FINAL

UNIFORM FEDERAL POLICY-QUALITY ASSURANCE PROJECT PLAN

SITE INSPECTION
FORMERLY USED DEFENSE SITE (FUDS) PROPERTY E05MI0013
FORMER RADAR STATION
FORT CUSTER REC/INDUSTRIAL AREAS
BATTLECREEK, CALHOUN COUNTY, MICHIGAN

November 2019

Contract No.: W912QR-17-D-0043
Task Order No.: W912QR18F0374

Prepared For:

U.S. ARMY CORPS OF ENGINEERS LOUISVILLE DISTRICT
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CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

SERES-Alliant JV, LLC (SERES-Alliant) has completed the Uniform Federal Policy for Quality Assurance Project Plan (UFP-QAPP) for the Former Radar Station at the Former Fort Custer in Battle Creek, Michigan. Notice is hereby given that an independent technical review, that is appropriate to the level of risk and complexity inherent in the project, has been conducted as defined in this UFP-QAPP. During the independent technical review, compliance with established policy principles and procedures was verified. This included review of: editorial content; substance; assumptions; methods and procedures used in the analyses; the appropriateness of data used and level obtained; and reasonableness of the result, including whether the deliverable meets the customer's needs consistent with law and existing USACE policy. All comments resulting from the independent technical review have been resolved.

_____November 2019
Independent Technical Review Team Leader

Significant concerns and the explanation of the resolution are as follows:

Internal SERES-Alliant Technical Review Comments are documented and maintained in the SERES-Alliant project file. Changes to this document addressing the comments have been verified by the Project Manager. As noted above, all concerns resulting from independent technical review of the project have been considered and resolved.

_____November 2019
Project Manager
Nathan Mullens, PG, REM

ACRONYMS

%R	Percent Recovery
ug/L	Microgram per liter
ug/m^3	micrograms per cubic meter
ADR	Automated Data Review
amsl	Above mean sea level
APP	Accident Prevention Plan
ASTM	American Society for Testing and Materials
bgs	below ground surface
BTEX	Benzene, toluene, ethylbenzene, and xylenes
CAS	Chemical Abstracts Service
CCV	Continuing Calibration Verification
CIH	Certified Industrial Hygienist
CLC	Common Lab Contaminants
COC	Contaminant of concern
COPC	Contaminant of potential concern
COR	Contract Officer Representative
CSM	Conceptual Site Model
CSP	Certified Safety Professional
cVOC	Chlorinated Volatile Organic Compound
DL	Detection Limit
DoD	Department of Defense
DQI	Data quality indicator
DQO	Data Quality Objective
DU	Decision Unit
DUP	Duplicate
E	Endangered
EB	Equipment Blank
EDD	Electronic Data Deliverable
EGLE	Environment, Great Lakes and Energy
EICP	Extracted Ion Current Profile
ELAP	Environmental Laboratory Accreditation Program
EM	Electromagnetic
eQAPP	Electronic representation of the quality assurance project plan
ESA	Environmental Site Assessment
FB	Field Blank
FCIP	Fort Custer Industrial Park
FCMR	Fort Custer Military Reservation
FCRA	Fort Custer Recreation Area
FCTC	Fort Custer Training Center
ft.	feet
FUDS	Formerly Used Defense Site
GPS	Global Positioning System

HTRW	Hazardous, Toxic and Radiological Waste
ICAL	Initial Calibration
ICV	Initial Calibration Verification
IDW	Investigation derived waste
ISM	Incremental sampling method
LCS	Laboratory Control Sample
LOD	Limit of Detection
LOQ	Limit of Quantification
LRL	U.S. Army Corps of Engineers, Louisville District
MB	Method Blank
MCL	Maximum Contaminant Level
MDEQ	Michigan Department of Environmental Quality
MDL	Method detection limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NA	Not Applicable
NFA	No Further Action
PA	Preliminary Assessment
PAH	Polyaromatic hydrocarbon
PE	Professional Engineer
PG	Professional Geologist
PhD	Doctor of Philosophy
PID	photo-ionization detector
PM	Project Manager
PMP	Project Management Plan
POC	Point of Contact
PQL	Practical Quantitation Limits
PQO	Project Quality Objective
PSG	Passive Soil-Gas
QA	Quality Assurance
QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan
QC	Quality Control
QSM	Quality Systems Manual
REC	Recognized Environmental Condition
RI	Remedial Investigation
RIASL	Recommendations for interim action screening level
ROE	Rights of entry
RPD	Relative Percent Difference
RRT	Relative Retention Time
RSL	Regional Screening Level
S&A	Sampling and Analytical
SC	Special Concern
SEDD	Staged Electronic Data Deliverable

SI	Site Inspection
SME	Sporadic marginal exceedance
SOP	Standard Operating Procedure
SPP	Systematic Planning Process
SSL	Soil screening level
T	Threatened
TB	Trip Blank
TBD	To Be Determined
TCE	Trichloroethene
TEMP	Temperature blanks
TM	Technical Manager
TPP	Technical Project Planning
UFP	Uniform Federal Policy
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VA	Veterans Administration
VISL	Vapor Intrusion Screening Levels
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound
XRF	X-Ray Fluorescence

Introduction

This Uniform Federal Policy for Quality Assurance Project Plan (UFP-QAPP) addresses investigation activities to be conducted during a Site Inspection (SI) at the former Radar Station at Fort Custer located in Battle Creek, Michigan. The SI will include collection of 170 Passive Soil-Gas (PSG) samples, and up to eight groundwater soil samples. Additional details and background are provided in Worksheet #10. The purpose of this UFP-QAPP is to detail the planning processes for data collection and to describe the implementation of the quality assurance (QA) and quality control (QC) activities developed for this program. The objectives of this UFP-QAPP are to generate project data that are technically valid, legally defensible, and are useful in meeting the project goals, as well as integrate the technical and QC requirements for future investigation activities. This QAPP addresses four primary elements:

- Project Management
- Measurement and Data Acquisition
- Assessment and Oversight
- Data Validation and Usability

The above elements incorporate QA/QC requirements cited within the following documents:

1 *U.S. Environmental Protection Agency (USEPA) Requirements for Quality Assurance Project Plans*, USEPA QA/R-5, March 2001.
2 *USEPA Guidance for the Data Quality Objectives Process*, QA/G-4, February 2006.
3 *Uniform Federal Policy for Quality Assurance Project Plans*, Final Version, March 2005.
4 *Optimized UFP-QAPP*, Final Version, March 2012.
5 *Department of Defense Quality System Manual*, Version 5.2, January 2017.
6 *U.S. Environmental Protection Agency (USEPA) Guidance on Quality Assurance Project Plans*, CIO-2106-G-05, January 2012.

The UFP-QAPP workbook format used herein implements the systematic planning process for environmental sampling and was developed via collaboration between the United States Environmental Protection Agency (USEPA), Department of Defense (DoD), and the Department of Energy. In 2010, a subgroup comprised of members from the participating agencies was established to review and optimize the UFP-QAPP workbook in close coordination with USEPA's update of QA/G5, *Guidance for Quality Assurance Project Plans* (CIO 2106-G-05 QAPP, January 2012). The optimized workbook format is used for this UFP-QAPP. The information contained in the worksheets captures the elements that would otherwise be included in related project-planning documents, such as a Sampling and Analysis Plan and Field Sampling Plan. Table 1 is a crosswalk between the optimized UFP-QAPP worksheets numbers and titles and the CIO 2106-G-05 QAPP Guidance (USEPA, 2012a).

Table 1-1. Crosswalk: UFP-QAPP Worksheet to 2106-G-05 QAPP

Optimized UFP-QAPP Worksheets		**2106-G-05 QAPP Guidance Section**	
1 & 2	Title and Approval Page	2.2.1	Title, Version, and Approval/Sign-Off
3 & 5	Project Organization and QAPP Distribution	2.2.3	Distribution List
		2.2.4	Project Organization and Schedule
4, 7 & 8	Personnel Qualifications and Sign-off Sheet	2.2.1	Title, Version, and Approval/Sign-Off
		2.2.7	Special Training Requirements and Certification
6	Communication Pathways	2.2.4	Project Organization and Schedule
9	Project Planning Session Summary	2.2.5	Project Background, Overview, and Intended Use of Data
10	Conceptual Site Model	2.2.5	Project Background, Overview, and Intended Use of Data
11	Project/Data Quality Objectives	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
12	Measurement Performance Criteria	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
13	Secondary Data Uses and Limitations	Chapter 3	QAPP Elements for Evaluating Existing Data
14 & 16	Project Tasks & Schedule	2.2.4	Project Organization and Schedule
15	Project Action Limits and Laboratory-Specific Detection / Quantitation Limits	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
17	Sampling Design and Rationale	2.3.1	Sample Collection Procedure, Experimental Design, and Sampling Tasks
18	Sampling Locations and Methods	2.3.1	Sample Collection Procedure , Experimental Design, and Sampling Tasks
		2.3.2	Sampling Procedures and Requirements
19 & 30	Sample Containers, Preservation, and Hold Times	2.3.2	Sampling Procedures and Requirements
20	Field QC	2.3.5	Quality Control Requirements
21	Field Standard Operating Procedures (SOPs)	2.3.2	Sampling Procedures and Requirements
22	Field Equipment Calibration, Maintenance, Testing, and Inspection	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
23	Analytical SOPs	2.3.4	Analytical Methods Requirements and Task Description
24	Analytical Instrument Calibration	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables

Optimized UFP-QAPP Worksheets		**2106-G-05 QAPP Guidance Section**	
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
26 & 27	Sample Handling, Custody, and Disposal	2.3.3	Sample Handling, Custody Procedures, and Documentation
28	Analytical Quality Control and Corrective Action	2.3.5	Quality Control Requirements
29	Project Documents and Records	2.2.8	Documentation and Records Requirements
31, 32 & 33	Assessments and Corrective Action	2.4	Assessments and Corrective Action
		2.5.5	Reports to Management
34	Data Verification and Validation Inputs	2.5.1	Data Verification and Validation Targets and Methods
35	Data Verification Procedures	2.5.1	Data Verification and Validation Targets and Methods
36	Data Validation Procedures	2.5.1	Data Verification and Validation Targets and Methods
37	Data Usability Assessment	2.5.2	Quantitative and Qualitative Evaluations of Usability
		2.5.3	Potential Limitations on Data Interpretation
		2.5.4	Reconciliation with Project Requirements

QAPP Worksheet #1 & 2: Title and Approval Page
(UFP-QAPP Manual Section 2.1)
(USEPA 2106-G-05 Section 2.2.1)

1. Project Identifying Information
    a. Site name/project name: SI at Former Radar Station, Fort Custer
    b. Site location/number: Battle Creek, MI / Formerly Used Defense Site (FUDS) Property No. E05MI0013
    c. Contract/Work assignment number: W912QR-17-D-0043 / Task Order No. W912QR81364183
2. Lead Organization: United States Army Corps of Engineers (USACE)
    a. Lead Organization Project Manager [PM] (name/title/signature/date)

USACE PM/Date: _____

Printed Name/Organization: Nicole Toth, USACE - Chicago District

b. Lead Organization Contracting Officer's Representative (name/title/signature/date)

USACE Contracting Officer's Representative/Date:

_____

Printed Name/Organization: Mr. Andrew Brooks Evens, USACE – Louisville District

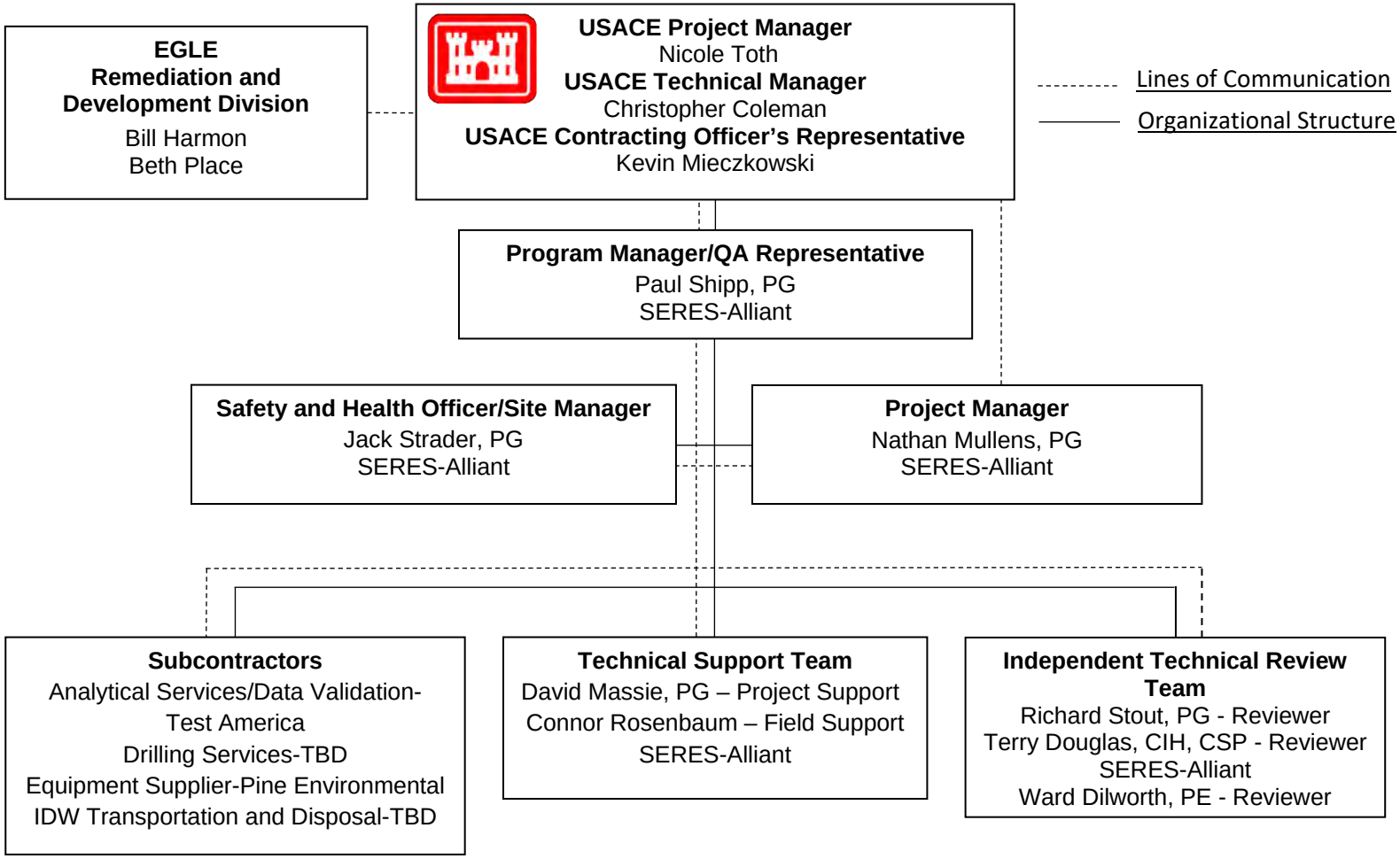
3. State Regulatory Agency: Environment, Great Lakes and Energy (EGLE) (No signature required)
   Printed Name/Organization: Mr. Bill Harmon, EGLE

4. Stake Holder: Neil Jenney - EPI (No signature required)
5. Stake Holder: Jet Perelli – ASMI (No signature required)
6. Stake Holder: Quoc Ly – Bleistahl (No signature required)

List plans and reports from previous investigations relevant to this project

Title	**Approval Date**
Revised Final Preliminary Assessment for Fort Custer Military Reservation	May 2017

QAPP Worksheet #3 & 5: Project Organization and QAPP Distribution



QAPP Worksheet #4, 7 & 8: Personnel Qualifications and Sign-off Sheet
(UFP-QAPP Manual Sections 2.3.2 – 2.3.4)
(USEPA 2106-G-05 Section 2.2.1 and 2.2.7)

This worksheet is used to identify key project personnel for each organization performing tasks defined in this QAPP.

ORGANIZATION: SERES-Alliant JV

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date
Paul Shipp, PG	Program Manager and QA Manager	BA Geology / 33 years	Professional Geologist	
Nathan Mullens, PG	Project Manager	BS Geological Sciences / 19 years	Professional Geologist	
David Massie	Senior Geologist	BA Geology / 26 years	Professional Geologist	No Signature Necessary
Terry Douglas, CIH, CSP	Program Health and Safety Manager and Project Chemist	BS Chemistry / 35 years	Certified Industrial Hygienist, Certified Safety Professional	

ORGANIZATION: Test America Laboratories, Denver, Colorado

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date
Patrick McEntee	Laboratory Manager of Project Management	B.A., Geology Experience: 32 years	--	No Signature Necessary
Roxanne Sullivan	Quality Assurance Manager	B.S., Chemistry Experience: 33 years	--	No Signature Necessary
Richard Clinkscales	Laboratory Director	B.S., Chemistry & English Experience: 32 years	--	No Signature Necessary
Mike Williams	Third Party Data Validation	PhD, PE	--	No Signature Necessary

*Signatures indicate personnel have read and agree to implement this QAPP as written

QAPP Worksheet #6 – Communication Pathways

Communication Drivers	Organization	Name/Role	Contact Information	Procedure (timing, pathways, documentation, etc.)
Executor and potential contractual issues	USACE	Kevin Mieczkowski – Contract Officer Representative (COR)	502-315-7447 kevin.m.mieczkowski@usace.army.mil	Communicate executor and potential contractual issues to SERES-Alliant and USACE, as necessary.
Project manager issues and modifications	USACE	Nicole Toth – PM	312-846-5517 nicole.l.toth@usace.army.mil	Communicate project management issues and modifications to SERES-Alliant and USACE, as necessary.
Technical lead decisions and modifications	USACE	Christopher Coleman – Technical Manager	502-315-6112 christopher.a.coleman@uasce.army.mil	Communicate technical lead decisions and modifications to USACE and/or SERES-Alliant, as necessary. All approved modifications will be included in the amendments to the UFP-QAPP by SERES and signed within 7 working days.
Project issues	SERES	Nathan Mullens – PM	843-478-0366 nrmullens@seres-es.com	Notify Chris Coleman, Kevin Mieczkowski and Nicole Toth (USACE PM) of project issues within 7 days by telephone or email.
Regulatory agency interface	USACE	Nicole Toth – PM	312-846-5517 nicole.l.toth@usace.army.mil	The USACE PM has the primary lead on coordination with EGLE, unless otherwise directed.
Preparation and approval of eQAPP	SERES	Nathan Mullens-PM	843-478-0366 nrmullens@seres-es.com	PM will direct the Project Chemist to prepare the eQAPP for USACE review and approval by.EGLE
Field progress reports	SERES	Nathan Mullens – PM	843-478-0366 nrmullens@seres-es.com	SERES-Alliant Site Supervisor (Sampling Team Leader) will send weekly field progress reports within 7 days of completion of the week's activities via email to USACE TM and USACE PM.

Communication Drivers	Organization	Name/Role	Contact Information	Procedure (timing, pathways, documentation, etc.)
Stop work due to safety issues	SERES	Kerry Sturgis– CIS, CSP, Program Health and Safety Manager	865-934-2222 ksturgis@alliantcorp.com	Work may be stopped at any time by any member of the field team for any safety concern. Refer to the Accident Prevention Plan (APP) for specifics related to health and safety. Persons other than the responsible entity may also stop work for safety concerns. All stop work issues will be recorded in the Daily Quality Control Report. The JV will notify USACE PM, Technical Manager (TM) and COR by phone, within 24 hours of a stop work situation.
UFP-QAPP changes prior to field work	SERES	Nathan Mullens – PM	843-478-0366 nrmullens@seres-es.com	Submit documented amendments within 10 working days for transmittal to USACE for approval. Amendments will be sent to EGLE upon USACE approval.
UFP-QAPP changes during project execution	SERES	Nathan Mullens – PM	843-478-0366 nrmullens@seres-es.com	Upon discovering the need for a UFP-QAPP change, the field team will secure same-day approval from SERES-Alliant Site Supervisor. The PM will secure approval for modifications to the UFP-QAPP from the USACE technical manager and LRL Chemists. SERES-Alliant PM will also work with USACE to notify EGLE of changes to field data collection procedures which differ from the procedures documented in the UFP-QAPP.
Data Verification Issues	SERES	Nathan Mullens – PM	843-478-0366 nrmullens@seres-es.com	Data Verification Issues will be brought to the attention of the USACE including LRL Chemists within 48 hours of discovery.

Communication Drivers	Organization	Name/Role	Contact Information	Procedure (timing, pathways, documentation, etc.)
Field corrective actions	SERES	Nathan Mullens – PM	843-478-0366 nrmullens@seres-es.com	The PM communicates within 24 hours of stop work to the USACE aby phone followed by a confirming e-mail. Work will restart when USACE approves a preliminary Corrective Action Report developed by SERES-Alliant.
Sample receipt variances	TestAmerica Beacon Environmental	Joy Chang – PM Ryan Schneider	303-467-7396 joy.chang@testamericainc.com 410-838-8780 Ryan.Schneider@Beacon-USA.com	All project field sample variance issues will be reported by the laboratory PM to the JV Project Chemist within 24 hours of identification of the technical concern. The SERES-Alliant PM will report all field sample variance issues to the USACE PM, USACE TM, and LRL Chemists within 24 hours (by phone followed by a confirming email) of notification from the laboratory.
Laboratory quality control variances	TestAmerica Beacon Environmental	Joy Chang – PM Ryan Schneider	303-467-7396 joy.chang@testamericainc.com 410-838-8780 Ryan.Schneider@Beacon-USA.com	All QA/QC issues with project field samples will be reported by the laboratory PM to the SERES PM, USACE TM, and Project Chemist within 24 hours of identification of the technical concern. The SERES-Alliant PM will report all QA/QC issues with project field samples to the USACE PM within 24 hours (by phone followed by a confirming email) of notification by the laboratory.

Communication Drivers	Organization	Name/Role	Contact Information	Procedure (timing, pathways, documentation, etc.)
Data verification issues, e.g., incomplete records	SERES	Nathan Mullens – PM	843-478-0366 nrmullens@seres-es.com	All verification issues will be reported by Project Chemist or data validator to SERES-Alliant PM via email within 24 hours of identification of the technical concern. The SERES-Alliant PM will report verification issues to the USACE PM and LRL Chemist via email within 24 hours (by phone followed by a confirming email) of notification. The communications will be specific to any errors of the chemistry noted during data verification, reason codes to correct errors; and, any laboratory corrective action that may be required.
Data validation issues, e.g., non-compliance with procedures	SERES	Nathan Mullens – PM	843-478-0366 nrmullens@seres-es.com	All validation issues will be reported by the validator to the PM and Project Chemist via email within 24 hours of identification of the technical concern. The PM will report all validation issues to the USACE PM USACE TM, and LRL Chemist within 24 hours (by phone followed by a confirming email) of notification.
Data review corrective actions	SERES	Nathan Mullens – PM	843-478-0366 nrmullens@seres-es.com	The need for data review corrective actions will be determined by the SERES-Alliant Project Chemist and/or validator, as appropriate, and will be documented in a memorandum to the SERES-Alliant PM. Data review corrective actions will be reported by the SERES-Alliant PM to the USACE PM within 24 hours (by phone followed by a confirming email) of notification.

Communication Drivers	Organization	Name/Role	Contact Information	Procedure (timing, pathways, documentation, etc.)
Soil-Gas Sample Analysis	Beacon Environmental	Ryan Schneider	410-838-8780 Ryan.Schneider@Beacon-USA.com	

QAPP Worksheet #9 – Project Planning Session Summary

Technical Project Planning Meeting #1 (via teleconference) – 26 February 2019

A stakeholder Technical Project Planning (TPP) Meeting for the SI at the Former Radar Station at Fort Custer was held via phone on 26 February 2019.

The purpose of the meeting was to:

- Introduce the Project Delivery Team
- Implement the TPP Process
- Discuss stakeholder involvement and communication tools
- Summarize site background and historic information used to develop the preliminary conceptual site model (CSM)
- Discuss the SI project objectives, considerations, and tasks
- Present the SI technical approach and associated draft Data Quality Objectives (DQOs)
- Discuss next steps and schedule
- Action Items/Next Steps.

Meeting Attendees:

Name	Organization	Phone Number	Email Address
Kevin Mieczkowski	USACE	502-315-7447	kevin.m.mieczkowski@usace.army.mil
Chris Coleman	USACE	502-315-6112	christopher.a.coleman@usace.army.mil
David Brancato	USACE	502 315 6494	david.j.brancato@usace.army.mil
Tray Richardson	USACE	502-315-6645	traylor.e.richardson@usace.army.mil
Nicole Toth	USACE	312-846-5517	nicole.l.toth@usace.army.mil
Corey Knox	USACE	502-315-2622	corey.s.knox@usace.army.mil
Bill Harmon	EGLE	517-284-5110	harmonw@michigan.gov
Beth Place	EGLE	517-899-7524	placeb1@michigan.gov
Nathan Mullens	SERES-Alliant	843-478-0366	nrmullens@seres-es.com
Paul Shipp	SERES-Alliant	865-251-5063	pshipp@alliantcorp.com
Jessica Travis	SERES-Alliant	302-561-4904	jatravis@seres-es.com

Meeting Minutes are provided below:

Schedule: Mr. Mullens reviewed the tentative project schedule, discussing that field work would likely occur in late July, and a second groundwater event in November. Would like to avoid any proposed fieldwork in Michigan winter weather. As detailed, the SI report from start to finish is approximately one year. Ms. Place asked if two reports would be submitted (one per site) or combined. Mr. Mullens confirmed that two deliverables would be submitted, consistent with the two UFP-QAPPs to be submitted.

Former Coal Yard Background: Mr. Mullens provided an overview of the known former Coal Yard history. The primary source of information is historical aerial photos. No documentation regarding volumes stored or records of quantity have been found. This SI is only focusing on the portion of the Site located west of Clark Rd, which is FUDS eligible. Mr. Mullens reviewed information provided in the 1997 Phase II Environmental Site Assessment (ESA). Polyaromatic hydrocarbons (PAHs) were detected in soils at concentrations less than current Michigan Department of Environmental Quality (MDEQ) criteria. Arsenic concentrations exceeded statewide background, drinking water protection and residential direct contact criteria. All of the arsenic soil concentrations were below the current nonresidential direct contact criterion. Mercury was detected in one sample at a concentration that exceeded drinking water protection but below the residential direct contact criterion less than MDEQ. Arsenic and mercury detections. Mr. Mullens provided an overview of human (industrial) and ecological receptors (downstream wetlands habitat).

Former Coal Yard Proposed Technical Approach: Mr. Mullens described the incremental sampling methodology (ISM) strategy to collect 30 incremental surface soil samples starting below any potential surface coal layer, within a ¼-acre decision unit (DU), with one replicate sample, and analyze for metals and PAHs. Additionally, the technical approach would include installation of one monitoring well with two rounds of groundwater sampling using low flow methods. Groundwater would also be analyzed for metals and PAHs. Screening criteria for soil would include regional screening levels (RSLs) and soil screening levels (SSLs) and for groundwater would include maximum contaminant levels (MCLs) and MDEQ surface water interface criteria for groundwater.

Former Radar station Background: Mr. Mullens provided an overview of the known former Radar Station history. According to the 2016 Preliminary Assessment (PA), carbon tetrachloride and trichloroethene (TCE) were likely historically used to clean electronic equipment and air filters. It is assumed these chemicals were used with rags in small quantities at the former Operations Building, Power Building, Transmitter Building, and Receiver Building. Mr. Mullens reviewed information provided in the 1997 Phase II ESA. The ESA indicated that two underground storage tanks (USTs) were historically present and later removed. Confirmatory soil sampling after the UST removal indicated no benzene, toluene, ethylbenzene, and xylenes (BTEX) present but elevated PAHs were detected. The elevated PAHs were believed to be from asphalt coating on the USTs. Subsequent soil sampling found no PAHs detections. Soil samples were collected from three other locations within the Former Radar Station. Volatile organic compounds (VOCs) were not detected and of the PAHs analyzed, only phenanthrene was detected but at a level below its cleanup criterion. Mr. Mullens provided an overview of human (industrial) and ecological receptors (downstream wetlands habitat).

Former Radar Station Proposed Technical Approach:

Mr. Mullens described a phased approach to collecting samples at the Former Radar Station, starting with proposed Geoprobe samples, consisting of 20 soil borings in each of 3 separate ½-acre grids. The soil borings would be evaluated with photo-ionization detector (PID) readings to determine if a soil gas survey necessary. Inside the building footprint, two separate ½-acre grids for sub-slab soil vapor sampling were proposed with 50-ft spacing. Logistics of the interior of the building is unknown, and whether or not this is feasible. Additionally, up to eight groundwater samples would be collected via 4 monitoring wells. Mr. Mullens asked if we have access inside the building. Ms. Toth stated that USACE is still working on one of the agreements (the bldg. to the west), and has rights of entry (ROE) in place for the centrally located building (owned by VIB Ink). The ROE is specific to inside operations, stating that they are not included. Additionally upon checking the date of expiration on this agreement it will need to be reinstated prior to the start of fieldwork. Real Estate office has started that process. Screening criteria for vapor would include MDEQ non-residential recommendations for interim action screening levels (RIASLs) and for groundwater would include MCLs and MDEQ volatilization and surface water interface criteria for groundwater.

MDEQ Feedback and Open Discussion: Mr. Harmon asked if UFP-QAPP format is being followed, and would DQOs be developed. Mr. Mullens confirmed UFP-QAPP and DQOs would be utilized. Mr. Harmon asked to confirm the decision units discussed on slide 21, and using PID to determine if soil-gas is needed. Would soil samples be collected from the borings as well, and analyze for full suite VOCs or just carbon tetrachloride and TCE. Mr. Mullens confirmed that 20 soil borings would be collected in each ½ acre DU, and analyzed for full suite VOCs. More details would be provided in the QAPPs. Mr. Harmon asked how thorough would 20 borings cover for the ½ acre, and what percent coverage is actually accomplished. Dr. Brancato stated that the approach was intended to be a qualitative method to establish a grid where the subsequent soil gas could be placed. However, Mr. Harmon stated he would prefer to start with soil-gas, and isn't necessary to conduct discrete soil sampling at this time. Ms. Toth asked for confirmation as to whether the contract has flexibility to adjust the technical scope as needed to meet objectives.

Mr. Mieczkowski agrees with Mr. Harmon. He suggested obtaining information on how the current building was constructed. He stated the technical approach should avoid any interior sampling for now. Ms. Toth stated the contractor and USACE should have an internal teleconference to agree on path forward. The teleconference would be scheduled this week and a definitive path forward determined and then shared in follow up with MDEQ.

Mr. Harmon stated a few other preliminary comments on the technical approaches that should be confirmed before submittal of the UFP-QAPP. Groundwater samples would be necessary at the former Radar Station at appropriate locations for no further action (NFA). He agreed the groundwater sampling locations can be based on soil-gas sampling results. If groundwater at the site is primarily perched water as suggested by prior investigations, installation of wells would still help with confidence that tight clay below the site provides confining layer. Ms. Place said they will request triplicate on the ISM at the Former Coal Yard, not one replicate. Ms. Place and Mr. Harmon agreed that the decision units for the coal yard should be based on overlay of aerials to create DU based on where source would be and not ¼-acre in size. They would also request global positioning system (GPS) checks and stakes confirming the Former Coal Yard coordinates.

Action Items: USACE and SERES-Alliant to have internal teleconference to discuss path forward and share additional information (e.g. figure, DQOs) to MDEQ once path forward determined.

Technical Project Planning Meeting #2 (via phone) – 20 June 2019

A stakeholder TPP Meeting for the SI at the Former Radar Station at Fort Custer was held at Battle Creek Unlimited near the project sites on 20 June 2019.

The purpose of the meeting was to:

- Introduce the Project Delivery Team and the other project stakeholders including property owners
- Summarize site background and historic information used to develop the preliminary CSM
- Discuss the SI project data needs, objectives, considerations, schedule, and tasks
- Present and refine the SI technical approach and associated DQOs
- Discuss next steps and schedule.

Meeting Attendees:

Name	Organization	Phone Number	Email Address
Kevin Mieczkowski	USACE	502-315-7447	kevin.m.mieczkowski@usace.army.mil
Chris Coleman	USACE	502-315-6112	christopher.a.coleman@usace.army.mil
Nicole Toth	USACE	312-846-5517	nicole.l.toth@usace.army.mil
Bridgette Jones	BCU	269.962.7526	jones@bcunlimited.org
Neil Jenney	EPI		n_jenney@epiinc.com
Jet Perelli	ASMI	269-964-1212	jetperelli@advantagesintered.com
Fred Kaplan	Kaplan Saunders Valente & Beninati LLP.	269-964-1212	fkaplan@kaplansaunders.com
Bob McLlvain	One Earth	269-441-3003	BMcIlvaine@teamtrg.com
Quoc Ly	Bleistahl	269-719-8585	
Bill Harmon	EGLE	517-284-5110	harmonw@michigan.gov
Beth Place	EGLE	517-899-7524	placeb1@michigan.gov
Nathan Mullens	SERES-Alliant	843-478-0366	nrmullens@seres-es.com
Gil Alexander	SERES-Alliant	502-836-4455	galexander@alliantcorp.com
Jessica Travis	SERES-Alliant	302-561-4904	jatravis@seres-es.com

Preliminary Meeting Minutes are below:

Meeting commenced with an introduction by Nicole Toth as to the purpose of the meeting and introductions and roles of persons attending. Nathan Mullens then went through a brief presentation on the project (Coal Yard related SI and Radar Site SI) with follow-up questions at the end.

There was an at length discussion primarily focused on the Radar Site SI. Business stake holders (primarily Jet Perelli) expressed concern that there are and have been business dealings on hold due to the ongoing investigation. Mr. Perelli indicated that there are environmental reports and data from previous investigations that indicate there were no issues. USACE indicated that they have not seen or heard of these previous investigations but if produced, the group would review and take them into consideration as appropriate. EGLE indicated that they are also unaware of any previous investigations but would look through their database. Mr. Perelli indicated that he would inform his legal counsel to forward these investigation reports and results to USACE for consideration.

Bridgette Jones asked if there was any way to expedite the study process. USACE and EGLE indicated they would investigate ways to expedite the study, but the review and comment periods and are a mandatory part of the process, and reviewers need to be given adequate time to complete their reviews.

Neil Jenney expressed concern about potential property damage associated with the placement and recovery of the soil vapor sampling probes based on the proposed location in parking lots and load dock areas. USACE and SERES-Alliant indicated that schedule and placement of the probes could likely be adjusted to accommodate traffic concerns, and repairs to match original ground surface would be made at the time the samplers were removed.

Copy of slide presentation will be forwarded by Nathan to the group. Bridgette also asked to receive a brief project schedule when available to brief BCU.

Stakeholders portion of meeting concluded at 10:15. Business stakeholders left the meeting.

Meeting with USACE, EGLE and SERES-Alliant resumes at 10:25

Discussion on the Coal Yard SI:

EGLE questioned the need and use of XRF in evaluating the coal pile for screening, since it would not be used to supply quantitative data. Contaminants of concern (COCs) have already been established from prior sampling. USACE indicates that the insertion of the XRF into the QAPP was at the suggestion of Dr. David Brancato (USACE) possibly as a method to determine the size and configuration of the DU. USACE will check with Dr. Brancato to clarify the use of the XRF and may consider dropping it from the QAPP.

A lengthy discussion was engaged between Bill Harmon and Kevin Mieczkowski on the best manner to determine the size and configuration of the DU as well as the depth of sampling from each point. One consideration may be to perform random core samples to determine at what depth the coal occurs in the subsurface and base sample depth on those observations. As for

configuration of DU, there must be consideration of bounding asphalt roads and potential for urban deposition. EGLE indicated they could be comfortable with configuration based on geo-rectified historic areal imagery, thus removing the need for XRF screening. Topography could be considered to see if gravity played a part.

EGLE would like the sampling procedure to be written in detail to assure that DQOs are well defined including determination of DU configurations, sampling intervals, how many increments will be pulled to ensure enough representative sample volume is collected, discussion of the expected level of precision/error and a consideration of particle size (microns) of coal to review exposure screening levels. There was a lengthy discussion of sieving the samples that occurred with the determination that if that is needed, it should take place in the laboratory with a write-up for the procedure.

EGLE asked what the justification for only looking at three metals was. USACE indicated that this was based on previous sampling data. EGLE stated that the justification for this limitation needed to be included in the write-up. Kevin Mieczkowski indicated that there might be an opportunity to fingerprint some of the coal still lying on the surface to see what metals were indicated. EGLE indicated that they were not opposed to this approach. EGLE also indicated that the 2005 Michigan Background Soil Survey data could be used as an evaluation tool in comparing the data obtained for risk exposure screening evaluation.

EGLE also wants to be able to clearly understand the criteria to be used for statistical data comparison (i.e. 95% confidence, mean, etc.). Additionally, EGLE indicated that a decision to move forward to Remedial Investigation (RI) (if necessary) would not be based on land use restrictions. Nathan indicated that the QAPP narrative will be reworked to address these suggestions.

There was a lengthy and unresolved discussion between Kevin Mieczkowski and Bill Harmon on the sampling of the soils matrix and use of the resulting data for evaluating future activities and project direction. Discussion included appropriate depth of sampling at each point. EGLE recommended taking samples from 0-6 inches, sieving the samples to remove the coal particles and sample remaining material. EGLE believes that sampling precision is improved because the samples being analyzed are directly below the former coal pile. USACE believes that sampling from 1-3 feet below ground surface would be a better sampling method, because sampling at the surface could result in false positives due to the three roads surrounding the site.

Discussion on the Radar Site SI:

EGLE indicated that USACE can use the "Oakland Site" SI as a guideline document with regard to vapor intrusion. This site is similar to the Radar site for multiple reasons including the fact that all buildings appear to be constructed slab-on-grade (no crawl spaces, basements, etc.).

In reviewing EGLE past comments on the QAPP, it was noted that groundwater sampling will be required if indicated by the soil vapor results. The comment had been misinterpreted by USACE and SERES-Alliant.

MCL's will not be used as a comparison criterion for groundwater and RSLs are to be used. Additionally, questions regarding the target populations will be addressed in the revised QAPP as well as how the target population may impact the sampling plan. Each sampling point will be located with a GPS coordinate. SERES-Alliant will confirm with Beacon Environmental that the American Society for Testing and Materials (ASTM) standard was used in determining sampler placement at 2'-4' below the ground surface. SERES-Alliant will evaluate the proposed location of the sampling probes based on concerns regarding access, traffic patterns and surface conditions.

Nicole Toth has requested an updated Gannt Chart Schedule based upon the current state of the Fort Custer project. Nicole Toth will transmit a list of Action Items resulting from this meeting to the USACE and SERES-Alliant group.

Meeting concludes at 14:45 Eastern Daylight Time

Due Outs:

1. Draft TPP Meeting minutes for participants' review (SERES-Alliant)
2. Provide SI schedule for USACE review and comment at next opportunity (SERES-Alliant)
3. Research depth of excavation during building construction (SERES-Alliant)
4. Research footing location (SERES-Alliant)
5. Follow up on XRF recommendation from Dr. Dave (complete)
6. Follow up on depth of sampling at coal storage area (USACE, ED)
7. Provide Nike D-97 UFP-QAPP to SERES-Alliant as example (complete)
8. Revisit EPI parking lot for sampling locations (SERES-Alliant)
9. Talk to Beacon about conversion table & lessons learned with passive vents (SERES-Alliant)
10. Review SOPs currently in QAPP, advise (EGLE)
11. Follow up regarding SI's completed by MDEQ at the Radar Station around 2017 (EGLE).

QAPP Worksheet #10: Conceptual Site Model
(UFP-QAPP Manual Section 2.5.2)
(USEPA 2106-G-05 Section 2.2.5)

Background information

The former Fort Custer Military Reservation (FCMR) consists of 15,052.2 fee acres and 4.86 easement acres that were formerly occupied by Camp Custer, a military training camp that was established in 1917 and subsequently expanded and designated as Fort Custer in 1940. Specifically, the subject of this SI is a Former Radar Station at FCMR that was identified on the FUDS-eligible property (E05MI00013). The FUDS site includes two areas, the Fort Custer Recreation Area (FCRA) and the Fort Custer Industrial Park (FCIP). The Former Radar Station is located within the FCIP, on the eastern portion of the FCMR and included an Operations Building, Power Building, Transmitter Building and, Receiver Building. The Former Radar Station was on a parcel that Custer Air Force Station leased from the Veterans Administration (VA) Hospital, and the 30-acre tract was part of the acreage conveyed by the VA to the City of Battle Creek in February 1981. The 30-acre Former Radar Station has been absorbed into the following parcels: (1) Parcel 0865-00-025-0, and (2) Parcel 0865-00-001-1. Most of the former Radar Station structures were located within the eastern parcel (0865-00-025-0). **Figure 10-1** shows the location of the former radar station, the FCIP, and FCMR.

According to the 2016 PA (2016, GEO Consultants), carbon tetrachloride and TCE were likely historically used to clean electronic equipment and air filters at the Former Radar Station. Based on the PA, it is unknown where carbon tetrachloride and TCE were used, but it is assumed they may have been used in the former Operations Building, Power Building, Transmitter Building, and Receiver Building, and these solvents were likely used in small quantities and with rags.

Known or suspected contaminants or classes of contaminants

A 1997 Phase II ESA conducted by Superior included an EM survey, excavation of test pits based on the EM survey, removal of two USTs associated with the Former Radar Station (estimated capacity of 8,000 gallons each), and soil sampling. No BTEX compounds were detected in the soil samples and elevated PAHs were measured in all four soil samples. However, further evaluation of the soil samples collected from the former UST excavations suggested that they may have been cross contaminated with protective asphalt coating from the former tanks. Subsequent soil samples did not contain any detectable levels of VOCs and PAHs. Soil samples were collected from three other locations within the Former Radar Station. VOCs were not detected and of the PAHs analyzed, only phenanthrene was detected and the measured concentration was below its cleanup criterion. The maximum arsenic concentrations in the soil samples exceeded state background and drinking water protection screening criteria. EGLE

concurred that no further action was necessary related to the USTs. However, during the 2016 PA, EGLE requested the retention of the Former Radar Station for further response action. Based on historical information from similar properties, EGLE was concerned that DoD may have used chlorinated solvents to clean equipment at the radar station.

The DoD concurred that potential Hazardous, Toxic and Radiological Waste (HTRW) issues may remain associated with potential cleaning of electronic equipment and air filters using carbon tetrachloride (prior to 1959) and TCE. According to historical descriptions of the Former Radar Station, the radar equipment at this site consisted of AN/FPS [and/or TPS-1B] series radar towers. No historical Technical Manuals were found that document maintenance procedures for this specific type of radar equipment. However, a Technical Manual of "Approved Solvents for Cleaning Electronic Equipment" dated April 1959 was likely applicable to the Former Radar Station, which was removed from service in March 1965. The Technical Manual notes that carbon tetrachloride was being replaced by TCE as an approved solvent. The guidance in the Technical Manual indicates that the volume of chlorinated solvent used for electronic equipment cleaning was not significant (i.e., "Application shall be in the smallest quantity…"). The Technical Manual does not specify a procedure for disposal of TCE used to rinse the solvent container. There was no evidence in any of the Radar Station site layout maps of an onsite wastewater disposal system, such as a septic drain field or lagoon where liquids disposed of into the station's sinks would have been discharged and potentially released into the environment.

The media to be evaluated in the SI will include soil-gas and groundwater. Because of its former use as a radar station, VOCs, primarily trichloroethene and carbon tetrachloride may be of concern. The removal of the historical tanks and subsequent investigations completed (detailed above), as well as the EGLE concurrence, has removed other contaminant of potential concern (COPCs) from further necessary investigation.

Primary release mechanism / Fate and transport considerations

Vapor intrusion is the primary potential migration routes/release mechanisms for VOCs present in surface (between 0-6 inches deep) and subsurface soils (anything below 6 inches deep) or groundwater. Runoff is a potential migration route/release mechanism to surface water bodies. Leaching is a potential migration route/release mechanism for groundwater. Uptake through the food chain is a potential migration route/release mechanism for biota. The primary COPCs associated with the historical use as a radar station are anticipated to be VOCs, primarily trichloroethene and carbon tetrachloride.

Potential receptors and exposure pathways

Potential Human Receptors

The FCIP is zoned predominantly for commercial industrial uses, and therefore, adult workers would be the primary human receptors in this area. The VA Medical Center is within the FCMR and immediately adjacent to the FCIP and Former Radar Station. Potential receptors at the VA Medical Center can be considered sensitive human populations that may respond to toxic chemicals differently from the general population due to age or health status.

Ecological Receptor Profile

Important ecological resources are surface waters and wetlands protected under federal law and state water quality laws. Other important ecological resources include dedicated natural areas and preserves; wildlife management units; threatened and endangered species, and their associated habitats, designated by the federal government or the state; and wildlife populations and their associated important nesting areas and food resources.

The Kalamazoo River flows from Battle Creek, north of a portion of the FCIP and VA properties, and forms the western boundary of the FCRA. The meandering river has a wide, shallow streambed with many slow-moving pools. The Kalamazoo River has wide wetlands and swampy areas extending from both sides of the streambed.

Portions of the FCMR include highly disturbed and/or developed areas with buildings, parking lots and/or maintained landscaped areas. The area of existing industries that generate human activities and associated disturbances are not generally designated critical habitats; and federally listed species or designated critical habitats have not been identified in Environmental Assessment/Baseline Environmental Assessments in these developed areas. However, some smaller wetland areas are located within the FCIP areas.

Exposure Pathways

Potentially complete exposure pathways exist for human receptors exposed to vapor intrusion at the current buildings on the site and those whom may ingest fish from habitats with potentially impacted sediments until COPC presence or absence can be confirmed.

Refer to **Figures 10-2** for a graphical representation of the conceptual site exposure model.

Regional Sensitive Ecological Resources

Studies have been completed in the FCRA, and nearby Fort Custer Training Center (FCTC) and Harts Lake areas to identify and manage sensitive environments and protect ecological resources. These documents include information on surveys, ecologically sensitive zones (e.g. nesting areas for trumpeter swans in the FCRA). FCRA contains oak barrens (widely spaced oak trees in fields of grasses and wildflowers) and dry-mesic southern (oak-hickory) forest. The following are occurrences of “Threatened” (T), “Special Concern” (SC), and “Endangered” (E) species in the

park: Lead Plant (SC), White False Indigo (SC), Yellow Harlequin (T), Downy Sunflower (T), False Boneset (SC), American Bittern (SC), Trumpeter Swan (T), Cooper's Hawk (SC), Common Moorhen (SC), Cerulean Warbler (SC), Prothonotary Warbler (SC), Louisiana Waterthrush (SC), Hooded Warbler (SC), Grasshopper Sparrow (SC), Henslow's Sparrow (T), Easter Box Turtle (SC), and Blanchard's Cricket Frog (SC).

FCTC staff annually assesses the effects of training activities on the population of sensitive species and monitors the installation's wildlife populations, including eleven state threatened or endangered species—trumpeter swan, prairie vole, Blanchard's cricket frog, Blanding's turtle, cerulean warbler, hooded warbler, Cooper's hawk, Eastern box turtle, pugnose shiner, Sprague's pygarctia and watercress snail, and two federally threatened or endangered species—bald eagle and Indiana bat (DoD 2005).

The current planned activities at the Former Radar Site will occur within the developed, light industrial areas. There is not anticipated to be any impact to sensitive species during the field work consisting of the installation of soil-gas point in the shallow subsurface.

Key physical aspects of the Site

Climate

The climate alternates between continental and semi-marine depending on the force and direction of the wind. When there is little or no wind, the weather becomes continental in character. A strong wind from Lake Michigan to the west may immediately transform the weather into a semi-marine type. Continental weather has pronounced fluctuations in temperature, hot weather in summer and severe cold in winter. The lake effect produces cooler summers and milder winters.

Topography and Vegetation

The former FCMR is located within the Southern Lower Peninsula Hills and Plains physiographic region of Michigan. The former FCMR is located within the Battle Creek Hills region characterized as a plain of moderate relief, dissected by several large stream valleys and containing several lakes. Kettles and inter-drumlin areas, which are typical glacial landforms, are present and tend to be wetter than the surrounding area. Lakes and wetlands form distinct, interconnected chains. Land use in the area consists of low intensity agriculture, with the cities of Battle Creek and Kalamazoo being the major urban areas.

The highest ground surface elevation is 1,020 feet above mean sea level (amsl) in the southeastern portion of the former FCMR. Ground surface elevations decrease to the north and northwest towards Kalamazoo River where elevation is at approximately 800 feet amsl. The topography of the former FCMR is very irregular and interspersed with streams, small lakes, and

marsh areas, consistent with the Battle Creek Hills region. West and north of the property the topography becomes more gently rolling to level and uniform in the floodplain of the Kalamazoo River. The northeast-eastern parts of the former FCMR (i.e., the industrial area of FUDS E05MI0013) are developed with structures, concrete and asphalt roadways, and parking areas, with vacant/vegetated lots scattered throughout.

Regional Geologic and Hydrogeologic Setting

The former FCMR is located in the Battle Creek Hills region of the Southern Lower Peninsula Hills and Plains physiographic province of Michigan. The landscape in this region is dominated by sandy and loamy sediment that becomes increasingly sandy and gravelly with depth. Soils in the uplands are formed in glacial outwash and other sandy sediment, and are well drained. Glacial deposits consisting largely of sands and gravels and bedrock aquifers are the source of most groundwater supplies in Kalamazoo and Calhoun County. Water wells in Kalamazoo County are predominantly drawing water from glacial drift, while water wells in Calhoun County are predominantly drawing water from bedrock likely from the Marshall Sandstone. In Fort Custer, the depth of groundwater typically ranges from approximately 11 to 55 feet below ground surface (ft. bgs). During Superior's Phase II assessment at the Former Radar Station, a well was attempted to be installed in the footprint of the former USTs. However, dry firm clay considered a confining layer was reached at 42 ft. bgs, and no well was installed. Further downgradient from the former USTs, groundwater was encountered at 37 ft. bgs and 62 ft. bgs. At the Former Radar Station, the groundwater is expected to flow north.

Hydrologic Setting

The former FCMR is located within the Kalamazoo River watershed; tributaries of the Kalamazoo River drain the former FCMR. Shallow groundwater flow would also migrate toward the river. The FCMR is interspersed with streams, small lakes, and marsh areas. Storm water runoff throughout the developed portion of the former FCMR (i.e., FCIP) are collected by storm water sewers and discharged to heavily vegetated low-lying areas.

Land Use Considerations

The site currently consists of three warehouse style buildings that make up light industrial businesses. There is no anticipated change in land use at this time.

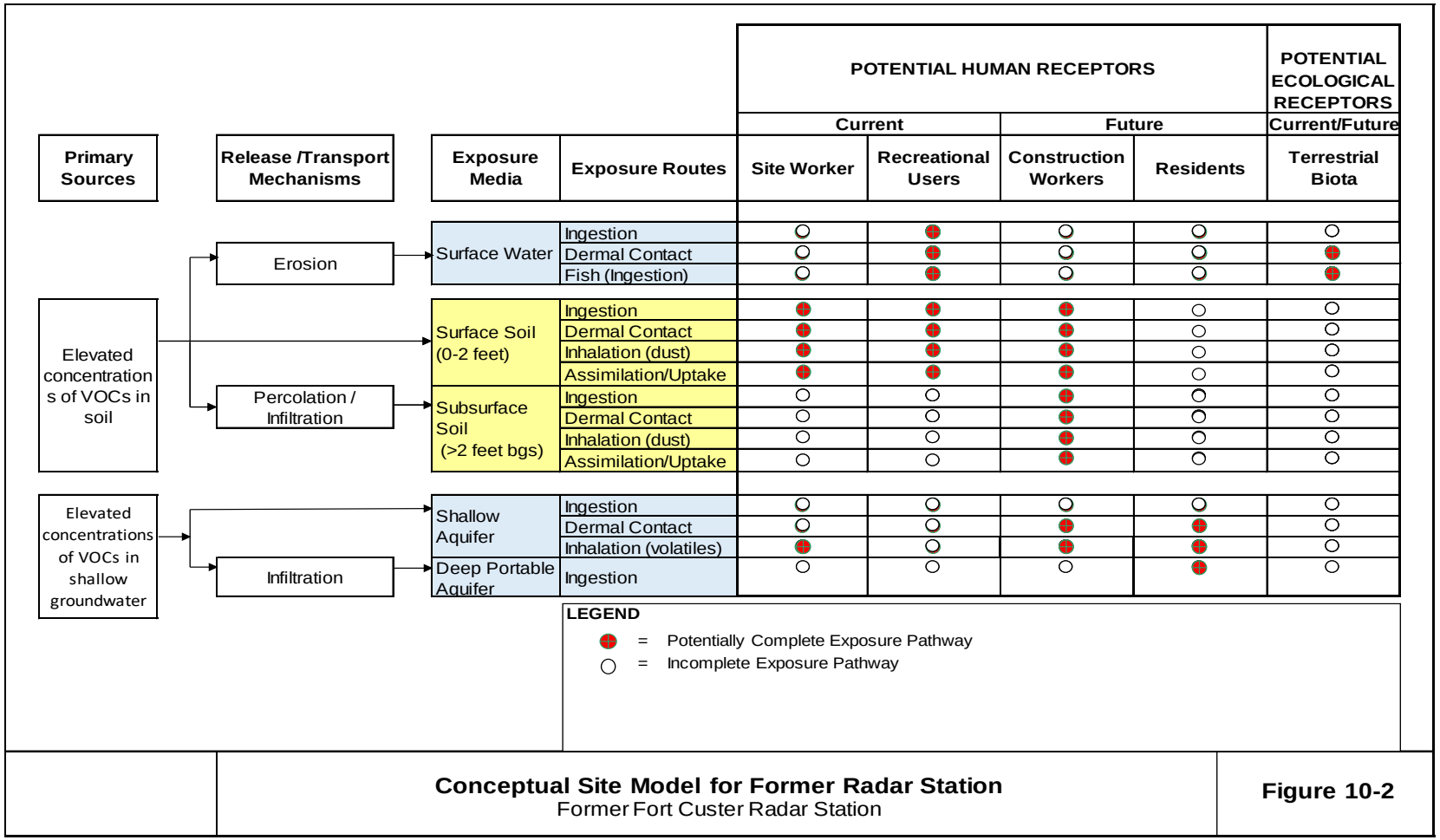
Data gaps and uncertainties associated with the CSM need to be clearly identified

The presence or absence of COPCs at concentrations that potentially present a hazard to human or ecological receptors is unknown. The purpose of PSG and groundwater sampling is to determine the presence or absence of COPCs at concentrations above established regulatory

screening levels. COPCs at this site could lead to vapor intrusion issues within the three warehouse style structures that are currently occupied.

Figure 10-1 Site Location Map

Figure 10-2. Conceptual Site Exposure Model



QAPP Worksheet #11: Project Quality Objectives/Systematic Planning Process Statements (UFP-QAPP Manual Section 2.6.1) (USEPA 2106-G-05 Section 2.2.6)

This worksheet documents the development of project quality objectives (PQOs) for the SI at Fort Custer Radar Station using the USEPA DQO process. The PQOs are project-specific DQOs.

Table 11-1 describes the DQOs using EPA's 7-step DQO process. Rigorous adherence to some aspects of the seven-step DQO process was determined unnecessary (i.e., Step 6, hypothesis testing and quantification of the probability for decision errors). The goal of the SI is to assess presence or absence of COPCs. Therefore, a qualitative evaluation of individual samples for the presence of COPC analytes greater than screening levels is adequate for Steps 5 and 6 of the DQO process. The selected investigation design is presented in Worksheet #17.

Table 11-1: Data Quality Objectives

DATA QUALITY OBJECTIVES	
Objective	Investigate soil gas and groundwater to determine if the next Comprehensive Environmental Response, Compensation, and Liability Act of 1980 step will be followed such as an RI or to determine if no action is required.
Problem Statement	Concentrations of site-specific VOCs may have impacted subsurface soils. Available data are insufficient to confirm the presence or absence of soil contamination that could lead to vapor intrusion issues at the three existing buildings on the site. Soil gas is being used to approximate the spatial variability and contaminant mass of site-specific Chlorinated Volatile Organic Compounds in the soil and/or groundwater. Previous soil sampling was limited and could not have adequately identified potential source areas.
Identify Goals of the Study	The goal of this SI is to evaluate potential impacts to soil, evaluate the potential for additional contaminant source areas to be present, and the presence of contaminant mass within the Former Radar Station. Analytical sampling results are required to make defensible decisions as to whether contamination is present or absent at the site, and if the site should be recommended for further investigation. To meet this goal, additional information in the form of PSG contaminant mass data are necessary where potential chlorinated VOCs (cVOC) impacts may exist. The sampling goals are: • Evaluate potential contaminant source area(s) and contaminant mass. o Collect PSG samples for analysis of cVOCs to identify potential contaminant source area(s) in the vadose zone and lateral extent of contamination. o PSG contaminant mass sampling results (measured in nanograms [ng]) will be converted to units of concentration (micrograms per cubic meter [µg/m3]) based on the verified uptake rates of the Beacon Sampler. If PSG concentrations exceed VISL, the PDT will use the PSG data to determine locations to install four monitoring wells. If necessary, additional wells may be added to get further delineation of the potential contaminant in groundwater. Groundwater sampling would provide qualitative and quantitative data that would be used to identify whether potential soil concentrations of cVOCs have contaminated groundwater. Sampling results would be compared to the USEPA RSLs. The JV would: o Collect two rounds of groundwater samples from the regional groundwater table for analysis of cVOCs o The second round of sampling would occur a minimum of 3 months after the first sampling round o Evaluate site-specific groundwater flow direction.

	If groundwater concentrations exceed EPA RSLs, an additional TPP meeting would be held to determine the best approach for additional sampling. A UFP-QAPP addendum would be developed to record the technical approach for additional site investigation. If PSG concentrations do not exceed VISL, the JV will not install groundwater wells and recommend no further action. The PSG sampling event has been designed to capture soil gas data in the areas of the former Radar Station where the highest likelihood of cVOC soil impacts may exist. Therefore, if the PSG sampling event indicates cVOC concentrations below VISL, there is low risk that these COPCs would be detected at other locations at the former Radar Station.
Inputs to Decision	Existing Inventory Project Reports • 1997 Phase II Environmental Assessment • 2016 Preliminary Assessment ▪ Analytical data for existing samples and for samples collected as part of the current investigation ▪ Georeferenced sampling locations, historical analytical sampling depths and regional groundwater depths ▪ Field observations and measurements from current and historical sampling activities. ▪ Site geologic and hydrogeologic information ▪ USEPA Regional Screening Levels ▪ USEPA Residential Vapor Intrusion Screening Levels (VISL) for Target Sub-Slab and Near-Source Soil Gas Concentrations ▪ Beacon Environmental Mass to Concentration Tie-In Correlations Each of these inputs will be used to determine if COPCs exist in the subsurface soil or groundwater and determine the next steps for the site.
Study Area Boundaries	Lateral boundaries were determined from historical aerial photographs and maps showing building and radar locations and uses. These aerial photos can be found in Attachment E. The boundary will consist of the area surrounding the existing building footprints as illustrated on Figure 17-1. Three buildings currently exist on the Former Radar Station. The Radar Station included 11 total Buildings based on historical information. The proposed soil gas survey encompasses each of those 11 buildings with the exception of the Security Building and Gate House. The vertical boundary is defined as the depth to groundwater. The temporal boundary begins when the PSG samples are installed and ends when they are collected two weeks later. Based on the results of the PSG sample analysis, a minimum of four groundwater wells may be installed and groundwater samples collected. These field activities are estimated to take another week to complete.
Acceptable Limits on Decision Error	Analytical data will meet quality expectations as defined by measurement performance criteria (Worksheet #12), project action limits and laboratory-specific

	Limits of Detection (LODs) and Limits of Quantification (LOQs) (Worksheet #15) and in accordance with the DoD Quality Systems Manual (QSM) 5.2. Decision errors will be further minimized by: • Use of multiple samples spaced at regular intervals to indicate spatial variability; sample locations with detected concentrations equal to or greater that 90% of the VISL will be considered for further investigation, minimizing Type I error. • Sample locations with results detected above VISL will also be further investigated, minimizing potential Type II errors. • Use of statistical hypothesis testing will not be necessary since the decision rule will be based on the presence/absence of COPCs above the VISL at each sampling location.
Decision Rule	If all PSG contaminant mass sampling results are less than 90% of the VISL, then no additional active soil gas, soil sampling and analysis, or groundwater sampling and analysis will be performed and the site will be recommended for no further action If any PSG sample contaminant concentrations are equal to or greater than 90% of the VISL, USACE, EGLE and SERES-Alliant will discuss installing groundwater wells at locations corresponding to elevated concentration areas. If all PSG sample contaminant concentrations are greater than VISL, a minimum of four groundwater wells will be installed and groundwater samples will be collected and analyzed. If all groundwater sampling results are less than the USEPA RSLs, the combination of a positive PSG sampling result and a negative groundwater sampling result will be inconclusive. USACE, EGLE and SERES-Alliant will discuss performing additional media sampling, including a potential VI investigation. If any groundwater sampling results are more than the USEPA RSLs but less than USEPA MCLs , USACE, EGLE and SERES-Alliant will discuss performing additional media sampling, including a potential VI investigation. If any groundwater sampling results are more than the USEPA RSLs and MCLs, the site will be recommended for a RI.
Optimize the Design	This UFP-QAPP was developed based on the needs of the project and obtaining sufficient quality data to address the project objectives. Input from stakeholders through review of this UFP-QAPP will optimize the overall project sampling design. How will the data be used: Soil gas data will be used by USACE, EGLE, and SERES-Alliant to identify any additional areas or medium of concern that may require evaluation prior to recommend the site for no action or further evaluation. What type of data are needed: Soil-gas samples will be collected via passive soil gas surveying at the locations shown on Figure 17-1. A total of 170 passive PSG samples will be installed adjacent

	to each of the 3 buildings within the area of concern. One row of PSG samples will be installed adjacent to the south side of the EPI Building (63 Clark Road). Another row of PSG samples will be installed just south of the building's parking lot. This design will be implemented to avoid vehicle traffic over the soil gas points during the two week period they are installed underground. See Worksheets #19 & #30. The PSG samples will be installed in accordance with ASTM D7758 using 25-foot spacing and will be installed at a depth of 3 feet bgs. The samples will be collected 14 days after installation. See Worksheet #20 for a summary of QC samples to be collected and see Worksheets #24 - #28 for a summary of laboratory instrument calibration data, sample procedures and other lab QC Controls. If necessary, a minimum of four two-inch monitoring wells will be installed in the regional groundwater aquifer. The wells will be installed in areas in which PSG sampling data indicated elevated levels of COPC concentrations. One up-gradient well will be installed south of the EPI Building (63 Clark Road). The wells will be sampled using low-flow sampling equipment. Groundwater samples will be analyzed for cVOCs via USEPA SW846 Method 8260 and validated results will be compared to the USEPA RSLs. See Worksheet #17 for additional details. A contract modification may be required to install additional groundwater monitoring wells.

QAPP Worksheet #12.1: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(USEPA 2106-G-05 Section 2.2.6)

Worksheet #12.1 – Measurement Performance Criteria (Analytical)

Matrix: Groundwater
Concentration Level: Low
Analytical Method: SW846 8260
SOP: Test America DV-MS-0002

Data Quality Indicator (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision - Overall	Field Duplicate	All Target Analytes Relative Percent Difference (RPD) ≤ 35%
Sensitivity	Method detection limit (MDL) /LOQ	Sufficiently low to support project specified screening criteria as specified in QAPP Worksheet #15; LOQs verified annually within ±20% using spiked samples
Accuracy/Bias Laboratory	Laboratory Control Sample (LCS)	Percent Recovery (%R) Per DoD QSM ver. 5.2 LCS Control Limits Appendix C, Table C-24 for water .
Precision	Laboratory Control Sample Duplicate (LCSD)	RPD < / = 20%
Contamination	Method Blank (MB), Field Blank (FB)	No target analyte > 1/2 LOQ. See Worksheet #15 for project specific LOQs.
Overall Accuracy/Bias Matrix Interference	Matrix Spike (MS)/Matrix Spike Duplicate (MSD)	%R Per DoD QSM ver. 5.2 LCS Control Limits Appendix C, Tables C-3, C-5. RPD < / = 20%
Completeness	Data Completeness Check	>90% sample collection, >90% laboratory analysis
Accuracy	Field data review by QA Manager or designee in accordance with Worksheet #37	Locations will be collected to a vertical accuracy of 0.1 and a horizontal accuracy of 0.05 using a hand held GPS unit

1. The laboratory will be DoD Environmental Laboratory Accreditation Program (ELAP) accredited for the test method and is expected to meet the Measurement Performance Criteria specified in DoD QSM version 5.2. The laboratory SOPs are provided in Appendix A.

Matrix: Vapor
Concentration Level: Low
Analytical Method: SW846 8260
SOP: Beacon Environmental SOP#18 Beacon

Data Quality Indicator (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision - Overall	Field Duplicate	All Target Analytes Relative Percent Difference (RPD) ≤ 50%
Sensitivity	Method detection limit (MDL) /LOQ	Sufficiently low to support project specified screening criteria as specified in QAPP Worksheet #15; LOQs verified within ±20% using spiked samples
Accuracy/Bias Laboratory	Laboratory Control Sample (LCS)/Laboratory Control Sample Duplicate (LCSD)	Percent Recovery (%R) Per DoD QSM ver. 5.2 LCS Control Limits Appendix C, Table C-24 for water and C-43 for vapor. RPD < / = 20%
Contamination	Method Blank (MB), Field Blank (FB), Equipment Blank[2] (EB) if collected	No target analyte > 1/2 LOQ. See Worksheet #15 for project specific LOQs.
Overall Accuracy/Bias Matrix Interference	Matrix Spike (MS)/Matrix Spike Duplicate (MSD)	%R Per DoD QSM ver. 5.2 LCS Control Limits Appendix C, Tables C-3, C-5. RPD < / = 20%
Completeness	Data Completeness Check	>90% sample collection, >90% laboratory analysis
Accuracy	Field data review by QA Manager or designee in accordance with Worksheet #37	Locations will be collected to a vertical accuracy of 0.1 and a horizontal accuracy of 0.05 using a hand held GPS unit

1. The laboratory will be DoD Environmental Laboratory Accreditation Program (ELAP) accredited for the test method and is expected to meet the Measurement Performance Criteria specified in DoD QSM version 5.2. The laboratory SOPs are provided in Appendix A.

QAPP Worksheet #13: Secondary Data Uses and Limitations
(UFP-QAPP Manual Section 2.7)
(USEPA 2106-G-05 Chapter 3: QAPP Elements for Evaluating Existing Data)

Data type	Source	Data Uses Relative to Current Project	Factors Affecting the Reliability of Data and Limitations on Data Use
Historical site assessment	Final Preliminary Assessment Fort Custer Military Reservation September 2016	The PA identifies the site location and summarizes the historical use	There are no known limitations on the information presented in the Property Survey Summary Sheet.

QAPP Worksheet #14/16: Project Tasks & Schedule
(UFP-QAPP Manual Section 2.8.2)
(USEPA 2106-G-05 Section 2.2.4)

The project schedule, including the specific task/activity, the person or group responsible for execution, and the planned start and end dates, is provided in the following table. The schedule for this project, including planning document preparation and field activities, SI report preparation, and meeting support, is presented in Appendix B of the Fort Custer Draft Project Management Plan (PMP)

Activity	Responsible party	Planned start date	Planned completion date	Deliverable(s)	Deliverable due date
Project Management Plan (PMP)	SERES-Alliant	31 July 2018	4 January 2019	Draft PMP Final PMP	7 September 2018 4 January 2019
Systematic Project Planning (SPP)	SERES-Alliant	26 February 2019	20 June 2019	Draft Meeting Material for SPP Meeting	20 June 2019
QAPP	SERES-Alliant	3 October 2018	12 November 2019	Draft QAPP/QASP Draft Final QAPP/QASP Final QAPP/QASP	24 May 2019 3 September 2019 12 November 2019
Sampling *assumes no installation of groundwater wells	SERES-Alliant	20 November 2019	16 December 2019	Field Notes, Documentation	16 December 2019
Sample Analysis	Beacon Environmental	16 December 2019	30 December 2019	Analytical Data Package	19 December 2019
SI Report	SERES-Alliant	30 December 2020		Draft SI Report Draft Final 1 SI Report Draft Final 2 SI Report Draft Final 3 SI Report Draft Final 4 SI Report	10 February 2020 6 April 2020 15 June 2020 10 August 2020 2 November 2020

Activity	Responsible party	Planned start date	Planned completion date	Deliverable(s)	Deliverable due date
				Draft Final 5 SI Report Final SI Report	4 January 2021 22 March 2121

*The schedule is subject to updates and revisions based upon field conditions.

QAPP Worksheet #15-1: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits
(UFP-QAPP Manual Section 2.6.2.3 and Figure 15)
(USEPA 2106-G-05 Section 2.2.6)

Worksheet #15-1 - Reference Limits and Evaluation Table for VOCs in Vapor
Matrix: Soil-gas
Analytical Group: VOCs 8260B (Beacon Environmental)

Analyte	CAS Number	Human Health CRITERIA[1] (ug/m3)	PQL (ug/m^3)	Laboratory Achievable Detection Limits		
				LOQs (ug/m^3)	LODs (ug/m^3)	DLs (ug/m^3)
Trichloroethene	79-01-6	6.95	6.95	1.52	0.76	0.38
Carbon tetrachloride	56-23-5	15.6	15.6	1.22	0.61	0.30
Tetrachloroethene (PCE)	127-18-4	139	139	1.26	0.63	0.32
1,1-Dichloroethene (1,1-DCE)	75-35-4	695	695	1.57	0.78	0.39
1,1-Dichloroethane (1,1-DCA)	75-34-3	58.5	58.5	0.62	0.31	0.15
Vinyl Chloride	75-01-4	5.59	5.59	0.67	0.34	0.17
1, 4-dioxane	123-91-1	18.7	18.7	5.92	2.37	2.37

1. EPA RSL Target Sub-Slab and Near-source Soil Gas Concentration

CAS	Chemical Abstracts Service	PQL	Practical Quantitation Limit
DL	Detection Limit	LOQ	Limit of Quantification
NE	Not Established	LOD	Limit of Detection
ug/m^3	micrograms per cubic meter		

Worksheet #15-2 - Reference Limits and Evaluation Table for VOCs in Groundwater

Matrix: Groundwater
Analytical Group: VOCs 8260 (TestAmerica)

Analyte	CAS Number	Human Health CRITERIA[1] (ug/L)	PQL (ug/L)	Laboratory Achievable Detection Limits		
				LOQs (ug/L)	LODs (ug/L)	MDLs (ug/L)
1,1-Dichloroethane	75-34-3	0.46	0.46	0.200	0.0700	0.025
1,1-Dichloroethene	75-35-4	0.28	0.28	0.200	0.150	0.102
Carbon tetrachloride	56-23-5	0.46	0.46	0.200	0.0700	0.025
Tetrachloroethene	127-18-4	4.1	4.1	0.500	0.250	0.084
Trichloroethene	79-01-6	0.28	0.28	0.200	0.150	0.066
Vinyl chloride	75-01-4	0.019	0.019	0.0200	0.0170	0.013
1, 4-dioxane	123-91-1	0.46	0.46	.200	.050	.036

1. USEPA RSLs

CAS Chemical Abstracts Service
DL Detection Limit
NE Not Established
ug/L Microgram per liter
PQL Practical Quantitation Limit
LOQ Limit of Quantification
LOD Limit of Detection

QAPP Worksheet #17: Sampling Design and Rationale
(UFP-QAPP Manual Section 3.1.1)
(USEPA 2106-G-05 Section 2.3.1)

The DQOs for the sampling program can be found in Worksheet #11. The sampling design and rationale for the Former Radar Station SI is described below.

Sampling will include PSG sample collection, potential monitoring well installation and potential groundwater sample collection. As discussed below, preliminary sampling locations were determined from historical maps, aerial photography, and observations from prior site visits. These locations are shown on the **Figure 17-1** and coordinates for the sample grids can be found on **Figure 17-2**. The sample locations may be relocated based on field observations and conditions such as immovable obstructions or subsurface utilities during the sampling event. If a location requires relocating, the USACE TM will be notified.

Soil-Gas Sampling

Soil-gas samples will be collected via PSG surveying at the locations shown on **Figure 17-1**. The locations were selected relative to the historical locations of Buildings used as a Transmitter, Receiver Building and Service Stock associated with the former Radar Station. Sample location will be as close to the three existing buildings as appropriate without striking the building footings during sample installation. The Soil-gas investigation is not specific to any buildings currently on site. Rather, the investigation is to determine if releases from previous operations (facilities that no longer exist) have impacted the subsurface. As recommended in EGLE Vapor Intrusion Guidance document, the locations for the soil gas sampling were identified as immediately above the identified "worst-case" vapor source area and adjacent to the base of an existing building foundation or basement. Locations may be adjusted somewhat in the field if identified Recognized Environmental Conditions (RECs) as established by ASTM E1527-05 are observed.

Before collecting samples, the areas surrounding the current buildings will be inspected for visual evidence of contamination and/or odors. Additional information including topography, precipitation data, barometric pressure, temperatures, and local air and wind data will also be evaluated. The information collected during this pre-assessment, will be used to further refine the CSM and adjust sampling locations as appropriate.

Samples will be collected from three grids outside of the current building footprints (see **Figure 17-1**) with 25-foot spacing between sample locations, for a total of 170 samples. To collect the PSG samples, an approximately one-inch diameter hole will be advanced to at least two feet bgs. Next, the sampler (which contains two sets of hydrophobic adsorbent cartridges) will be installed in the hole and covered with an aluminum foil plug and soil to seal the sampler in the ground.

The samples will be exposed to subsurface gas for 14 days. Following the exposure period, the samplers will then be extracted from the ground and shipped to the laboratory for analysis.

Any Investigation Derived Waste (IDW) will be containerized and characterized to determine the proper means with which to dispose of it. Laboratory analysis will determine the type of disposal facility where the waste will be disposed. SERES-Alliant will follow applicable regulations during IDW transportation and disposal.

Groundwater Sampling

If necessary, a minimum of four new monitoring wells will be installed to complete the objectives of the SI and to further delineate COPCs. The 2016 PA indicates groundwater flows north towards the Kalamazoo River and also provides a groundwater contour map that has been added to the QAPP as Attachment F. One well would be installed up-gradient at the south-central portion of the site as indicated in figure 17-1. A contract modification may be required for additional well installations.

Based on drilling history with the local geology, the new monitoring wells will be installed using a sonic drill rig. Locations for new monitoring wells will be determined by using analytical data from the PSG Sampling events along with information regarding historical use of the site, locations of historical buildings, and the known direction of groundwater flow.

Depth to water is expected to range from 11 feet to up to 60 feet bgs. Two-inch monitoring wells will be installed to a depth of approximately 7 feet below the water table. Each well will be constructed using 10 feet of slotted screen to straddle the water table. The top two feet of the well casing will be solid casing to establish a good seal. Following monitoring well installation, each well will be properly developed to establish continuity with the groundwater table. Groundwater samples will be collected using low-flow sampling methods in accordance with USEPA *Low Stress (Low Flow) Purging and Sampling Procedures for the Collection of Groundwater Samples* (USEPA, 2017). Field parameters to be measured during purging of each well are temperature, specific conductance, pH, dissolved oxygen, turbidity, and oxidation reduction potential using a multimeter. Parameters will be allowed to stabilize in accordance with the SOP prior to collecting a sample.

Sampling of the new wells will be conducted during two events that are at least three months apart to obtain a sufficient quantity of data for determination if additional investigation is necessary, or if sampling design changes are warranted. All groundwater samples will be analyzed for VOCs. Dedicated tubing will be used for each well.

IDW samples will be collected from containerized drill cuttings (soil) and from containerized decontamination water and purge water for disposal characterization.

Quality Assurance/Quality Control Samples

QC samples to be collected include field blanks (FB), trip blanks (TBs), equipment blanks (EBs) (if applicable), temperature blanks (TEMP), MS/MSDs, and field duplicates (DUPs). The QC samples will be handled in the same manner as the regular samples. Duplicates and QA Samples will be collected in accordance with Worksheet #20.

- FBs: Field blanks will be collected along with the PSG samples. A PSG sampler will be exposed to ambient air for the approximate durations that an actual sample is exposed to ambient air during installation and extraction (15 seconds total).
- TBs: Trip blanks are provided by the lab at a frequency of one per cooler containing samples for analysis of VOCs.
- EBs: If applicable, EBs will be will be collected during each sampling episode (one per day) to verify that sampling equipment decontamination procedures being employed are effective. The samples will be collected by pouring laboratory provided deionized water through decontaminated sampling equipment into the appropriate sample container. EBs will not be required for new, precleaned or dedicated sampling equipment which does not require decontamination.
- MS/MSDs: Additional sample volume will be collected for the analysis of the parent sample and will include two additional aliquots (to be spiked with target analytes by the laboratory) to evaluate any matrix interferences. MS/MSDs will be collected at a frequency of 5% (1 per 20 field samples) for each media.
- DUPs: DUPs samples will be collected in a quantity equal to at least 10% (1 per 10 field samples). DUPs will be collected to evaluate reproducibility of the sampling SOPs.
- TEMP: Temperature blanks are provided by the lab at a frequency of one per cooler. TEMP blanks will be used by the laboratory to determine the arrival temperature of the samples.

The eQAPP library for FUDSCHEM will be created and provided to the LRL chemist for review/approval prior to field activity.

See also Worksheets #12 and #28.

Sample Handling

Soil-gas samples will be collected in the provided passive-gas samplers, retrieved, and shipped to Beacon's Environmental laboratory for analysis. Each sample will be labeled with the location

identifier, “SG” for soil-gas and date in YYYYMMDD format (e.g., FCMR-01-SG-20191001). It will not be necessary to use ice or preservatives during shipment; however, the samplers will be sealed and shipped under established chain-of-custody procedures. The Chain-of-Custody Form accompanies the field samples at all times from the time the samples are collected until final analysis. Beacon Environmental supplied BESURE Kits™ are shipped with tug-tight custody seals to ensure that samplers are not tampered with during transport. Once samples are received at the laboratory, the sample custodian receives the samples and logs the samples into the laboratory’s Sample Receipt Log.

Groundwater samples will be collected in laboratory-supplied sample containers with appropriate preservatives for analysis. Each sample will be labeled with the location identifier, “GW” for groundwater, and date in YYYYMMDD format (e.g., FCMR-01-GW-20191001). After labeling, each sample container will be placed in a new, clean, zipper-sealed plastic bag and then put into a cooler with ice for transportation via chain-of-custody protocol to TestAmerica for analysis.

Figure 17-1. Proposed Sampling Locations

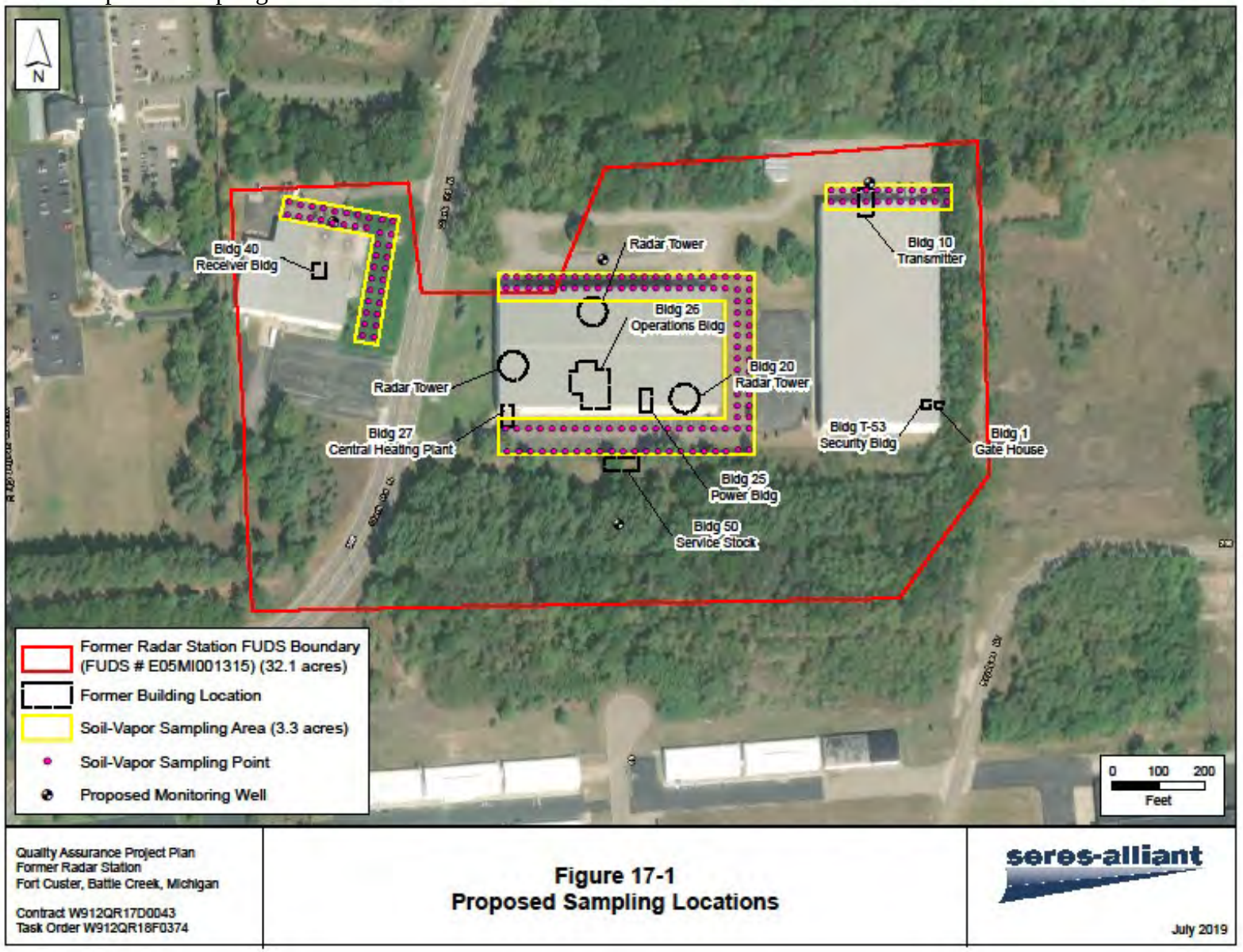
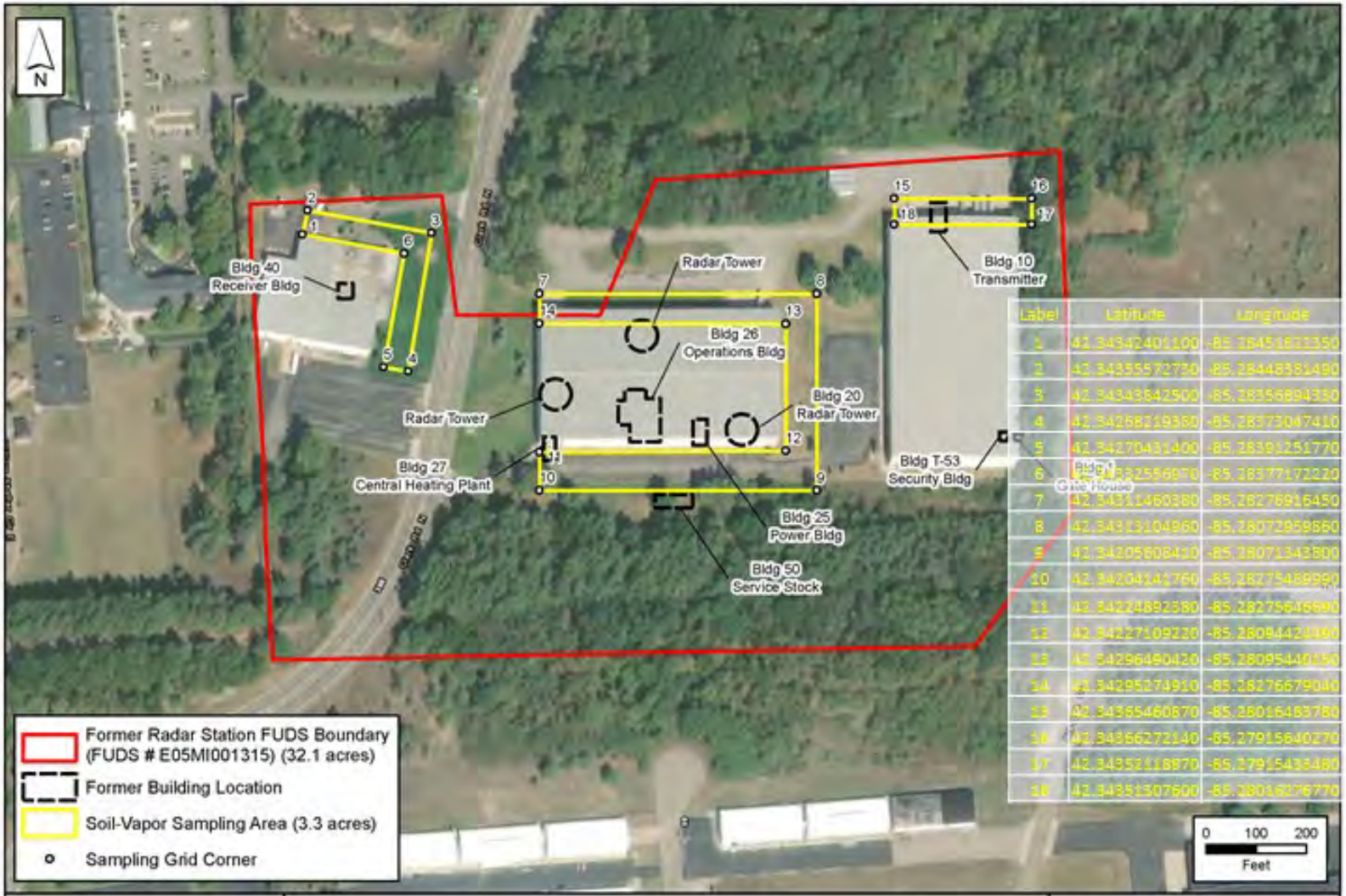


Figure 17-2 Sampling Grid Coordinates



Quality Assurance Project Plan
Former Radar Station
Fort Custer, Battle Creek, Michigan

Contract W912QR17D0043
Task Order W912QR18F0374

Figure 17-2
Sampling Grid Coordinates

seres-alliant

February 2019

QAPP Worksheet #18– Sampling Locations and Methods/Standard Operating Procedure Requirements

Sample ID	Matrix	Depth (inches bgs)	Type	Analyte/ Analytical Group	Sampling SOP	Maximum Number of Samples
FCMR-GW-01-MMDDYY through FCMR-GW-04-MMDDYY	Groundwater	Depth to Water TBD	Groundwater	Site Specific VOCs	SOP 8	8 (+2TB, 1FD, and 1 MS/MSD)
FCMR-SG-01-MMDDYY through FCMR-SV-147-MMDDYY	Soil-gas	36	Soil gas	Site Specific VOCs	SOP 1	170 (+8TB, 1FD, and 1 MS/MSD)

QAPP Worksheet #19 & 30: Sample Containers, Preservation, and Hold Times
(UFP-QAPP Manual Section 3.1.2.2)
(USEPA 2106-G-05 Section 2.3.2)

Laboratory (Name, sample receipt address, Point of Contact (POC), email, and phone numbers)

TestAmerica Denver (QA Laboratory)
4955 Yarrow St.
Arvada, CO 80002
Contact: Joy Chang
Phone: 303.467.7396
Email: joy.chang@testamericainc.com

Beacon Environmental Services, Inc.
2203A Commerce Rd #1
Forest Hill, MD 21050
Phone: 410.838.8780
Email: ryan.schneider@beacon-usa.com

Stage 4 data packages to be delivered within 21 calendar days
Samples will be shipped via FedEx or UPS

DoD ELAP and National Environmental Laboratory Accreditation Program Certifications are included in Attachment B.

Matrix	**Analyte Group**	**Analytical / Preparation Method SOP Reference[1]**	**Containers** (number, size, and type)	**Sample volume[2]** (units)	**Preservation Requirements** (chemical, temperature, light protected)	**Maximum Holding Time** **Preparation**	**Maximum Holding Time[3]** **Analysis**
Water	Site Specific VOCs	8260 / DV-MS-0010	3x40 mL glass VOA Vials	40 mL glass VOA vial	Cool ≤ 6 °C; adjust HCl pH < 2;	14 Days – Preserved	14 days – Preserved
Vapor	Site Specific VOCs	8260 / SOP 18	Sorbent Cartridge	NA	NA	30 days	30 days

[1] Refer to the Analytical SOP References table (Worksheet #23).
[2] The minimum sample size is based on analysis allowing for sufficient sample for reanalysis. Additional volume is needed for the laboratory Matrix Spike/Matrix Spike Duplicate sample analysis.
[3] Maximum holding time is calculated from the time the sample is collected to the time the sample is prepared/extracted.

QAPP Worksheet #20: Field Quality Control Sample Summary Table
(UFP-QAPP Section 3.1.1 and 3.1.2)
(USEPA 2106-G-05 Section 2.3.5)

Matrix	Analytical Group	Field Samples	Trip Blanks	No. of Field Blanks	No. of Field Duplicates	No. of QA Samples	No. of MS/MSDs	No. of Equip. Blanks	Total No. of Samples to Lab
Vapor	VOCs	170	8	8	1	NA	1	1 per day for all reusable sampling equipment	180
Groundwater	VOCs	8	2	NA	1	NA	1		12

Notes:
MS matrix spike
MSD matrix spike duplicate

QAPP Worksheet #21.2 – Field Standard Operating Procedure References
(UFP-QAPP Manual Section 3.1.2)
(USEPA 2106-G-05 Section 2.3.2)

SOP# or Reference	Title, Revision, Date and URL (if available)	Originating Organization	SOP Option of Equipment Type (if SOP provides different options)	Modified for Project Work? (Yes/No)	Comments
SOP 10	Passive Soil Gas Testing	Beacon Environmental	Beacon PSG sampler	No	NA
SOP 3	Field Log Book Entries, Revision 0, 11 October 2018.	Seres Engineering and Services, LLC	Field Log Book	No	NA
SOP 2	Chain of Custody, Revision 0, 11 October 2018.	Seres Engineering and Services, LLC	Chain of Custody Record Form	No	NA
SOP 5	Field Equipment Decontamination, Revision 0, 11 October 2018.	Seres Engineering and Services, LLC	Health and Safety Equipment	No	NA
SOP 20	Investigation-Derived Waste Handling and Storage, Revision 0, 11 October 2018	Seres Engineering and Services, LLC	55-gallon steel drums, Department of Transportation 1A2 or equivalent	No	NA
SOP 8	Low Stress (Flow) Purging and Sampling Procedures for the Collection of Groundwater Samples from Monitoring Wells	USEPA		No	NA

1 SOPs are reviewed/revised on an annual schedule. The current version will be followed at the time of sample receipt.

QAPP Worksheet #22 – Field Equipment Calibration, Maintenance, Testing and Inspection
(UFP-QAPP Manual Section 3.1.2.4)
(USEPA 2106-G-05 Section 2.3.6)

Field equipment will be maintained, inspected, and tested as presented in the table below.

Field Equipment	Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
GPS	Number of satellites acquired, and quality of data will be checked periodically while collecting GPS data.	Daily, prior to use	Per equipment manual			Per equipment manual
Water Quality Meter	Calibration standards for pH, turbidity, specific conductance, oxidation/reduction potential, and dissolved oxygen per manufacturer's instructions / daily	Daily before use	Within manufacturer's recommended value	According to manufacturer's instructions	Sampling personnel	Per equipment manual
Water level meter	Check all sensors, cable and check battery charge	Calibrated by the Manufacturer	Within manufacturer's recommended value	Contact manufacturer for new water level meter	Sampling personnel	N/A

2 SOPs are reviewed/revised on an annual schedule. The current version will be followed at the time of sample receipt.

QAPP Worksheet #23: Analytical SOPs
(UFP-QAPP Manual Section 3.2.1)
(USEPA 2106-G-05 Section 2.3.4)

SOP #	Title, Revision Date and/or Number	Definitive or Screening Data	Matrix/Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Yes/No)
DV-MS-0010	Determination of Volatile Organics by GC/MS (SW846 8260B and EPA 624)	Definitive	Volatiles, Water & Soil	GC/MS	TestAmerica Denver	N
DV-OP-0007	Concentration and Clean-up of Organic Extracts (SW-846 3510C, 3520C, 3540C, 3546, 3550B, 3550C, 3620C, 3660B, 3665A, and EPA 600 series)	Definitive	Organic Prep, Water & Soil	N/A	TestAmerica Denver	N
DV-OP-0013	Multi-incremental Sub-sampling from Soils and Sediments (ASTM D 6323)	Definitive	Organic Prep, Soil	N/A	TestAmerica Denver	N
DV-OP-0015	Microwave Extraction of Solid Samples by Method [SW 3546]	Definitive	Organic Prep, Soil	Microwave Extraction System	TestAmerica Denver	N
SOP 18	GC/MS Sample Analysis for Passive Soil Gas Samples following EPA Method 8260C	Definitive	Volatiles, Air	GC/MS	Beacon Environmental	N

3 SOPs are reviewed/revised on an annual schedule. The current version will be followed at the time of sample receipt.
4 If yes, then specify the modification that has been made. Note that any analytical SOP modification made relative to project specific needs must be reviewed and approved by the USACE.

QAPP Worksheet #24 – Analytical Instrument Calibration
(UFP-QAPP Manual Section 3.2.2)
(USEPA 2106-G-05 Section 2.3.6)

Matrix: Groundwater

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference [1]
GC/MS	Tune Check - Check of mass assignments using PFTBA autotune and BFB	Prior to ICAL and at the beginning of each 12-hour period	Acceptable mass assignments using auto tune function	Retune instrument and verify.	Analyst / Section Supervisor	DV-MS-0010
	Initial Calibration (ICAL) Minimum five-point initial calibration for target analytes, lowest concentration standard at or near the reporting limit.	Initial calibration at instrument set-up and after ICV or CCV failure, prior to sample analysis	Each analyte must meet one of the options below: Option 1: analyte ≤ 15% according to Beacon SOP 18.. Option 2: linear least squares regression for each analyte: $r^2 \geq 0.99$; Option 3: nonlinear least squares regression (quadratic) for each analyte: $r^2 \geq 0.99$	Verify standard solutions still valid, perform instrument maintenance as needed, then repeat the ICAL.	Analyst / Section Supervisor	DV-MS-0010
	Initial Calibration Verification (ICV)	Second source standard, once after each ICAL.	All reported analytes within ± 20% of true value.	Correct problem, and verify second source standard. Rerun verification. If still fails, repeat initial calibration.	Analyst / Section Supervisor	DV-MS-0010
	Retention Time Window Position Establishment	Once per ICAL, and at the beginning of the analytical sequence for each analyte and	Set position using the mid-point standard of the ICAL when ICAL is performed. On days when ICAL is not performed, use initial	NA	Analyst / Section Supervisor	DV-MS-0010

QAPP Worksheet #24 – Analytical Instrument Calibration
(UFP-QAPP Manual Section 3.2.2)
(USEPA 2106-G-05 Section 2.3.6)

Matrix: Groundwater

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference [1]
		surrogate.	CCV.			
	Evaluation of Relative Retention Times (RRT)	With each sample	RRT of each reported analyte within ± 0.06 RRT units.	Correct problem, then rerun ICAL	Analyst / Section Supervisor	DV-MS-0010
	Retention Time Window	With each sample	RRT of each reported analyte within 0.06 RRT units of the mean RRT of the calibration standards. RRT may be updated based on the daily CCV.	Correct problem and then rerun ICAL.		
	Continuing calibration verification (CCV)	Daily, prior to sample analysis and after every 12 hours of analysis time; and at the end of the analytical batch.	All reported analytes and surrogates within ± 20% of true value. If analyte identified as a poor performer in Table 15, use criteria of ± 30% (± 20% according to Beacon SOP 18) of true value. All reported analytes (except poor performers identified in Table 15) and surrogates within ± 50% for end of analytical batch CCV.	Evaluate failure and impact on samples. If samples non-detect for analytes which have a high bias, report non-detect results with case narrative comment. For closing CCVs, if compounds are not identified as critical compounds of concern report results with qualifiers. For closing CCVs, if the compound is identified as a critical compound of concern, then recalibrate, and reanalyze all affected samples since the last acceptable CCV; or immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails, take	Analyst / Section Supervisor	DV-MS-0010

QAPP Worksheet #24 – Analytical Instrument Calibration
(UFP-QAPP Manual Section 3.2.2)
(USEPA 2106-G-05 Section 2.3.6)

Matrix: Groundwater

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference [1]
				corrective action(s) and re-calibrate; then reanalyze all affected samples since the last acceptable CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.		
GC/MS	Internal Standards	During acquisition of calibration standard.	Retention time within ± 10 seconds from retention time of the midpoint standard in the ICAL; EICP area within - 50% to +100% of ICAL midpoint standard in accordance with DoD QSM version 5.2	Inspect mass spectrometer and GC for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning	Analyst / Section Supervisor	DV-MS-0010

Matrix: Soil-Gas

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
GC/MS	"Minimum 5 levels for linear and 6 levels for quadratic. No samples shall be analyzed until ICAL has passed. If the specific version of a method requires additional evaluation (e.g., RFs or low calibration standard	(Minimum) Quarterly At instrument set-up and after ICV or CCV failure, before sample analysis	"Each analyte must meet one of the three options below: Option 1: RSD for each analyte ≤ 15%;	Perform instrument maintenance. Correct problem then repeat ICAL.	Analysts	Beacon SOP 18 GC-MS Analysis by 8260C for PSG Samples

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
	analysis and recovery criteria) these additional requirements must also be met."		Option 2: linear least squares regression for each analyte: r2 ≥ 0.99; Option 3: non-linear least squares regression (quadratic) for each analyte: r2 ≥ 0.99."			
GC/MS	Retention Time window position establishment	Once per ICAL and at the beginning of the analytical sequence.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	N/A	Analysts	Beacon SOP 18 GC-MS Analysis by 8260C for PSG Samples
GC/MS	Retention Time (RT) window width	At method set-up and after major maintenance (e.g., column change).	RT width is ± 3 times standard deviation for each analyte RT from the 72-hour study or 0.03 minutes, whichever is greater.	N/A	Analysts	Beacon SOP 18 GC-MS Analysis by 8260C for PSG Samples
GC/MS	Continuing Calibration (CCV)	Daily before sample analysis; after every 12 hours of analysis time; and at the end of the analytical batch run.	All reported analytes and surrogates within ± 20% of true value. All reported analytes and surrogates within ± 50% for end of analytical batch CCV	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails or if two consecutive CCVs cannot be run, perform corrective action(s) and repeat CCV and all	Analysts	Beacon SOP 18 GC-MS Analysis by 8260C for PSG Samples

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
				associated samples since last successful CCV. Alternately, recalibrate if necessary; then reanalyze all associated samples since the last acceptable CCV.		
GC/MS	Internal Standards	If employed, every field sample, standard, and QC sample.	Retention time within ± 0.06 RRT UNITS from retention time of the midpoint standard in the ICAL; Internal standard signal (area or height) within -50% to +100% of ICAL midpoint standard. On days when ICAL is not performed, the daily initial CCV can be used.	Inspect GC for malfunctions and correct problem. Reanalysis of samples analyzed while system was malfunctioning is mandatory.	Analysts	Beacon SOP 18 GC-MS Analysis by 8260C for PSG Samples
GC/MS	Calibration Standard Verification	After initial calibration, then following the lab method blank before sample analysis	±20% true value	Correct problem. Rerun ICV. If that fails, repeat ICAL.	Analysts	Beacon SOP 18 GC-MS Analysis by 8260C for PSG Samples
GC/MS	Tuning	Prior to ICAL and prior to each 12-hour period of sample analysis	Method determined limits listed in EPA TO17 or EPA 8260C for BFB	Retune instrument and verify	Analysts	Beacon SOP 18 GC-MS Analysis by 8260C for

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
						PSG Samples

QAPP Worksheet #25 – Analytical Instrument and Equipment Maintenance, Testing and Inspection
(UFP-QAPP Manual Section 3.2.3)
(USEPA 2106-G-05 Section 2.3.6)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
GC/MS	Clean sources, maintain vacuum pumps	Tuning	Instrument performance and sensitivity	Service vacuum pumps twice per year, other maintenance as needed	Tune and CCV pass criteria	Recalibrate instrument	Analyst	Quality Assurance Manual – Section 20
GC/MS	Change septum, clean injection port, change or clip column, install new liner, change trap	Response factors and chromatogram review	Instrument performance and sensitivity	As needed	Tune and CCV pass criteria	Re-inspect injector port, cut additional column, reanalyze CCV, recalibrate instrument	Analyst	Quality Assurance Manual – Section 20
GC/MS	Transfer line	Preventive maintenance	Check for leaks and O-ring wear, check cold trap (front Tenax trap) for adsorbent shrinkage	When responses start to drop and tunes fail	Tune and CCV pass criteria	Tighten ferrules, inspect for leaks, and check alignment. Rebuilt cold trap if necessary.	Analyst	Beacon Environmental SOP 18
GC/MS	Detector maintenance	Column change, unable to tune	Clean Detector, change pump oil	When responses drop and tunes fail	Tune passes, air and water not present in scan	Disassemble detector and check parts, check filaments, reanalyze tune	Analyst	Beacon Environmental SOP 18

SOPs are reviewed/revised on an annual schedule. The current version will be followed at the time of sample receipt.

QAPP Worksheet #26 & 27– Sample Handling, Custody and Disposal
(UFP-QAPP Manual Section 3.3)
(USEPA 2106-G-05 Section 2.3.3)

Sampling organization: SERES

Laboratory: TestAmerica

Method of sample delivery (shipper/carrier): Federal Express

Number of days from reporting until sample disposal: At least 60 days

Activity	Organization and title or position of person responsible for the activity	SOP reference
Sample labeling	SERES	See "Sample Identification System" below.
Chain of custody form completion	SERES	See SOP 2. Also see "Sample Handling and Custody" below.
Packaging	SERES	See "Field Procedures" below.
Shipping coordination	SERES	See Field SOP 2. Also see "Transfer of Custody and Shipment" below.
Sample receipt, inspection, and log-in	TestAmerica, Beacon Environmental	See "Laboratory Custody Procedures" below.
Sample custody and storage	TestAmerica, Beacon Environmental	See "Laboratory Custody Procedures" and "Final Evidence Files" below.
Sample disposal	TestAmerica, Beacon Environmental	Labs must follow all applicable regulatory guidance for the proper disposal of environmental samples.

Sample Identification System

A sample numbering system will be used to identify each sample; the sample numbers will be sequentially assigned to ensure there is no duplicate of sample numbers. This system will provide a tracking procedure to allow retrieval of information about a particular sample and will assure that each sample is uniquely numbered. The sample identification will consist of the components described below:

Project Code:

Installation Name: FCMR (refers to Fort Custer Radar Station; use for all samples)

Sample Media: A two-character designation of media as follow:

- SG = soil-gas sample
- GW = groundwater
- Sample Number: A two-character designation assigned in chronological order (e.g., 01-20).
- Date Sampled: Six-digit date in MMDDYY format

For example:

- The first soil-gas sample, collected on 01 April 2019, would be identified as 'FCMR-SG-01-040119

Sample Handling and Custody

Sample custody procedures ensure the timely, correct, and complete analysis of each sample for all parameters requested. A sample is considered to be in someone's custody if it:

- Is in his/her possession.
- Is in his/her view, after being in his/her possession.
- Is in his/her possession and has been placed in a secure location.
- Is in a designated secure area.

Sample custody documentation provides a written record of sample collection and analysis. The sample custody procedures provide for specific identification of samples associated with an exact location, the recording of pertinent information associated with the sample, including time of sample collection and any preservation techniques, and a chain of custody record that serves as physical evidence of sample custody.

The chain of custody documentation system provides the means to individually identify, track, and monitor each sample from the time of collection through final data reporting. Chain of custody procedures document pertinent sampling data and all transfers of custody until the samples reach the analytical laboratory. All chain of custody forms must be filled out and signed in ink. The following information is typically recorded on manual chain of custody forms.

- Project name and/or project number.
- Signature of Site Supervisor or designee.
- Date and time of sample collection.
- Discrete sample designation.
- Sample matrix.
- Analyses required.
- Preservation technique.
- Signatures and dates for transfer of custody.
- Air express/shipper's bill of lading identification number.

The Chain-of-Custody Form serves as an official communication to the laboratory detailing the particular analyses required for each sample. The chain of custody record will accompany the samples from the time of sampling through all transfers of custody. It will be kept on file at the laboratory where samples are analyzed and archived. Two copies of the Chain-of-Custody Form are created: one copy is retained by the Site Supervisor and one is sent to the laboratory. The Site Supervisor or designee completes a chain of custody record to accompany each shipment from the field to the laboratory. The completed chain of custody is put in a zip-lock bag and taped to the inside cover of the sample shipping container. If there is more than one container in a shipment, copies of the Chain-of-Custody Form will be placed in each container. The container is then sealed with custody seals and custody is transferred to the laboratory. Commercial carriers are not required to sign off on the chain-of-custody form as long as the forms are sealed inside the sample cooler and the custody seals remain intact.

Samples will be packaged for shipment as outlined below:

- Securely affix the sample label to the container with clear packing tape.
- Check the cap or seal on the sample container to confirm that it is properly sealed.
- Wrap the sample container cap (if applicable) with clear packing tape to prevent the label from becoming loose.
- Complete the chain-of-custody form with the required sampling information and confirm that the recorded information matches the sample labels. Note: If the designated sampler relinquishes the samples to other sampling or field personnel for packing or other purposes, the sampler will complete the chain-of-custody prior to this transfer. The appropriate personnel will sign and date the chain-of-custody form to document the sample custody transfer.
- Using duct tape, secure the outside drain plug at the bottom of the cooler.
- Wrap sample containers in bubble wrap or other cushioning material.
- Place 1 to 2 inches of cushioning material at the bottom of the cooler.
- Place the sealed sample containers into the cooler.
- For groundwater samples, place ice in plastic bags and seal. Place loosely in the cooler.

- Fill the remaining space in the cooler with cushioning material.
- Place Chain-of-Custody Forms in a plastic bag and seal. Tape the forms to the inside of the cooler lid.
- Close the lid of the cooler, lock and secure with duct tape.
- Wrap strapping tape around both ends of the cooler at least twice.
- Mark the cooler on the outside with the shipping address and return address, affix "Fragile" labels and draw (or affix) arrows indicating "this side up." Cover the labels with clear plastic tape.
- Place a signed custody seal over the sample cooler lid.

Field Procedures

The field sampler is personally responsible for the care and custody of samples until they are transferred to the Site Supervisor or until they are properly dispatched. As few people as possible should handle the samples.

The Site Supervisor, or designee, is responsible for entering the proper information in the field logbook, including all pertinent information such as sample identification number, date and time of sample collection, type of analysis, and description of sample location. The information entered into the field logbook will be used to generate a chain of custody. Field logbooks will provide the means of recording the data collecting activities that are performed. As such, entries will be described in as much detail as possible so that persons going to the site could reconstruct a particular situation without reliance on memory. Entries will be made in ink, with no erasures. If an incorrect entry is made, the information will be crossed out with one strike mark.

All sample containers will be labeled with the project identification, sample number, matrix, analysis required, and preservation used. Sample labels will be completed using waterproof ink. The completed sample labels will be affixed to each sample bottle and covered with clear tape.

The Site Supervisor or designee will review all field activities to determine whether proper custody procedures were followed during the field work and if additional samples are required.

Transfer of Custody and Shipment

The custody of samples must be maintained from the time of sampling through shipment and relinquishment to the laboratory. Instructions for transferring custody are given below.

All samples are accompanied by a chain of custody. When transferring custody of sample, the individuals relinquishing and receiving will sign, date, and note the time on the chain of custody. This form documents sample custody transfer from the Site Supervisor or designee, through the shipper, to the analytical laboratory. Since a common carrier will usually not accept responsibility for handling chain of custody forms, the name of the carrier is entered under "Received by", the bill-of-lading number is recorded in the comments section, and the chain of custody form is placed in a zip-lock plastic bag and taped to the inside lid of the shipping cooler. Copies of the chain of custody forms will be placed in each cooler included in the shipment. Copies of the chain of custody and bill of lading will be retained by the

Site Supervisor and placed into the project files.

Samples will be packaged for shipment and dispatched by the appropriate laboratory via overnight delivery service. Samples will be shipped within 24 hours of sampling. Shipping containers will be sealed for shipment to the laboratory. Two custody seals will be applied to each cooler to document that the container was properly sealed and to determine if the container was tampered with during shipment. The custody seals will be placed on the coolers in such a manner that the custody seal would be broken if the cooler were opened.

Laboratory Custody Procedures

A designated sample custodian accepts custody of the samples and verifies that all information on the sample labels matches that on the chain of custody. The sample custodian will document any discrepancies and will sign and date all appropriate receiving documents. The sample custodian will also document the condition of the samples upon receipt by the laboratory.

Once the samples have been accepted by the laboratory, checked and logged in, they must be maintained in accordance with laboratory custody and security requirements.

To assure traceability of samples while in the possession of the laboratory, a unique laboratory identification number will be assigned to each sample.

The following stages of analysis must be documented by the laboratory:

- Sample extraction/preparation.
- Sample analysis.
- Data reduction.
- Data reporting.

Laboratory personnel are responsible for the custody of the samples until they are returned to the sample custodian.

Sample Holding Times

Information on sample holding times and required preservation for each test method are provided in QAPP Worksheet #19&30.

Final Evidence Files

This is the final phase of sample custody. The chain of custody records are archived in the project file. Laboratory custody forms, sample preparation and analysis logbook, and data packages will become part of the laboratory final evidence file. Other relevant documentation including records, reports, correspondence, logs, photographs, and data review reports will be archived by project personnel.

QAPP Worksheet #28: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(USEPA 2106-G-05 Section 2.3.5)

Worksheet 28a – VOCs
Matrix: Groundwater
Analytical Group: Low Concentration
Analytical Method/SOP: SW846 8260 / DV-MS-0010

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits[1]	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Internal Standards	Each calibration standard, field sample and QC field sample	Retention time within ± 0.06 RRT UNITS from retention time of the midpoint standard in the ICAL; Internal standard signal (area or height) within -50% to +100% of ICAL midpoint standard. On days when ICAL is not performed, the daily initial CCV can be used.	Inspect mass spectrometer and GC for malfunctions; Correct problem; mandatory reanalysis of field samples analyzed while system was malfunctioning in accordance with DoD QSM version 5.2 requirements. If field samples still outside criteria, qualify data and explain in case narrative.	Analyst / Section Supervisor	Precision/ Accuracy/Bias	Compounds meet retention time criteria and EICP area requirements as defined within the "QC Acceptance Limits" column.
Method Blank	One per preparatory batch (20 samples)	No Target Compounds> ½ LOQ or > 1/10 the amount in any sample or 1/10 the regulatory limit	If sufficient sample is available, re-prep and reanalyze all samples including QC samples. Qualify data as needed.	Analyst / Section Supervisor	Accuracy/Bias-Contamination	No Target Compounds>1/2 LOQ; no common lab contaminants > LOQ.

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits[1]	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
		(whichever is greater). No common lab contaminants >LOQ.				
Laboratory Control Sample	One per preparatory batch (20 samples)	QSM limits (if available) or current in-house limits if no QSM limits published.	If exceedance is not a critical chemical of concern as identified by the project team, evaluate for sporadic marginal exceedance (SME). If acceptable, report with case narrative comment. If not acceptable for SME, evaluate samples for detections, and LCS for high bias. If LCS has high bias, and samples non-detect, report with case narrative comment. If LCS has low bias, or if there are detections for critical chemicals of concern, evaluate and correct problem, and re-prep and reanalyze the LCS and all samples in the associated prep batch for failed analytes, if sufficient sample material is available. If reanalysis cannot be performed, data must be qualified and explained in the Case Narrative.	Analyst / Section Supervisor	Accuracy/Bias	QSM or Laboratory % Recovery Control Limits

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits[1]	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Matrix Spike/Matrix Spike Duplicate	One MS/MSD per preparatory batch (20 samples)	Recovery: QSM limits (if available) or current in-house limits if no QSM limits published. RPD: RPD between MS and MSD ≤ 20%	Determine root cause; flag MS/MSD data; discuss in narrative.	Analyst / Section Supervisor	Accuracy/Bias/ Precision	QSM or Laboratory % Recovery / RPD Control Limits
Surrogates	Every field and QC sample	QSM limits (if available) or current in-house limits if no QSM limits published.	Evaluate data, if samples non-detect and surrogate recovery is above upper limits, report with case narrative comment. If obvious chromatographic interference is present, discuss with case narrative comment. Otherwise, correct problem, then re-extract and reanalyze all failed samples for all surrogates in the associated preparatory batch if sufficient sample material is available.	Analyst / Section Supervisor	Accuracy/Bias	QSM or Laboratory % Recovery Control Limits

1- This is a summary of the acceptance criteria; refer to the method SOP for specific or more information.
2- SOPs are reviewed/revised on an annual schedule. The current version will be followed at the time of sample receipt.

Matrix: Air
Analytical Group: VOCs
Analytical Method/SOP: SW-8460c/SOP#18

QC Sample	Number/Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Data Quality Indicator (DQI)	Project-Specific MPC
Method Blank	1 per prep. batch of p to 20 samples.	No analytes detected > ½ reporting limit (RL), 1/10 the amount measured in any sample, or 1/10 the regulatory limit, whichever is greater.	Re-prep and reanalyze the method blank and all samples processed with the contaminated blank. If problem persists, call PM.	Analyst / Laboratory Quality Assurance Officer	No common laboratory chemicals on method blank	The concentration of any target analyte (chemical of concern) in the blank exceeds 1/2 the LOQ or is greater than 1/10th the amount measured in any associated sample, or 1/10th the regulatory limit, whichever is greater;
Continuing Calibration	1 per prep. batch of up to 20 samples.	QC acceptance criteria ± 20 of true value for all QA/QC analytes and target analytes	Re-prep and reanalyze the CC and all samples processed with the contaminated blank. If problem persists, call PM.	Analyst / Laboratory Quality Assurance Officer	All target compounds w/in ± 20%	All target analytes in samples found to be within +/- 20%
LCS containing all analytes	One per preparatory batch of up to 20 samples.	QC acceptance criteria ±20 of true value for all QA/QC analytes and target analytes	Correct problem, re-prep and reanalyze LCS and all samples in associated batch for failed analytes. If	Analyst / Laboratory Quality Assurance Officer	All target compounds w/in ± 20%	All target analytes in samples found to be within +/- 20%

QC Sample	Number/Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Data Quality Indicator (DQI)	Project-Specific MPC
			problem persists, call PM.			
LCSD (second source)	One per preparatory batch of up to 20 samples.	QC acceptance criteria ≤30% of true value for all QA/QC analytes and target analytes	Correct problem, re-prep and reanalyze LCSD and all samples in associated batch for failed analytes. If problem persists, call PM.	Analyst / Laboratory Quality Assurance Officer	All target analytes w/in ± 30%	All target analytes in samples found to be within +/- 30%

QAPP Worksheet #29: Project Documents and Records
(UFP-QAPP Manual Section 3.5.1)
(USEPA 2106-G-05 Section 2.2.8)

Record	Generation	Verification	Storage location/archival
Sample Collection and Field Records			
Field logbook or data collection sheets Chain of custody forms Air bills Contractor daily QC reports Deviations Corrective action reports Correspondence Field audit checklists	Jack Strader, PG, Site Supervisor, SERES-Alliant	Nathan Mullens, PM, SERES	Project file
Project Assessments			
Field Audit checklist Data verification checklists Data validation reports Data usability assessment	Jack Strader, Site Supervisor, SERES-Alliant	Nathan Mullens, PM, SERES	Project file
Data validation report Data usability assessment report	Terry Douglas, Project Chemist, SERES-Alliant	Nathan Mullens, PM, SERES	Project file
Laboratory Records			
Chain of custody records Sample receipt records Electronic data deliverables Analytical results and supporting data Sample data packages	Patrick McEntee, PM TestAmerica Denver	Roxanne Sullivan, Quality Assurance Manager (QAM) TestAmerica Denver	Project file
Records of sample preparation Records of sample analysis Instrument calibration records Raw data files	Laboratory analysts TA Denver	Roxanne Sullivan, QAM TestAmerica Denver	Project file

QAPP Worksheet #31, 32, & 33 – Assessments and Corrective Actions

Assessments: See Worksheet 14/16 for estimated dates

Assessment Type	**Responsible Party & Organization**	**Number/Frequency**	**Estimated Dates**	**Assessment Deliverable**	**Deliverable Due Date**
Review of QAPP, SOPs, and daily QC report with field staff	Nathan Mullens, SERES	Prior to sampling start up	Prior to sampling	Contained within daily QC report.	Prior to sampling
Daily logbook and field forms	Jack Strader, Site Supervisor , SERES-Alliant	Daily	During field activities	Contained within written report.	As part of Draft Report
Laboratory assessment for appropriate certifications and capacity; QAPP review with laboratory staff	Nathan Mullens, SERES Terry Douglas, Project Chemist	Prior to sampling start up	Prior to sampling	Receipt of copies of certifications. Email traffic concerning laboratory capacity prior to sampling start up. QAPP sign-off sheet received from laboratory.	Prior to sampling
Daily tailgate safety meeting	Jack Strader, Site Supervisor , SERES-Alliant	Daily	During field activities	Verbal debriefing and daily sign off log. If a safety violation occurs, an incident report is completed.	Last deliverable received no later than one week after field activities
Field sampling and chain of custody review against QAPP requirements	Jack Strader, Site Supervisor , SERES-Alliant	Daily	During field activities	Communication in the form of an email.	Last email received no later than 24 hours after last sampling event
Laboratory report deliverables and analytical results review against QAPP requirements	Terry Douglas, Project Chemist	Per sample delivery group	Immediately following field sampling	Communication if the form of an email.	Three weeks after receipt of data
Data verification	Terry Douglas, Project Chemist	Per sample delivery group	Following analytical report	Communication in the form of an email requesting additional laboratory forms, backup data that may be missing and/ or clarification of the analytical report.	Three weeks after receipt of data
Data validation	Terry Douglas, Project Chemist	Per sample delivery group	Following analytical report	Communication in the form of an email requesting additional laboratory forms, backup data that may be missing and/ or clarification of the analytical report.	Three weeks after receipt of data

Assessment Response and Corrective Action:

Assessment Type	Responsibility for Responding to Assessment Findings	Assessment Response Documentation	Timeframe for Response	Responsibility for Implementing Corrective Action	Responsibility for Monitoring Corrective Action Implementation
Review of QAPP, SOPs, and daily QC report with field staff	Jack Strader, Site Supervisor, SERES-Alliant	Daily QC report will be amended with corrective action	Within 24 hours	Nathan Mullens, SERES	Kate Borg, SERES
Daily logbook and field forms	Jack Strader, Site Supervisor, SERES-Alliant	Daily QC report will be amended with corrective action	Within 24 hours	Nathan Mullens, SERES	Kate Borg, SERES
Laboratory assessment for appropriate certifications and capacity; QAPP review with laboratory staff	Roxanne Sullivan, QAM TestAmerica Denver Ryan Schneider Beacon Environmental	Response to email	Within 48 hours after notification	Roxanne Sullivan, QAM TestAmerica Denver Ryan Schneider Beacon Environmental	Kate Borg, SERES
Daily tailgate safety meeting	Jack Strader, Site Supervisor, SERES-Alliant	Included as part of the Incident Report	Within 48 hours after notification	Nathan Mullens, SERES	Kate Borg, SERES
Field sampling and chain of custody review against QAPP requirements	Jack Strader, Site Supervisor, SERES-Alliant	Response to email	Within 24 hours after sampling	Nathan Mullens, SERES	Kate Borg, SERES
Laboratory report deliverables and analytical results review against QAPP requirements	Roxanne Sullivan, QAM TestAmerica Denver Ryan Schneider Beacon Environmental	If required, laboratory reports will be amended and corrections noted in the case narrative	Within 72 hours of notification	Roxanne Sullivan, QAM TestAmerica Denver Ryan Schneider Beacon Environmental	Kate Borg, SERES
Data verification	Roxanne Sullivan, QAM TestAmerica Denver Ryan Schneider Beacon Environmental	If required, laboratory reports will be amended and corrections noted in the case narrative	Up to 7 days	Roxanne Sullivan, QAM TestAmerica Denver Ryan Schneider Beacon Environmental	Kate Borg, SERES
Data validation	Roxanne Sullivan, QAM TestAmerica Denver Ryan Schneider Beacon Environmental	If required, laboratory reports will be amended and corrections noted in the case narrative and documented in the validation report	Up to 7 days	Roxanne Sullivan, QAM TestAmerica Denver Ryan Schneider Beacon Environmental	Kate Borg, SERES

QAPP Worksheet #34 – Data Verification and Validation Inputs

Item	Description	Verification	Validation
	Planning Documents		
1	QAPP	x	
2	Laboratory Contract	x	
3	Field SOPs	x	
4	Laboratory Methods	x	x
	Field Records		
5	Field Logs	x	x
6	Chain of Custody Forms	x	x
7	Change Forms / Deviations / Variances	x	x
8	Field Equipment Calibration	x	x
9	Field Corrective Action Reports	x	x
10	Sampling Diagrams	x	x
11	Relevant Correspondence	x	x
	Analytical Data Package		
12	Coversheet (Laboratory Identifying Information)	x	x
13	Case Narrative	x	x
14	Definition of Laboratory Qualifiers	x	x
15	Communication Records	x	x
16	Sample Receipt Records	x	x
17	Sample Chronology (i.e., dates and times of receipt, preparation, and analysis)	x	x
18	Results Reporting Forms	x	x
19	QC Sample Results, including • Blanks • Surrogate Recoveries • Internal Standard Retention Times and Areas • GC/MS Turning • LCS/LCSD Recoveries/RPDs • MS/MSD Recoveries/RPDs	x	x

QAPP Worksheet #34 – Data Verification and Validation Inputs

Item	Description	Verification	Validation
	• Duplicates RPDs • Control charts as applicable		
20	Corrective Action Reports	x	x
21	Instrument Calibration Records	x	x
22	LOQ Establishment and Verification	x	x
23	Standards Traceability	x	x
24	Raw Data	x	x
25	Electronic Data Deliverables	x	x

QAPP Worksheet #35 – Data Verification Procedures

Records Reviewed	Required Documents	Process Description	Responsible Person, Organization
Field logbook (sampling methods and procedures)	QAPP Field SOPs	Establish that required sampling methods were used and documented. Establish that any required field monitoring was performed and results are documented. Verify that the sampling procedures and field measurements met performance criteria and that any deviations were documented in the field logbook.	*Daily* – Site Supervisor SERES *At conclusion of field activities* – Nathan Mullens, SERES
Field logbook (documentation)	QAPP	Verify the records are present and complete for each day of field activities. Verify that all planned samples, including field QC samples, were collected and the sample collection locations are documented. Verify that meteorological data were provided for each day of field activities. Verify that changes/exceptions are documented and were reported in accordance with requirements.	*Daily* – Site Supervisor, SERES *At conclusion of field activities* – Nathan Mullens, SERES
Field Audit	QAPP	Field audits may be conducted by the Quality Manager or other personnel not related to the sampling activities	Nathan Mullens, SERES
Chain of custody forms	QAPP Field SOPs Laboratory SOPs/QA Manual	All samples to be analyzed by the laboratory will be shipped via overnight delivery service under chain of custody. Prior to shipment of the samples to the laboratory, the chain of custody will be checked by the Site Supervisor or representative for completeness and accuracy and ensure data matches what was recorded in the field book. Upon receipt at the laboratory, the sample custodian will check the chain of custody forms and shipping documentation for verification against the sample coolers they represent, and will sign and data the chain of custody to acknowledge sample receipt. They will also check the appropriate methods and record the sample preservation. The lab will also confirm the appropriate sample volume was collected for QC Samples and verify signatures, dates and any transcription errors. The laboratory is responsible for verifying the integrity of the custody seals and that the sample containers are received in good condition. The Laboratory Information Management System will provide evidence of sample custody from receipt by the laboratory until appropriate disposal.	*Daily* – Site Supervisor SERES *Upon receipt* – Sample Custodian, TestAmerica

QAPP Worksheet #35 – Data Verification Procedures

Records Reviewed	Required Documents	Process Description	Responsible Person, Organization
Laboratory correct action and report procedure	QAPP Laboratory SOPs/QA Manual	Routine corrective actions apply to all analytical quality control parameters and analytical system specification as defined in the laboratory SOPs. Bench analysts have full responsibility and authority for performing routine corrective action, which are documented as part of the analytical record. Defective processes, holding time violations, systematic errors and quality defects that occur are to be reported by the analyst to the laboratory supervisor and a non-conformance record initiated. The Laboratory PM will then notify the Project Chemist and SERES PM. All notifications must be made in a timely manner. The non-conformance record should become part of the analytical record.	*Before release* – Roxanne Sullivan, QAM TestAmerica Denver *Upon receipt* – Terry Douglas Validator
Analytical data package	QAPP Laboratory SOPs/QA Manual	All data produced by the laboratory will be required to undergo several levels of review, which will include two levels of management review at the laboratory. The laboratory will review the data packages internals for completeness and verification that all of the required forms and raw data are included for each data package type. The laboratory QA Manager may also select to review randomly chosen data packages for additional internal audits. Any deviations should be documented in the report narrative.	Roxanne Sullivan, QAM TestAmerica Denver
Analytical data package	QAPP Laboratory SOPs USEPA National Functional Guidelines	The Project Chemist and Data Validator will verify that data have been received for all samples sent to the laboratory. An evaluation of the data will be performed to determine whether the laboratory met the QC requirements for the analysis as stated in the analytical method, laboratory SOPs, QAPP, and USEPA National Functional Guidelines for Data Validation. This verification should include (at a minimum): (1) review of dates of sample preparations and analyses to verify they have been performed within applicable holding times, (2) review of associated blanks for potential contamination, (3) determination that project quantitation limits were achieved, and (4) review of QC sample performance criteria. Any deviations should be documented in the report narrative.	Terry Douglas

QAPP Worksheet #35 – Data Verification Procedures

Records Reviewed	Required Documents	Process Description	Responsible Person, Organization
Laboratory electronic data deliverable (EDD)	QAPP Automated Data Review (ADR) specifications	The laboratory will provide EDDs in accordance with the Staged Electronic Data Deliverable (SEDD) version 5.2 (or the most recent format). The EDD will be reviewed using ADR software for accuracy and completeness.	Terry Douglas

QAPP Worksheet #36 – Data Validation Procedures

Data Validator:	Terry Douglas
Analytical group/method:	VOCs
Data deliverable requirements:	SEDD Stage 2B XML file
Analytical specifications:	VOCs by SW846 8260 (see Worksheet #12)
Measurement performance criteria:	DoD QSM version 5.2 (see Worksheets #12 and #28)
Percent of data packages to be validated[1]*:*	100% Stage III 10% Stage IV
Percent of raw data reviewed:	10%
Percent of results to be recalculated:	10%
Validation procedures:	USACE EM-200-1-10 UFP-QAPP DoD QSM 5.2 National Functional Guidelines for Superfund Organic Methods Data Review (EPA-540-R-2017-002)
Electronic validation program/version:	ADR

Notes:
[1] 100% of the data will be reviewed and verified. 100% of the data packages/EDDs will be reviewed using ADR.

QAPP Worksheet #37 – Data Usability Assessment

The Data Usability Assessment will be performed by SERES for data associated with the Former Radar Station SI. Documentation generated during the Data Usability Assessment will consist of data validation checklists with a brief summary of overall data usability and a summary table of qualified results, as required. Data validation will be performed on the critical samples. 100% of the data will be reviewed and verified. 100% of the data packages/EDDs will be reviewed using ADR. Ten percent of all samples, critical and non-critical, will undergo a full data validation (i.e., Stage IV).

The Data Usability Assessment process involves data verification and validation. Data verification is the process by which laboratory results are checked to provide that the proper QC steps were performed and key items have met QC objectives (both analytical and contractual). Key steps of the data verification include:

- identifying sample collection, handling and analysis procedures
- documenting handling and analysis activities (e.g., QC checklist)
- verifying (internally, at the data generator level) all sampling, handling, on-site analytical laboratory data
- verifying laboratory data (e.g., laboratory-qualified data)
- verifying sampling, on-site analytical laboratory data
- verifying data package deliverable completeness
- reviewing the case narrative
- presenting all analytical results
- summarizing QC sample data
- evaluating applicable raw data

All required data deliverables must be present in the data package in order to proceed to the next step of data validation.

Data validation entails a review of the sample collection, handling, QC data, and the raw data to verify that the laboratory was operating within required limits, analytical results were correctly transcribed from the instrument read-outs and which (if any) environmental samples were related to out-of-control QC samples. The objective of data validation is to identify any questionable or invalid laboratory measurements.

The DQIs used to evaluate conformance with the project DQOs are presented below.

DQIs are generally defined in terms of six parameters:

1. representativeness
2. comparability

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3. completeness
4. precision
5. accuracy
6. sensitivity

Each parameter is defined below. Specific objectives for the site actions are presented in other sections of this QAPP, as referenced below.

Representativeness

Representativeness is the degree to which sampling data accurately and precisely represent site conditions. This QAPP presents the design and rationale for selecting sampling methodologies, sample quantities, sample locations, sample types, sample containers, holding times, preservation requirements, and analytical methods to allow evaluation of the representativeness of the data that is obtained.

Comparability

Comparability is the degree of confidence with which one data set can be compared to another. Comparability between phases of the actions (if additional phases are required) will be dependent upon sampling design and will be satisfied by ensuring the approved plans are followed and proper sampling and analysis techniques are applied. Further, data sets must be of known, documented quality.

Completeness

Completeness is defined as a measure of the amount of valid data obtained from an event and/or investigation compared to the total amount that was obtained. This will be determined upon final assessment of the analytical results. Completeness of a field or laboratory data set will be calculated by comparing the number of valid sample results generated to the total number of results generated.

$$\text{Completeness} = \frac{\text{Number valid results}}{\text{Total number of results generated}} \times 100$$

As a general guideline, overall project completeness is expected to be at least 90 percent. The assessment of completeness will require professional judgment to determine data usability for intended purposes.

Precision

Precision is a measure of the reproducibility of sample results. The goal is to maintain a level of analytical precision consistent with the objectives of the action. To maximize precision, sampling and analytical procedures will be followed. All work for the site actions will adhere to established protocols presented in the QAPP. Checks for analytical precision will include the analysis of LCS and LCSD samples, matrix spike/matrix spike duplicates, laboratory duplicates and field duplicates, as appropriate for the analytical method. Checks for field measurement precision will include duplicate field measurements.

The precision of data will be measured by calculating the RPD by the following equation:

$$\text{RPD} = \frac{(A-B)}{} \times 100$$

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$$(A+B)/2$$

Where:

A = Analytical result from one of two duplicate measurements.

B = Analytical result from the second measurement.

Accuracy

Accuracy is a measure of how close a measured result is to the true value. Both field and analytical accuracy will be monitored through initial and continuing calibration of instruments. In addition, reference standards, LCS, MS, blank spikes and surrogate standards will be used to assess the accuracy of the analytical data.

Accuracy will be calculated in terms of percent recovery as follows:

$$\% \text{ Recovery} = \frac{A-X}{B} \times 100$$

Where:

A = Value measured in spiked sample or standard.

X = Value measured in original sample.

B = True value of amount added to sample or true value of standard.

Sensitivity

Sensitivity is a quantitative measurement to determine if the analytical laboratory's procedures / methodologies and their associated DoD detection limits (LOQ) can satisfy the project requirements as they relate to the project action limits. Detection limits are updated annually by the laboratory based on analyses of low concentration LCS samples or laboratory fortified blank samples with concentrations at or near the LOQs. The current LOQs for the analytical laboratories are presented in QAPP Worksheet #15.

Data Validation and Usability

Terry Douglas will validate data generated using this QAPP, USACE EM-200-1-10, DoD QSM 5.2, and National Functional Guidelines for Superfund Organic Methods Data Review (EPA-540-R-2017-002). These procedures and criteria may be modified, as necessary, to address project-specific and method-specific criteria, control limits and procedures. Data validation will consist of data screening, checking, reviewing, editing and interpretation to document analytical data quality and to determine whether the quality is sufficient to meet the DQOs.

The data validator will verify that reduction of laboratory measurements and laboratory reporting of analytical parameters is in accordance with the procedures specified for each analytical method and/or

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as specified in this QAPP. Any deviations from the analytical method or any special reporting requirements apart from those specified in this QAPP will be detailed on chain of custody forms.

Upon receipt of laboratory data, the following procedures will be executed by the data validator:

- Evaluate completeness of data package.
- Verify that field chain of custody forms were completed and that samples were handled properly.
- Verify that holding times were met for each parameter. Holding time exceedances, should they occur, will be documented. Data for all samples exceeding holding time requirements will be flagged as either estimated or rejected. The decision as to which qualifier is more appropriate will be made on a case-by-case basis.
- Verify that parameters were analyzed according to the methods specified.
- Review QA/QC data (i.e., confirm that duplicates, blanks, LCS, and spikes were analyzed on the required number of samples, as specified in the method and verify that duplicate, LCS/LCSD, and MS/MSD recoveries and RPDs are acceptable).
- Investigate anomalies identified during review. When anomalies are identified, they will be discussed with the Project Manager and/or Laboratory Manager, as appropriate.
- If data appear suspect, Seres-Alliant will contact the Lab Manager and investigate the specific data of concern. Calculations will be traced back to raw data. If calculations do not agree, the cause will be determined and corrected and a corrective action report will be developed and submitted to the USACE TM and USACE PM.

Deficiencies discovered as a result of the data review, as well as the corrective actions implemented in response, will be documented and submitted in the form of a written report addressing the following topics, as applicable to each method:

- assessment of the data package
- description of any protocol deviations
- failures to reconcile reported and/or raw data
- assessment of any compromised data
- overall appraisal of the analytical data
- table of site name, sample quantities, matrix and fractions analyzed

It should be noted that qualified results do not necessarily invalidate data. The goal to produce the best possible data does not necessarily mean that data must be produced without QC qualifiers. Qualified data can provide useful information.

During the review process, laboratory qualified and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted or modified by the data

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reviewer. Results will be qualified with the following codes:

- U Not detected: Analysis for the analyte was performed, but the analyte was not detected above the level of the associated value. The associated value is the LOD.
- J Estimated: The analyte was detected and identified. The associated numerical value is the approximate concentration of the analyte in the sample.
- UJ The analyte was analyzed for, but was not detected. The reported quantitation limit (LOQ) is approximate and may be inaccurate or imprecise.
- NJ Tentatively identified, reported concentration is estimated: The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification and the associated numerical value represents the approximate concentration. For example, analyte not included in the calibration or second column confirmation not performed.
- R Rejected: The data are unusable.
- J+ Estimated with high bias.
- J- Estimated with low bias.

Two facts will be noted to all data users. First, the "R" flag means that the associated value is unusable. In other words, due to significant QC problems, the analysis is invalid and provides no information as to whether the compound is present or not. Analytes with "R" values should not appear on data tables because they cannot be relied upon for any reason. The second fact is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

Resolution of any issues regarding laboratory performance or deliverables will be handled between the laboratory and the data validator. Suggestions for reanalysis may be made by the Data QA Coordinator at this point.

Validation Reports

The data validation reports will identify all deficiencies and the potential impact on the results. Terry Douglas (or his designee) will amend qualifiers generated during the validation process to the database. The validation checklists and the database will be the primary location of all applicable data qualifiers. Qualifiers will not be applied to the hard copy analytical reports.

Field Data Review

Field data are generated from in-field measurement, which may include a geophysical survey, well development and groundwater sampling. The quality objective for the in-field measurement activities is to obtain accurate measurements of sample characteristics, including aqueous pH, conductivity, temperature, turbidity and dissolved oxygen, using appropriate equipment. Data are recorded in field logbooks or on field sampling sheets and calibration logs. Calibration logs will be reviewed by the Project

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Manager with other field documentation to identify any potential impacts to data quality and usability. Field logbooks are reviewed as part of the QC inspections.

Reconciliation with Data Usability Requirements

Data results will be examined to determine the performance that was achieved for each data usability criterion. The performance will then be compared with the project objectives and DQOs. Deviations from objectives will be noted. Data that has been rejected will not be used and Seres-Alliant will ensure this data is removed from the project repository. Rejected data will be recorded as such and a corrective action report will be generated documenting the reasons for rejection. The corrective action report will be submitted to the USACE TM and USACE PM Data that has been qualified but not rejected will be considered useable (i.e., qualified as estimated) and definitive data. If there is an instance where further limitations must be placed on qualified data, the associated data is non-definitive data and should be used for screening purposes only.

Additional action may be warranted when performance does not meet performance objectives for critical data. Options for corrective action relating to incomplete information, questionable results or inconsistent data may include any or all of the following:

- retrieval of missing information
- request for additional explanation or clarification
- reanalysis of sample from extract (when appropriate)
-
- development of a corrective action report

These actions may improve the data quality, reduce uncertainty and eliminate the need to qualify or reject data. If these actions do not improve the data quality to an acceptable level, the following additional actions may be taken:

- extrapolation of missing data from existing data points
- evaluation of the critical/noncritical nature of the sample

If the data gap cannot be resolved by these actions, the data bias and potential for false negatives and positives can be evaluated. If the resultant uncertainty level is unacceptable, the following action must be taken:

- additional sample collection and analysis