized to evaluate and compensate for sample-specific influences and preparation aberrations on the radionuclide quantification. They are evaluated to determine if data require qualification due to excessive variation in acceptable tracer quantitative or qualitative performance measures. For example, a decrease or increase in tracer recovery for a given isotope may reflect a change in sensitivity that can be attributed to the sample matrix or preparation process. Because quantitative determination of many radionuclides is based on the use of tracers, evaluation is critical to the provision of reliable analytical results.

11.2.2.7 Furnace Atomic Absorption QC

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

11.2.2.8 Calibration

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

11.2.2.9 Sample Reanalysis

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

11.2.2.10 Secondary Dilutions

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

11.2.2.11 Laboratory Case Narratives

Analytical laboratory case narratives are reviewed for specific information concerning the analytical process. This information is used to direct the data validator to potential problems with the data.

11.3 PROJECT ANALYTICAL DATA SET

Analytical data for this project will be screened electronically and validated by qualified chemists. Flags signifying the usability of data will be noted and entered into an analytical data base. Deficiencies in data deliverables will be corrected through direct communication with the field or laboratory, generating immediate response and resolution. All significant data discrepancies noted during the validation process will documented through NCRs, which are sent to the laboratory for clarification and correction.

Decisions to repeat sample collection and analyses may be made by the SAIC Project Manager based on the extent of the deficiencies and their importance in the overall context of the project.

All data generated for investigations will be computerized in a format organized to facilitate data review and evaluation. The computerized data set will include data flags in accordance with the above-referenced protocols as well as additional comments of the Data Review Team. The associated data flags will include such items as: (1) estimated concentration below-required reporting limit; (2) estimated concentration due to poor calibration, internal standard, or surrogate recoveries; (3) estimated concentration due to poor spike recovery; and (4) estimated concentration of chemical that was also determined in the laboratory blank.

SAIC data assessment will be accomplished by the joint efforts of the data validator, the data assessor, and the Project Manager. Data assessment by data management will be based on the criteria that the sample was properly collected and handled according to the SAP and Sections 4.0 and 5.0 of this QAPP. An evaluation of data accuracy, precision, sensitivity and completeness, based on criteria in Section 9.0 of this QAPP, will be performed by a data assessor and presented in the QCSR. This data quality assessment will indicate that data are: (1) usable as a quantitative concentration, (2) usable with caution as an estimated concentration, or (3) unusable due to out-of-control QC results.

Project investigation data sets will be available for controlled access by the SAIC Project Manager and authorized personnel. Each data set will be incorporated into investigation reports as required.

11.4 DATA REPORTING

Laboratories will prepare and submit analytical and QC data reports to SAIC in compliance with the requirements of this QAPP, including data forms listed in Table 11-1. An electronic copy of data will be provided in an ASCII data file, CLP format, or other compatible format for entry into the SAIC data base. An acceptable configuration is presented in Table 11-2 with all QA/QC sample data being provided in a companion ASCII file.

The laboratory will be required to confirm sample receipt and log-in information. The laboratory will return a copy of the completed COC and confirmation of the laboratory's analytical log-in to SAIC within 24 hours of sample receipt.

The subcontract analytical laboratory will prepare and retain full analytical and QC documentation similar to that required by CLP. Such retained documentation will include all hard copies and other storage media (e.g., magnetic tape). As needed, the subcontract analytical laboratory will make available all retained analytical data information.

12.0 PREVENTIVE MAINTENANCE PROCEDURES

12.1 FIELD INSTRUMENTS AND EQUIPMENT

The field equipment for this project may include temperature probes; pH meters; conductivity meters; alpha/beta and gamma survey meters; organic vapor detectors (FID or PID); and geophysical equipment. Specific preventative maintenance procedures to be followed for field equipment are those recommended by the manufacturers. These procedures are included in the technical procedures governing the use of these instruments.

Field instruments will be checked and/or calibrated before they are shipped or carried to the field. Each field instrument will be checked daily against a traceable standard or reference with a known value to ensure that the instrument is in proper calibration. Instruments found to be out of calibration will be recalibrated before use in the field. If the instrument cannot be calibrated, it will be returned to the supplier or manufacturer for recalibration, and a back-up instrument will be used in its place. Calibration checks and calibrations will be documented on the Field Meter/Calibration Log Sheets in the M&TE Log Book. Any maintenance conducted on field equipment must be documented in the M&TE Log Book.

Critical spare parts such as tapes, papers, pH probes, electrodes, and batteries will be kept on site to minimize down time of malfunctioning instruments. Back-up instruments and equipment should be available on site or within 1-day shipment to avoid delays in the field schedules.

12.2 LABORATORY INSTRUMENTS

As part of their QA/QC Program, a routine preventive maintenance program will be conducted by all investigation-associated laboratories to minimize the occurrence of instrument failure and other system malfunctions. All laboratory instruments will be maintained in accordance with manufacturers' specifications and the requirements of the specific method employed. This maintenance will be carried out on a regular, scheduled basis and will be documented in the laboratory instrument service log book for each instrument. Emergency repair or scheduled manufacturer's maintenance will be provided under a repair and maintenance contract with factory representatives.

13.0 PERFORMANCE AND SYSTEM AUDITS

Performance and system audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in the SAP and QAPP. Audits of laboratory activities will include both internal and external audits.

13.1 LABORATORY AUDITS

The USACE HTRW CX conducts on-site audits and validates laboratories on a regular basis. These USACE independent on-site systems audits in conjunction with performance evaluation samples (performance audits) qualify laboratories to perform USACE environmental analysis every 18 months.

These system audits include examining laboratory documentation of sample receiving, sample log-in, sample storage, COC procedures, sample preparation and analysis, instrument operating records, etc. Performance audits consist of sending performance evaluation samples to USACE laboratories for on-going assessment of laboratory precision and accuracy. The analytical results of the analysis of performance evaluation samples are evaluated by USACE HTRW CX to ensure that laboratories maintain an acceptable performance.

Internal performance and system audits of laboratories will be conducted by the Laboratory QA Officer as directed in the laboratory QA plan. These system audits will include examination of laboratory documentation of sample receiving, sample log-in, sample storage, COC procedures, sample preparation and analysis, instrument operating records, etc. Internal performance audits are also conducted on a regular basis. Single-blind performance samples are prepared and submitted along with project samples to the laboratory for analysis. The Laboratory QA Officer will evaluate the analytical results of these single-blind performance samples to ensure that the laboratory maintains acceptable performance.

Additional audits of laboratories may be planned and budgeted within specific USACE task scopes. These project-specific laboratory performance review audits would be conducted by SAIC at the direction of and in conjunction with the USACE, when requested.

External audits may be conducted in conjunction with or at the direction of the EPA Region or the State of Missouri regulatory agency.

14.0 QA REPORTS TO MANAGEMENT

14.1 DAILY QUALITY CONTROL REPORTS

During the field investigation activities performed for this project, SAIC will prepare Daily Quality Control Reports (DQCRs), which will be signed and dated by the SAIC CQC Representative. An example of the DQCR format to be used by SAIC is illustrated in Figure 14-1. These reports will be submitted to the USACE District Project Manager on a weekly basis. The contents of each DQCR will include a summary of activities performed at the project site, weather information, results of Contractor Chemical Quality Control (CCQC) activities performed including field instrument calibrations, departures from the approved Work Plan problems encountered during field activities, and any instructions received from government personnel. Any deviations that may affect the project data quality objectives will be immediately conveyed to the USACE District Project Manager.

14.2 QUALITY ASSURANCE REPORTS

Each laboratory will provide LORs and analytical QC summary statements (case narratives) with each data package. All COC forms will be compared with samples received by the laboratory and a LOR will be prepared and sent to SAIC describing any differences in the COC forms and the sample labels or tags. All deviations will be identified on the receiving report such as broken or otherwise damaged containers. This report will be forwarded to SAIC within 24 hours of sample receipt and will include the following: a signed copy of the COC form; itemized SAIC sample numbers; laboratory sample numbers; cooler temperature upon receipt; and itemization of analyses to be performed.

Summary QC statements will accompany analytical results as they are reported by the laboratory in the form of case narratives for each sample delivery group.

Any departures from approved plans will receive prior approval from the USACE District Project Manager and will be documented with field change orders. These field change orders will be incorporated into the project evidence file.

SAIC will maintain custody of the project evidence file and will maintain the contents of files for this project, including all relevant records, reports, logs, field logbooks, pictures, subcontractor reports, correspondence, and COC forms, until this information is transferred to the USACE Project Manager. These files will be stored under custody of the SAIC Project Manager. Analytical laboratories will retain all original analytical raw data information (both hard copy and electronic) in a secure, limited access area and under custody of the laboratory Project Manager.

DATE _____

DAY

S	M	T	W	TH	F	S

DAILY QUALITY CONTROL REPORT

WEATHER

Bright Sun	Clear	Overcast	Rain	Snow

TEMP

To 32°	32-30°	30-70°	70-85°	85° up

WIND

Still	Moder.	High	Report No.

HUMIDITY

Dry	Moder.	Humid	

COE PROJECT MANAGER _____

PROJECT _____

JOB NO. _____

CONTRACT NO. _____

SUB-CONTRACTORS ON SITE:

EQUIPMENT ON SITE:

WORK PERFORMED (INCLUDING SAMPLING):

Figure 14-1 Example Daily Quality Control Report

PROJECT _____ REPORT NO. _____

JOB NO. _____ DATE: _____

QUALITY CONTROL ACTIVITIES (INCLUDING FIELD CALIBRATIONS):

HEALTH AND SAFETY LEVELS AND ACTIVITIES:

PROBLEMS ENCOUNTERED/CORRECTION ACTION TAKEN:

SPECIAL NOTES:

TOMORROW'S EXPECTATIONS:

By: _____ QA Check by: _____

(Signature and date) (Signature and date)

Figure 14-1 (continued).

14.3 QUALITY CONTROL SUMMARY REPORTS

At the conclusion of field investigation activities and laboratory analysis, SAIC, in addition to any review conducted by the laboratory, will perform its own validation of the submitted data. This activity will include assignment of flags to data, documentation of the reason(s) for the assignments, and description of any other data discrepancies. SAIC will then prepare a QCSR, which will be included as an appendix to the final report. This report will be submitted to the USACE District Project Manager as determined by the project schedule. The contents of the QCSR will include data validation documentation and discussion of all data that may have been compromised or influenced by aberrations in the sampling and analytical processes. Both field and laboratory QC activities will be summarized, and all DQCR information will be consolidated. Problems encountered, corrective actions taken, and their impact on project DQOs will be determined.

The following are examples of elements to be included in the QCSR as appropriate.

- Laboratory QC evaluation and summary of the data quality for each analytical type and matrix. Part of the accuracy, precision, and sensitivity summarized in the data quality assessment.

- Field QC evaluation and summary of data quality relative to data useability. Part of the accuracy, precision, and sensitivity summarized in the data quality assessment.

- Overall data assessment and usability evaluation.

- DQCR consolidation and summary.

- Summary of lessons learned during project implementation.

Specific elements to be evaluated within the QCSR include the following:

- sample results,
- field and laboratory blank results,
- laboratory control sample percent recovery (method dependent),
- sample matrix spike percent recovery (method dependent),
- matrix spike/matrix spike duplicate or sample duplicate RPD (method dependent),
- analytical holding times, and
- surrogate recovery, when appropriate.

An example of the format that will be used by SAIC for preparation of the project QCSR is presented in Figure 14-2.

QUALITY CONTROL SUMMARY REPORT

1. Introduction

    1.1 Project Description
    1.2 Project Objectives
    1.3 Project Implementation
    1.4 Purpose of this Report

2. Quality Assurance Program

    2.1 Monthly Progress Reports
    2.2 Daily Quality Control Reports (DQCRs)
    2.3 Laboratory "Definitive Level Data Reporting

3. Data Validation

    3.1 Field Data Validation
    3.2 Laboratory Data Validation
    3.3 Definition of Data Qualifiers (Flags)
    3.4 Data Acceptability

4. Data Evaluation

    4.1 Accuracy
        - Metals
        - Volatile Organic Compounds
        - Total Petroleum Hydrocarbon
        - etc.

    4.2 Precision
        - Laboratory Precision
        - Field Precision

    4.3 Sensitivity
    4.4 Representativeness and Comparability
    4.5 Completeness

5. Data Quality Assessment Summary

6. References

Figure 14-2. Quality Control Summary Report Format

QUALITY ASSURANCE PROJECT PLAN
FOR THE
ST. LOUIS AIRPORT AND DOWNTOWN SITES
ST. LOUIS, MISSOURI

APPENDIX A

REFERENCES

REFERENCES

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QUALITY ASSURANCE PROJECT PLAN
FOR THE
ST. LOUIS AIRPORT SITE AND CONTIGUOUS PROPERTIES
ST. LOUIS, MISSOURI

APPENDIX B

DATA MANAGEMENT PLAN

1.0 INTRODUCTION

This Appendix of the QAPP presents the Data Management Plan (DMP) for project activities to be performed by Science Applications International Corporation (SAIC) for the SLAPS Characterization, St. Louis, Missouri. This plan describes the data management process to be implemented for this project. The DMP presents the process used for the planning, collection, tracking, verification, validation, analysis, presentation, and storage of site characterization data. The plan identifies required data documentation materials and procedures, as well as project file requirements. The plan also provides the reporting requirements for presenting the raw data and conclusions of the investigation.

The characterization activities planned for the SLAPS will produce a large amount of information. The information collected is critical for several reasons. Because the proposed work plan is a dynamic work plan, information collected during the course of the site characterization will influence the course of the characterization work. All data will be maintained on a Web site with ftp access to facilitate dissemination to all data users. This section describes the data acquisition, management, and analysis requirements for the SLAPS investigation effort.

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

2.0 INVESTIGATION DATA

2.1 DATA TYPES

Data acquisition activities associated with the SLAPS characterization fall into ten broad categories:

1. Existing historical information, including photographs and the results from any previous characterization activities at the site;

2. Mapping data (including survey data from surveying crews);

3. Gradiation walkover data;

4. Nonintrusive geophysical data;

5. Discrete sample results;

6. Inorganic and organic screening data;

7. Secondary borehole information;

8. Gamma exposure measurement data;

9. In situ gamma spectroscopy data; and

10. Critical project records.

2.1.1 Historical Information

Significant historical information exists for the SLAPS. This information includes reports documenting past investigations and discrete soil and water analytical results. Most of the analytical results exist in electronic format. Discrete sampling data will be loaded and maintained in an electronic relational data base. For other types of information that cannot be loaded into the relational data base, electronic data files will be maintained in an appropriate directory on the SLAPS ftp site.

2.1.2 Mapping Data

Mapping data will be collected during the course of the characterization program. These data fall into several categories: (1) aerial fly-over data that will be used to establish an accurate base map for the site in State Plan coordinates; (2) data that will be used to identify additional physical features of the site currently unavailable in existing maps such as the spatial layout of buried utilities and the layout of any local coordinate system used for the radiation walkover and nonintrusive geophysics; and (3) data that identifies discrete locations for sampling stations/monitoring wells produced as part of this characterization effort. The primary issue associated with mapping data is the issue of insuring that the various data sets that include spatial locational information are consistent relative to each other.

The base coordinate system for the characterization work is State Plane meters. All data produced by this characterization effort will be delivered in State Plane meters. In the event that raw data is obtained in State Plane feet, a conversion factor of 0.30480061 will be used to convert this data into meters. In the event that raw data is obtained in latitude/longitude, an appropriate conversion routine will be applied to the data such that the coordinates of established monuments at the site can be recovered in State Plane meters with a calculation error of less than 0.1 m. Topographical data (i.e., mean sea level readings, depth to samples, depth to water table measurements, etc.) will be delivered in feet.

Survey monuments will be established at key locations across the site to facilitate the establishment of local grids and the implementation of spatial accuracy QA/QC techniques. These monuments may be based on established site features (i.e., building corners, large rocks, trees, etc.) or may be introduced. All monuments will be appropriately marked in the field so that they are readily identifiable, will be tagged with their name and State Plane meters location, and will have

their positions in State Plane meters and descriptions recorded electronically. The subcontractor responsible for the civil survey will provide the project with a hardcopy report of the civil survey.

In certain instances (i.e., nonintrusive geophysical surveys and gamma walkover surveys), it may be advantageous to work with local coordinate systems. In the event that local coordinate systems are used, these local coordinate systems will be tied to at least three established monuments, and the final data deliverables will conform to the State Plane meters requirement.

The base level of accuracy for all mapping work at the site is 0.1 m for horizontal coordinates and 0.1 ft for vertical measurements. If methodologies are used to determine locations that cannot guarantee a locational error of less than 0.1 m horizontally or 0.1 ft vertically, these data will be accompanied by an estimate of the maximum and average error expected from the methodology used to generate the data. Examples of methodologies likely to be used at the site that fall into this category are Global Positioning Systems, hand-held survey instruments, and chaining techniques. In the case of all data sets collected for the site that involve spatial coordinates, data set specific QA/QC techniques will be employed that can identify and eliminate egregious locational errors. Examples of these techniques include visual reviews of mapped data, the use of monument recovery as QA/QC controls, and the use of survey closure techniques.

2.1.3 Radiation Walkover Data

Radiation walkover data will be collected primarily during the second stage of the SLAPS characterization effort. Radiation walkover data will be generated by using a combination of GWS and a GPS. In the case of SLAPS, two different gamma sensors will be deployed. Using these two sensors, the GWS/GPS system will provide 100 percent coverage of the SLAPS.

To facilitate the management and analysis of information, the SLAPS will be divided into 100 m by 100 m blocks. Each block will be subdivided into four 50 m by 50 m quadrants. GWS/GPS data collection will be based on these quadrants. The corners of quadrants will be clearly staked in the field prior to the initiation of GWS/GPS data collection activities. Data collection will take place on a quadrant by quadrant basis.

The GWS/GPS system used for the site will include both real time and post processing capabilities—real time for assisting in the identification of anomalies that require further investigation or description and for verifying locational control, post processing for error correction, and delivering the required electronic deliverables in State Plane meters. Post processed data will be available within one business day from the date of collection. Horizontal accuracy will be within ± one meter. The vendor will provide a GPS forecast for each day of GPS operation (including, for example, PDOP, number of usable satellites, etc.) to allow surveyors to plan around periods of signal degradation. The GWS/GPS system employed will make use of at least one established base system with base locations verified by standard surveying techniques and at least tow roving systems. The roving systems will be compatible with multiple sensors and will be able to collect and record data streams from multiple sensors simultaneously. Backup equipment will be maintained so that in the case of equipment failure the GWS/GPS system can be made operational within one working day. The vendor will be capable of providing full time onsite personnel for processing data and general GPS oversight.

At the outset of data collection for a quadrant, the first and last four locations "shot" with the GPS will be the four corners of the quadrant to provide for locational control. In addition, at least one known monument will be "shot" per electronic data file. The contractor collecting the GWS/GPS data will maintain field notebooks in which comments pertaining to GWS/GPS data collection can be entered. Data for a particular quadrant will be confined to one electronic file; data from different quadrants will not be mixed in the same file. GWS/GPS data will be delivered from the contractor with coordinates in State Plane meters. The delivered file will include one line of header information that identifies which quadrant the file contains, the date the data were collected, and the data the file contains. Each data line will contain a northing, an easting, and one field per sensor included in the survey. In the event that one or more sensors are missing information for a particular location, the data entered for that sensor at that location will be -99.

To facilitate the review of GWS/GPS sensor data quality, three control points will be established and surveyed at the start and end of each day with the GPS and each sensor used during the course of that day with weather conditions and approximate soil moisture contents noted. In the event that the instruments return results that are significantly different from previous results, sampling will not continue until the reason is identified.

GWS/GPS data files received from the contractor will be checked visually for locational accuracy by mapping the data and evaluated visually for completeness and plausibility of sensor results. After this initial QA/QC screen, the data files will be placed on the ftp site for general dissemination. In addition, a GWS/GPS data tracking table will be maintained on the Web that tracks the collection of GWS/GPS data. For each quadrant at the site, the table will include at a minimum when GWS/GPS data is expected to be collected, when it was collected, and when it became available at a data file on the ftp site.

2.1.4 Nonintrusive Geophysical Data

Nonintrusive geophysical data will be collected at the site to assist in determining the presence or absence of subsurface fill and to assist in mapping buried conductive materials and utilities to support intrusive sampling. Raw nonintrusive geophysical data collected by contractors will be delivered in ASCII file format in State Plane meters. Each data file should include at least three data points that correspond to known monuments at the site. Data files delivered by the contractor will be mapped and checked visually for locational errors. Once cleared in this fashion, the ASCII files will be posted to the ftp site for general dissemination. In addition, the contractor will also deliver at least one bit-mapped (raster-based) image file of graphical interpretation for each data file and an electronic version of the contractor's report in standard word processing format (i.e., WordPerfect or MS Word). These will also be posted to the Web. Finally, a nonintrusive geophysical data tracking table will be included on the Web that identifies each of the areas targeted for nonintrusive surveys, the types of surveys planned for those areas, when the surveys were completed, and when the data became available on the Web site.

2.1.5 Discrete Sample Results

Discrete samples will be collected for analysis in various stages of the planned characterization activities. The primary data management resource for discrete sample information will be a relational database name the FUSRAP Environmental Information Management System (FEIMS). The types of data to be stored in FEIMS include: (1) sample planning information to be used for pre-populating FEIMS and generating sample labels and chain-of-custody documentation in the field; (2) sampling station information; (3) sample descriptions; (4) field screening results associated with samples; and (5) analytical results associated with samples.

Pre-population of FEIMS with sampling stations/sample identification and the generation of sampling labels and chain-of-custody records will take place at the site or an SAIC office. In addition, the submittal of field screening results to FEIMS will be done by staff at the site. In the case of onsite laboratory and/or field screening techniques, to minimize data handling and the potential errors it introduces, standard electronic deliverable formats will be negotiated with the contractors responsible for data generation.

All handling of offsite laboratory results will be completed by SAIC at Oak Ridge following project procedures. Summary data files from selected FEIMS tables will be generated daily and placed on the ftp site to facilitate data dissemination.

Locational information for sampling stations will be estimated from civil surveys and base maps. The maximum locational error expected for these is ± 1.667 feet. In the event that locational errors are thought to exceed this maximum, the estimated error will be noted. Sampling station locational data will be mapped and visually inspected for gross locational errors.

A discrete sample tracking table will be maintained on the Web. This table will identify at a minimum all planned samples to be collected, their sampling stations, the analyses to be performed, the dates these were completed, and the date the information became available within FEIMS.

2.1.6 Secondary Borehole Information

Secondary borehole information includes many types of data that are generated during the course of completing soil bores, temporary well points, and monitoring wells. It can include stratigraphic information/soil classification data, depth-to-water table data, down hole screening results (i.e., gamma surveys and resistivity measurements) and notes recorded by field staff at the time of bore completion. These data typically are hand entered in field notebooks during the completion of the bore.

These field notebooks will be maintained in a logical and reasonable manner. If a particular data set proves to be of particular importance (i.e., screening results, depth-to-water table data, soils information, etc.), it may be entered either directly into an appropriate FEIMS table or placed in a spreadsheet on the Web for dissemination. In particular, down-hole gamma readings will be entered into the FEIMS field results table for archiving and dissemination purposes.

na Exposure Measurement Data

:ed gamma exposure measurement data will be collected from approximately 8 locations ior to the commencement of intrusive field sampling activities. The results from these made available in electronic spreadsheet format via the SLAPS ftp site, with maps e locations where the measurements were taken. Locations will be provided in State

u Gamma Spectroscopy Data

u gamma spectroscopy with a HPGe crystal will be used to provide real-time in situ isotope-specific activity levels at the site. Coordinates for the locations of the HPGe be determined using GPS. Results from the measurements will be recorded in field At the end of each day, these will be entered into electronic format and uploaded into Ge data collection will be tracked using the Web-based progress tracking table developed amples.

al Project Records

:al project records such as survey reports, chain-of-custody forms, laboratory data d validation results will be maintained in the project file.

)ENTIFIERS

:ey identifiers for project sampling data will be the sample location/station and a unique ification number. All samples will be assigned an area and station to identify the t where the field measurements or samples were collected. Descriptions, geographic and elevations will be obtained for these sampling locations.

ue sample numbers are derived from the location, sampling station within the location, ım, sample type, plus a sequential number. Field duplicates represent a separate sample tinct depths receive different sequential numbers so no duplication of sample numbers The sample identification will appear on the sample collection log sheet, sample label, tody form, and on any correspondence related to the sample. Additional information nple identification is presented in the Field Sampling Plan.

:urements not associated with physical samples (walkover surveys) will be identified inates of the measurement location (NAD83 state plane meters) and the date and time ıent.

3.0 DATA MANAGEMENT SYSTEM

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

(1) a multi-disciplinary team of data management professionals;

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

(3) guidance provided in the SAIC *Quality Assurance Technical Procedures Volume I: Data Management*; and

(4) a standardized data base structure to support the collection, management, analysis, and presentation of site characterization data.

4.0 DATA MANAGEMENT AND TRACKING PROCESS

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

4.1 SAMPLING AND ANALYSIS PLANNING

Plans for the collection of field and laboratory quality control samples are detailed in the SAP and the QAPP. These two plans together specify all applicable sampling and analytical data that will be entered into the data base.

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

Prior to initiating field work, the project database will be populated with sample locations, sample numbers, analytical parameters and detection limits, and associated sampling and laboratory information based on the requirements of the SAP. A report of all planned samples will be generated for review by the SAIC Field Manager. After approval of the pre-sampling database, the data coordinator will generate field sampling forms including preprinted sample information, bind and number the logbooks, and print and organize the required sample labels. This process will increase the accuracy of the final database and minimize the amount of information samplers must record in the field.

4.2 FIELD SAMPLE COLLECTION AND MEASUREMENT

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

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

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

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

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

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

4.3 CHAIN-OF-CUSTODY DOCUMENTATION

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

When the samples are received at the laboratory, the laboratory receiving staff will check and document the condition of the samples upon arrival, check that the sample identification numbers on containers and chain-of-custody forms match, and assign laboratory sample identification numbers traceable back to the field identification numbers. Within 24 hours of receipt of the sample containers, the laboratory will send a letter of receipt to the SAIC Laboratory Coordinator or his designee. This letter will provide the following information:

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

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

4.4 ANALYTICAL LABORATORY DOCUMENT AND DATA SUBMISSION

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

Analytical results will be submitted to the SAIC Laboratory Coordinator or designee on standardized forms in data packages in accordance with the subcontract scope of work for analytical services. These forms will contain results and required QA/QC information applicable to the analytical laboratory method used for analysis. In addition, as required by the scope of work, results of analyses will also be provided in electronic format on diskettes. The data coordinator receiving laboratory deliverables will make a copy of each data package and/or diskette and submit the originals

to the project file. Results will be transferred to the data base either electronically by diskette or manually from the hard copy into appropriate data tables within the data base.

4.5 DATA VERIFICATION AND VALIDATION

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

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

4.6 DATA CENTRALIZATION AND STORAGE

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

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

4.7 DATA SUMMARIZATION AND REPORTING

When field sampling has been completed and the analytical data have been received, validated, and transferred into the project data base, the project report and Quality Control Summary

Report (QCSR) will be generated. Information regarding the format and content for QCSRs is presented in Section 14.0 of the QAPP.

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

4.8 RECORDS MANAGEMENT AND DOCUMENT CONTROL

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

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

4.9 DATA DISSEMINATION AND THE WEB

The principle resource for dissemination of data from the SLAPS project will be a Web site established for that purpose. The Web site will be secured with login and password to prevent unauthorized access to draft characterization data associated with the site. The Web site will include the following principle components/capabilities: (1) description of characterization activities planned for the site; (2) a catalog of electronic photos taken at the site; (3) links to an ftp site to allow for the maintenance and transferral of large electronic files; (4) links to other, pertinent Web sites such as those maintained by the Ohio EPA and by DOE's FUSRAP; (5) a list server that allows users of the site to post questions and concerns to project technical staff; (6) a place for the distribution of pertinent electronic copies of documents such as this sampling and analysis plan; (7) a place where graphics (i.e., maps, bore logs, etc.) and text produced by data analysis can be distributed; (8) a project data collection schedule that reports the progress of the data collection and sample analysis activities, including discrete samples, nonintrusive geophysical data, GWS/GPS data, LIBS; and (9) connections

to sample analytical results through interaction with FEIMS. The Web site will be configured so that it is accessible by Netscape 2.0 or later versions and MS Explorer 3.0 or later versions.

Administrative Record for the Formerly Utilized Sites Remedial Action Program (FUSRAP) North St. Louis County Sites

St. Louis County, Missouri

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Volumes 4 - Feasibility Study
4.4 – Work Plans & Progress Reports
4.5 – Invoices/Contractor Payments/Cost Reports
4.7 - ARARs

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