ADEQ's UST PROGRAM

QUALITY ASSURANCE PROGRAM PLAN

Douglas A. Ducey, Governor
Misael Cabrera, Director

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY
Waste Programs Division

Date: September 2016
Revision A

A.1 TITLE AND APPROVAL PAGE

This QA Program Plan is hereby recommended for approval and commits the Department to follow the elements described within.

Arizona Department of Environmental Quality

Laura L. Malone, Director, Waste Programs Division

Signature: Laura L. Malone Date: 10/17/16

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Rebecca Jamison, EPA Project Officer, EPA Region 9

Signature: _____ Date: 1/4/2017

The Arizona Department of Environmental Quality (ADEQ) has prepared this Quality Assurance (QA) Program Plan titled **ADEQ's UST Program Quality Assurance Program Plan** following the *EPA Requirements for Quality Assurance Project Plans (EPA QA/R-5)* dated March 2001, the *EPA Guidance for Quality Assurance Project Plans (EPA QA/G-5)* dated December 2002, the *EPA Region 9 Requirements for Quality Assurance Program Plan (R9QA/03.2)* dated March 2012, and the *ADEQ Quality Management Plan* dated May 2016.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

October 11, 2016

MEMORANDUM

SUBJECT: Quality Assurance Program Plan for ADEQ's Underground Storage Tank Program [QA Office Document Control Number USTP0029PV2]

FROM: David R. Taylor, Ph.D., Sr. Document Reviewer
Quality Assurance Office, EMD 3-2

THROUGH: Eugenia McNaughton, Ph.D., Manager
Quality Assurance Office, EMD 3-2

TO: Rebecca Jamison, Project Officer
Underground Storage Tank Section, LND 4-3

The subject Draft Quality Assurance Program Plan (QAPrP) and a Response to Comments (RTC), prepared by the Underground Storage Tank Program of the Arizona Department of Environmental Quality (ADEQ) and dated July, 2016, were reviewed. The review was based on "*EPA Region 9 Guidance for Quality Assurance Program Plans*" (R9QA/03.2, March, 2012), "*EPA Requirements for Quality Management Plans*" (EPA R-2, December, 2001), "*EPA Requirements for Quality Assurance Project Plans*" (EPA QA/R-5, March, 2001, "*EPA Guidance for Quality Assurance Project Plans*" (EPA QA/G-5, December, 2002), "*Guidance for the Data Quality Objectives Process*" (EPA QA/G-4, August, 2000) and a QA Office letter dated September 7, 2016..

All previous concerns have been addressed. The QAPrP is approved by the QA Office.

Original concerns are reproduced below in bold face type. An evaluation of the revised QAPrP follows in normal type. If you have any questions or need further information please feel free to contact me by phone at 415-972-3803 or by email at <Taylor.David@epa.gov>.

cc: Wayne Pudney, ADEQ
Lyndsey Tu, EPA

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ACRONYMS AND ABBREVIATIONS

AAC	Arizona Administrative Code
ADEQ	Arizona Department of Environmental Quality
ADHS	Arizona Department of Health Services
ADQ	Audit of Data Quality
ARS	Arizona Revised Statutes
ASTM	American Society for Testing and Materials
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CSM	Conceptual Site Model
CWA	Clean Water Act
DQA	Data Quality Assessment
DQI	Data Quality Indicator
DQO	Data Quality Objective
EDD	Electronic data deliverable
EPA	Environmental Protection Agency
HASP	Health and Safety Plan
ICP	Inductively Coupled Plasma
IDW	Investigative Derived Waste
ITRC	Interstate Technical Regulatory Council
LCS	Laboratory Control Sample
LUST	Leaking Underground Storage Tank
MDL	Method Detection Limit
MQO	Measurement Quality Objective
MS/MSD	Matrix Spike and Matrix Spike Duplicate
MSR	Management System Review

MI	Multi-increment
MPC	Measurement Performance Criteria
NIST	National Institute of Standards and Testing
NOV	Notice of Violation
PARCCS	Precision, Accuracy, Representativeness, Completeness, Comparability, and Sensitivity
PE	Performance Evaluation
PID	Photo Ionization Detector
PPE	Personnel Protective Equipment
PQL	Practical Quantitation Limit
PRQL	Project Required Quantitation Limit
QA	Quality Assurance
QC	Quality Control
QMP	Quality Management Plan
RCRA	Resource Conservation and Recovery Act
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
SDG	Sample Delivery Group
SDWA	Safe Drinking Water Act
SLU	State Lead Unit
SOP	Standard Operating Procedure
TICE	Tanks Inspection, Compliance, and Enforcement Unit
TOO	Task Order Offer
TSA	Technical System Audit
UCU	UST Coordination Unit
UST	Underground Storage Tank
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound
WPD	Waste Programs Division

Distribution List

UST-LUST Program Staff
ADEQ Technical Support Staff
Pamela Nicola, UST-LUST Section Manager
QA/QC Manager and/or QA/QC Representative

GROUP A: PROGRAM MANAGEMENT

Introduction

The United States Environmental Protection Agency (EPA) requires that all environmental monitoring and measurement efforts mandated or supported by EPA have in place a centrally managed Quality Assurance (QA) Program Plan. ADEQ provides this QA Program Plan for guidance on how quality assurance (QA) and quality control (QC) procedures are applied to produce data that are:

- Scientifically valid.
- Of documented quality.
- Legally defensible.

The format and elements of this QA Program Plan are in accordance with EPA Region 9 Guidance for Quality Assurance Programs Plans R9QA/03.2 (March 2012), EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations EPA QA/R-5 (March 2001), and EPA Guidance for Quality Assurance Project Plans EPA QA/G-5 (December 2002). Specific elements required in a QA Program Plan include: project management, measurement data acquisition, assessment and oversight, data review and verification, and usability.

ADEQ's Waste Programs Division Underground Storage Tank Program (ADEQ's UST Program)
Minimum procedures to ensure the precision, accuracy, completeness, comparability, and representativeness of data generated for programs operated under the Arizona Department of Environmental Quality (ADEQ) Waste Programs Division (WPD) UST Program (ADEQ's UST Program) are the responsibility of the party generating the data and must report them to ADEQ's UST Program. All QA/QC procedures must be in accordance with applicable professional technical standards, EPA requirements, government regulations and guidelines, and specific project goals and requirements The QA Program Plan is a management tool. It helps guarantee data are of sufficient known quality to withstand scientific and legal challenge relative to its intended use.

EPA and ADEQ's UST Program developed activities such as cooperative enforcement, corrective actions, closures, and inspection agreements for ADEQ's UST Program. ADEQ is the state lead agency for RCRA regulatory programs and the Arizona Revised Statutes (ARS) authorizes ADEQ to conduct UST enforcement, compliance, inspection, corrective action, closures and permitting. Examples of activities within ADEQ's UST Program include the inspection of UST facilities, complaint investigations, and corrective actions at UST facilities. Many of the activities include the sampling and analysis of various media to verify possible violations for enforcement purposes or to establish site conditions during the operation or closure of regulated facilities. ADEQ establishes monitoring programs for groundwater protection at permitted UST facilities and at facilities undergoing corrective actions for the purpose of site characterization and remediation.

ADEQ can require the UST facility/responsible party to conduct the sampling or designate agency personnel who are responsible for collecting such samples and/or documenting field collection activities. Those activities will occur within a framework that is well-defined by specific documentation requirements. Most activities occur along a coordinated flow path consisting of the submittal and review

of documents. Submittal of media and waste samples to an Arizona Department of Health Services (ADHS) licensed laboratory support the activities of ADEQ's UST Program.

A4: Program Organization and Planning Documentation

ADEQ's UST Program operates within the Waste Programs Division of the ADEQ. This Division functions as a consolidated source of environmental cleanup in the State of Arizona, with authorities and responsibilities arising from delegated authorities through the Resource Conservation and Recovery Act (RCRA), the Clean Water Act (CWA) and from cooperative work agreements through Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). ADEQ's UST Program is one component of the Waste Programs Division and consists of the UST-LUST Section Manager, four unit supervisors, and several full-time employees. The four units within UST-LUST Section are TICE, SIRU, SLU, and the UST Information and Support Unit.

ADEQ employs agency-wide QA/QC program management (AQPM) for QA/QC purposes. This approach decentralizes the role of QA/QC, whereby each Division of ADEQ is responsible for deciding how they will specifically implement the general policies and procedures of ADEQ's Quality Management Plan. The AQPM consists of either an agency-wide QA/QC manager and/or designated QA/QC representatives from each division to fulfill the roles and responsibilities stated in this QMP. The AQPM is independent of the Leadership Team, the policy making group for ADEQ, for reasons of autonomy.

The AQPM is independent of the Leadership Team who are the policy making group for ADEQ. With this separation of groups, Leadership Team, division specialists, and the AQPM autonomy is preserved in fact and appearance. The ultimate responsibility for Quality Assurance for ADEQ lies with the agency Director.

The QA/QC Manager or QA/QC Representatives are not routinely involved with the day-to-day activities of the UST-LUST Section. The QA/QC Manager or QA/QC Representatives do not routinely participate in any of the planning phases of a project nor are involved in the review/approval of submitted planning documents (e.g. work plans) or reports. However, the QA/QC Manager or QA/QC Representatives can assist in the review of data when requested/necessary. Please see Section A4.1.2 under QA/QC Manager or QA/QC Representatives for a full description of the QA/QC Manager or QA/QC Representative's role.

A4.1 Program/Task Organization

ADEQ's UST Program, as described below, performs inspections and compliance, reviews reports generated by an UST facility or a State Lead contractor and collects samples when necessary. A UST facility can be a facility that is currently in operation or has a history of operating USTs as described in ARS Title 49, Chapter 6.

The operation of ADEQ's UST Program involves a number of parties/organizations with specific responsibilities related to data quality. These parties/organizations have specific functions related to the operation of ADEQ's UST Program. The following paragraphs discuss these organizations and their general responsibilities, followed by discussions of specific responsibilities held by various individuals within those organizations.

An organizational chart showing all the parties/organizations involved in the data quality system has been included as Figure A1: Components of the Quality System for ADEQ's UST Program. Figure A1 identifies entities based on their applicable data roles: data quality management, data generators or data users. The defined ADEQ UST Program includes: 1) UST-LUST Section Manager; 2) Tanks Inspections/Installations, Compliance & Enforcement Unit Supervisor; 3) State Lead Unit Supervisor; 4) Site Investigation & Remediation Unit Supervisor; and 5) UST Information and Support Unit Supervisor. This section and its units include technical support and staff level personnel. Figure A1 incorporates the EPA Region 9 Arizona Project Officer. The prospective data users include the facility Owner/Operator, property owner, and local and state government.

A4.1.1 Organizational Roles and Responsibilities

Environmental Protection Agency (EPA)
EPA works closely with Arizona in implementing the underground storage tank program by providing grant funding, setting national goals and priorities, and conducting program oversight. Each year, EPA identifies the national priorities for implementing all of its programs, including the RCRA Subtitle I program. These priorities form the basis for EPA and ADEQ workload negotiations for the upcoming year as part of the establishment of grant funding. Also, EPA regional staff has oversight responsibilities to promote national consistency in RCRA implementation, encourage coordination and agreement between EPA and ADEQ on technical and management issues, ensure proper enforcement by the ADEQ and ensure appropriate expenditure of federal grant funds.

Arizona Department of Environmental Quality
ADEQ is responsible for the operation of ADEQ‘s UST Program. All ADEQ UST Program programmatic activities reside in the Waste Programs Division of ADEQ. The UST-LUST Section referenced in Section A4 and A4.1 carry out the main functions of ADEQ's UST Program. The section and units has a designated Section Manager and Unit Supervisors (one Section Manager and four Unit Supervisors in total).

Environmental Laboratory Services
All parties and organizations submitting data generated for and submitted to ADEQ's UST Program are required to use analytical laboratories licensed by the Arizona Department of Health Services (ADHS). The licensed analytical laboratories are required to follow all Arizona Administrative Code (AAC) applicable to ADHS laboratories (see Appendix A). The data produced from the analysis of environmental samples provide information to make informed decisions relating to the health and welfare of Arizona's citizens. These data must be of known quality, technically sound and legally defensible.

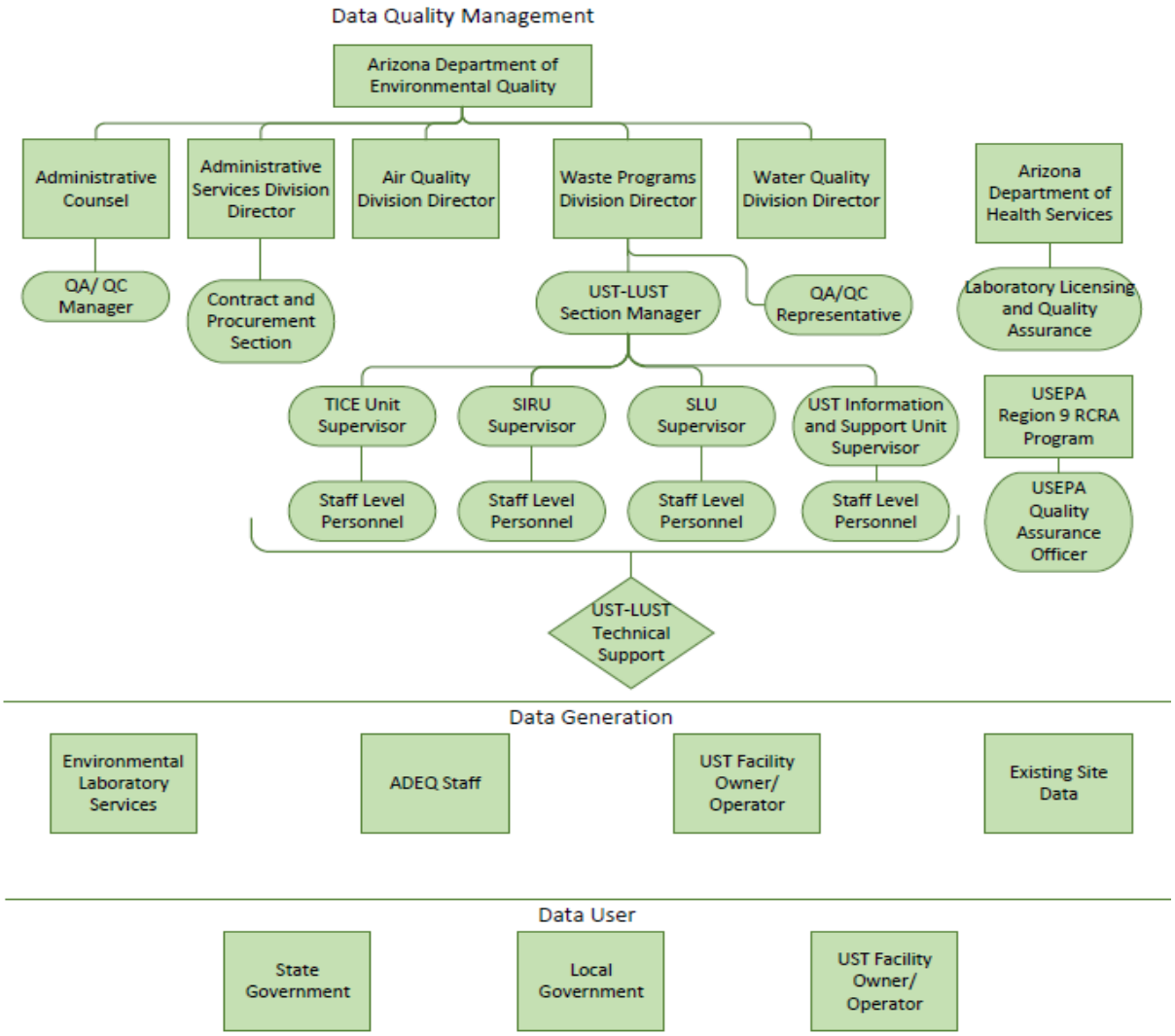
Upon application for an environmental laboratory license, ADHS shall issue the license if, after investigation, ADHS determines that the application conforms to the standards established by ADHS.

The ADHS Director shall prescribe rules providing for minimum standards of proficiency, methodology, quality assurance, operation, and safety for environmental laboratories and may prescribe standards for personnel education, training, and experience to meet Federal environmental statutes or regulation. The ADHS Director may also allow reciprocity with other states and prescribe reporting formats for

compliance testing results. Development of the rules shall be in cooperation with the Director of the Department of Environmental Quality and shall be consistent with Title 49 (Section 49-101 et seq.).

Unless exempted by ARS § 36-495.02, no person may operate or maintain an environmental laboratory without a license issued by the ADHS pursuant to ARS §§ 36-495.03 through 36-495.14.

Figure A1: Components of the Quality System for the ADEQ's UST Program



Underground Storage Tank Facility Owner/Operators

As primary data generators, the UST Facility Owner/Operators – usually through their environmental contractors - are responsible for the implementation and documentation of a number of QC elements, such as collection and analysis of field blanks, field duplicates and rinsate samples, to satisfy the requirements

of the QA Program Plan. Please note that Section B.5 of this QA Program Plan discusses Quality Control in detail.

Please note: Facility Owner/Operators rarely employ staff that are qualified to satisfy the requirements of a QA Program Plan and, therefore, hire environmental contractors to generate environmental data. Also, a certified Arizona Board of Technical Registration registrant of an appropriate discipline must seal all documents requiring professional judgment.

The documentation of all environmental data collection activities must meet the following minimum requirements:

- Documentation of data must be direct, prompt, and legible. All reported data must be uniquely traceable to the raw data. Documentation of all data reduction formulas must occur.
- All original data records include, as appropriate, a description of the data collected, units of measurement, unique sample identification, station or location identification (if applicable), name (signature or initials) of the person collecting the data, and date of data collection.
- Any changes to the original (raw data) entry must not obscure the original entry. The person making the change must document the rationale and initial and date the change.

In addition, development of standard operating procedures (SOPs) for data collection should follow EPA's 2007 ***Guidance for Preparation of Standard Operating Procedures for Quality-Related Operations***. SOPs should be included as an appendix of all the planning documents and reports referenced in Figure A2. QA or QC reports (see Sections C2.2 and C2.3) should be included as an appendix to all planning documents and reports submitted to ADEQ's UST Program. The field team should document rationale for any deviations from an SOP and include that documentation in all planning documents and reports submitted to ADEQ's UST Program.

A.4.1.2 Individual Roles and Responsibilities

In addition to those general responsibilities maintained by the above organizations, individuals involved in ADEQ UST Program activities have specific QA responsibilities. These individuals will be referred to only as a given project title or position, since these assigned duties will be unaffected by staff changes within these positions. The listed individuals below correspond to the organization structure outlined above. They are described according to the level of direct oversight those individuals provide in ADEQ's UST Program's QA system.

EPA Region 9, Arizona Project Officer
The EPA Arizona Project Officer for the UST grant has responsibility for:

- Monitoring all activities and ADEQ's progress on the meeting grant commitments;
- Review progress reports to ensure ADEQ is performing the work as agreed and approved in the grant application;
- Serving as the focal point for programmatic and technical issues;
- Ensure completion of EPA's programmatic terms and conditions; and
- Maintaining documentation.

Director, Arizona Department of Environmental Quality

The ADEQ Director has overall responsibility for ADEQ's QA Program as outlined in EPA Order CIO 2105.0 (formerly 5360.1 A2). More specifically, the ADEQ Director is responsible for ensuring that QA is an identifiable activity having adequate resources allocated for the accomplishment of the mission's goals for ADEQ's divisions and Southern Regional office. These goals include providing the resources for the collection of the right type, quantity, and quality for all data generated in-house and externally.

Environmental Laboratory Services

ADEQ's UST Program relies on the ADHS licensing program for the satisfaction of many of the QA elements associated with laboratory operation and reporting (see Appendix A of this QA Program Plan). The ADHS is used to maintain oversight on analytical labs for QC on all environmental samples submitted for analysis under a regulatory program—either the CWA, Safe Drinking Water Act (SDWA) or RCRA. QA plans, as required by AAC R9-14-615.B, describe licensed laboratory QA responsibilities. ADHS maintains a list of licensed laboratories and periodically inspects them to ensure compliance.

ADEQ's UST Program also has the option of having audits performed by ADEQ's QA/QC Manager or QA/QC Representatives on laboratories licensed by ADHS. All ADEQ laboratory audits must be performed in accordance with Section 2.3.2 of ADEQ's August 2010 Quality Management Plan.

Director, Waste Programs Division of ADEQ

ADEQ, through its combined authorities from state-delegated environmental programs, oversees all site investigations and cleanups conducted in the State of Arizona. The Waste Programs Division Director is responsible for the administration of all these cleanup authorities. In addition, because site cleanup regulations play an integral part in the development of data quality guidelines, the Division Director also plays an important function in determining data quality and sufficiency for the Waste Programs of ADEQ, including ADEQ's UST Program.

The regulations governing investigations and cleanups (ARS Title 49 – The Environment) in Arizona determine, on a general level, the type and amount of data necessary to make decisions regarding issuance of Notice of Violations (NOVs), compliance orders, and the issuance of determination letters (e.g. "case closure" letters). The Division Director is responsible for ensuring a consistent application of these regulations across all Waste Programs cleanup sites. All site information is available to the Division Director for review and consideration of site decisions. The Division Director also holds regular supervisor-level meetings to discuss ADEQ issues and Waste Programs operations.

Section Manager, UST-LUST Section of the Waste Programs Division

The UST-LUST Section Manager is responsible for staff level participation in all the administrative and technical areas of the UST-LUST Section. The UST-LUST Section Manager is responsible for ensuring that all units within the UST-LUST Section performs their functions consistent with WPD policies and procedures. The Section Manager's level of review will routinely consist of ensuring that the proper staff members reviewed, commented, and drafted an appropriate document (e.g. determination letter). The UST-LUST Section Manager ensures that the Section meets program goals. Also, the UST-LUST Section Manager approves the EPA Grant Work Plans, establishes section-wide priorities, and prepares and/or negotiates the overall budget. The UST-LUST Section Manager is available for consultation regarding investigations, remedial actions and closures.

Unit Supervisors, State Lead Unit and Site Investigation and Remediation Unit
The Unit Supervisors are responsible for ensuring performance of corrective actions in accordance with State and Federal rules and guidance. The Unit Supervisor assigns work, manages priorities, and reviews staff outputs, including comment and decision making letters. The Unit Supervisors are responsible for final approval of work plans and any required reporting.

Unit Supervisor, Tanks Inspections/Installation, Compliance and Enforcement Unit
The Unit Supervisor of the TICE unit is responsible for staff level participation in all the administrative and technical areas of the TICE unit. The Unit Supervisor's level of review routinely consists of ensuring that proper staff members carry out inspections, enforcement actions, and review, comment on and draft an appropriate response to submitted planning documents and reports. The Unit Supervisor will also edit, if necessary, any comment or approval letter. The Unit Supervisor is responsible for final approval of submitted planning documents and reports.

Unit Supervisor, UST Information and Support Unit
The Unit Supervisor of the UST Information and Support Unit is responsible for staff level participation in ADEQ's UST Program data management and responsible party identification. The Unit Supervisor's level of review routinely consists of ensuring that proper staff members carry out their assigned duties with respect to ADEQ UST Program data storage and availability. This unit is not responsible for any environmental data collection, analysis, quality assurance, or quality control.

Staff Level Personnel of ADEQ's UST Program
Staff level personnel consist of Environmental Hydrogeologists, Engineers, Scientists, and Inspectors. Their responsibilities with quality control may involve reviewing planning documents and reports (see Figure A2) submitted by the UST Facility Owner/Operators – either directly or through their contractors - to investigate and remediate soil and groundwater contamination. Soil, groundwater and soil gas samples may be collected directly by staff during split sampling events or during facility inspections. Personnel can conduct announced or unannounced inspections to ensure a UST facility maintains compliance with regulatory requirements.

A work plan or Corrective Action Plan typically details proposed investigation or remediation. The Unit Supervisor is responsible for and sometimes reviews, comments upon and approves the document after resolution of all issues and before the investigation begins. Review of data collection results occur after submittal of those results in the required report. The following is a short list of some of the most common goals for sampling:

a. To document a release to the environment;
b. To determine the substance released;
c. To document the source area of release;
d. To establish the amount/concentration of a substance in a release;
e. To document the extent and degree of contamination; or
f. To document that an area is below clean-up standards.

On the infrequent occasions when ADEQ staff collects samples and has them analyzed by an ADHS approved laboratory (i.e. during split sampling events), the Technical Support person is available to assist the various staff level personnel when necessary. The Technical Support person, upon request from the

staff level personnel, Unit Supervisor or Section Manager, will review this data with regards to QA Program Plan requirements, sampling goals and data quality objectives (DQO's).

ADEQ's UST Program, Technical Support

Technical Support is available to assist with site assessment and/or remediation issues to ensure the investigation and data collection efforts of the environmental consultant and facility meet QA objectives. Technical Support is technical staff typically placed in an "Associate", "Senior", or "Principal" position. Described below are three major activities for Technical Support:

1 Review of Planning Documents (see Figure A2) — Technical Support is available to assist staff members when necessary. Technical Support is available upon request from staff level personnel, Unit Supervisor or Section Manager, and will review and comment on the submitted planning documents with regards to QA Program Plan requirements, project goals and DQO's.

2. Development of DQOs — An initial scoping session may be held with all available stakeholders to outline project goals and DQOs prior to the preparation of planning documents by the Facility/Responsible Party/Property Owner or its contractor. These initial meetings will roughly follow EPA's 2006 ***Guidance on Systematic Planning using the Data Quality Objectives Planning Process*** for guidance on the standard DQO process. The results of these initial meetings will guide the development of the project-specific planning documents.

3. Review of Data Reports (see Figure A2) — Technical Support will be available to assist the various staff level personnel when necessary. Technical Support is available upon request by staff level personnel, the Unit Supervisor, or the Section Manager. Technical Support will review submittals generated under planning documents with regards to QA Program Plan requirements, project goals, and DQO's.

On the infrequent occasions when ADEQ staff collects samples and has them analyzed by an ADHS approved laboratory (i.e. during split sampling events), the Technical Support person is available to assist the various staff level personnel when necessary. The Technical Support person, upon request from the staff level personnel, Unit Supervisor or Section Manager, will review this data with regards to QA Program Plan requirements, sampling goals and DQO's.

When requested by the staff level personnel, the Unit Supervisor, or the Section Manager, Technical Support will prepare comments for revision of the data reports.

QA/QC Manager or QA/QC Representatives:

QA/QC Manager or QA/QC Representatives provides assessment of ADEQ's UST Program activities through the processes listed below:

- Technical System Audits
- Performance Evaluations
- Audits of Data Quality

- Data Quality Assessments

Please see Section C1.2.2 – Assessment of Program Activities for specific details on these processes. The QA/QC Manager or QA/QC Representatives also reviews and can revise the QA Program Plan. An update of the QA Program Plan can accommodate new developments in QA/QC. Revisions to the QA Program Plan may become necessary through several different routes, and the QA/QC Manager or QA/QC Representatives will be responsible for responding and making these revisions when appropriate. For example, the EPA QA Officer may make quality performance improvement suggestions that necessitate a change to the QA Program Plan. During a Technical System Audit (TSA), the QA/QC Manager or QA/QC Representatives will examine the QA Program Plan and the performance of ADEQ's UST Program and may make suggestions for improved performance that result in revisions to the QA Program Plan.

The QA/QC Manager or QA/QC Representatives is not routinely involved with the day-to-day activities of ADEQ's UST Program. The QA/QC Manager or QA/QC Representatives does not routinely participate in any of the planning phases of a project, nor is the QA/QC Manager or QA/QC Representatives involved in the review/approval of submitted documents. The QA/QC Manager or QA/QC Representatives may assist in the review of data when requested.

Underground Storage Tank Facility Owner/Operators
As primary data generators, the UST Facility Owner/Operators – either directly or through their contractors - are responsible for the implementation and documentation of a number of QC elements, such as collection and analysis of field blanks, field duplicates and rinsate samples, to satisfy the requirements of the QA Program Plan. Please note that Section B.5 of this QA Program Plan discusses Quality Control in detail. Owner/Operators are responsible for the timely submittal of all required planning documents and reports listed in Figure A2.

Please note: Facility Owner/Operators and Property Owners rarely employ staff that are qualified to satisfy the requirements of a QA Program Plan and, therefore, hire contractors to generate environmental data. Also, a certified Arizona Board of Technical Registration registrant of an appropriate discipline must seal all documents requiring professional judgment.

A4.2 Planning and Reporting Documentation

Sampling activities conducted or overseen by ADEQ's UST Program personnel will be associated with those planning document or reports identified in Figure A2. Those activities will occur within a framework that is well-defined by specific documentation requirements. Figure A2 describes a coordinated flow path for the submittal and review of documents that describe sampling activities. Therefore, each defined document will play a role in establishing QC elements to ensure the production of a usable, reliable final product.

Outlined below are descriptions of planning documents and reports associated with ADEQ's UST Program. The descriptions are in an order that follows a projects life cycle. For instance, a typical ADEQ UST Program environmental project life cycle is as follows: UST system closure, Baseline Assessment or

release discovery → site investigation → remedial activities → case closure. The reports listed below are those reports that are necessary for decision making at different phases of the life cycle.

Section B9: Non-direct Measurements of this Quality Assurance Program Plan explains the documentation and use of previously generated data. Later sections will discuss other documentation issues, particularly the development of audits.

A4.2.1 Planning Documents and Reports

The following describes documents and reports for ADEQ's UST Program:

Planning Documents

The four types of ADEQ UST Program planning documents - Baseline Assessment Work Plan, Preapproval Work Plan, Corrective Action Plan and Task Assignment Offer - are primary planning documents for sampling activities prepared by the UST facility or its contractor or a State Lead Unit contractor. Detailed below are the functions of the four different planning documents:

a. The primary function of a **Baseline Assessment Work Plan** is to provide a description of proposed work, a description of known site conditions, and a plan for conducting the work to assist in identifying releases at likely release areas. It provides for collection of sufficient information to allow assessment of current environmental conditions at the property with respect to UST releases. This Baseline Assessment Work Plan is a non corrective actions work plan - it investigates whether or not a release has occurred at a facility. This Baseline Assessment Work Plan differs from the other planning documents in that other planning documents address actions for confirmed releases. The Baseline Assessment Work Plan must meet all requirements outlined in ARS § 49-1052. The Baseline Assessment Work Plan must be submitted to the department for review and approval per ARS § 49-1052(B). Primary responsibility for review of Baseline Assessment Work Plans resides with the UST-LUST Section.

b. The primary function of a **Preapproval Work Plan** is to provide a description of proposed work, a description of known site conditions, and a plan for conducting the work to address a confirmed release(s). It provides for a collection of sufficient information to allow for determining the full extent of contamination, remedial progress, and/or satisfaction of LUST case closure requirements. The Preapproval Work Plan requirements must meet all of the requirements outlined in ARS § 49-1051. The Preapproval Work Plan must be submitted to ADEQ for review and approval per ARS § 49-1051. Primary responsibility for review of a Preapproval Work Plan resides with the UST-LUST Section or a designated contractor to ADEQ.

c. The primary function of a **Corrective Action Plan** is to address remediation of characterized UST releases where contamination is above regulatory cleanup thresholds. It includes a collection of sufficient information to allow for determining remedial progress and satisfaction of LUST case closure requirements. A Corrective Action Plan is a required document for releases that have one or more of the conditions listed in AAC R18-12-263(D). A Corrective Action Plan differs from a Preapproval Work Plan in that a Preapproval Work Plan can address characterization as well as remediation. ADEQ, per AAC R18-12-263.02, requires submittal of a Corrective Action

Plan for review and approval. Primary responsibility for review of Corrective Action Plans resides with the UST-LUST Section.

d. The primary function of a **Task Order Offer** (TOO) function is to address corrective actions for confirmed releases. Functions also include UST system removals and Baseline Assessments. A TOO includes a collection of sufficient information to allow for determining the full extent of contamination, remedial progress, and/or satisfaction of LUST case closure requirements. The SLU (see Section A4.1.2) of the UST-LUST Section is responsible for reviewing this planning document and oversight of the selected contractor performing corrective actions outlined in the TOO. The SLU performs corrective actions at releases where the requirements of ARS § 49-1017 are met – mainly orphan sites and sites where the owner or operator is financially or technically incapable of performing corrective actions.

Reports

A UST facility or its contractor or a SLU contractor prepare ADEQ UST Program reports that contain data derived from field efforts. Detailed below are descriptions of the eight required reports associated with UST systems:

a. The major function of a **Baseline Assessment Report** is to provide information on undocumented releases at a site. A Baseline Assessment Report details laboratory analytical results derived from sampling efforts at the most likely release areas from a UST system. The media sampled includes soil, groundwater, soil vapor, and/or soil vapor or groundwater found in preferential pathways, such as utility corridors. The sampling results will indicate if there is an undocumented release to the environment. Primary responsibility for review of a Baseline Assessment Report resides with the UST-LUST Section.

b. The major function of a **90-day report for a suspected release** (AAC R18-12-251(F)) is to provide information on suspected releases at a site. A 90-day report details laboratory analytical results from a site check's sampling efforts. This report is similar to a Baseline Assessment Report, but sampling is normally limited to problem areas identified from tank tightness test results or during inspections. If laboratory analytical results indicate a release to the environment, the corrective action process (i.e. notification to investigations to remediation to closure) commences. The laboratory analytical results are part of the 14-day report required by AAC R18-12-260(C). Primary responsibility for review of the 90-day report resides with the UST-LUST Section (SLU and TICE unit).

c. The major function of a **UST Closure Report** is to provide information on environmental samples collected at a site during UST closure activities. A UST Closure Report details laboratory analytical results of samples collected during the closure of a UST system. AAC R18-12-272 details required sampling for UST closures. If laboratory analytical results indicate a release to the environment, the corrective action process (i.e. notification to investigations to remediation to closure) commences. Primary responsibility for review of the 90-day report resides with the UST-LUST Section (SIRU, SLU, and TICE unit).

d. The major function of a **14-day report** is to provide information from any activities that occurred since release discovery. A 14-day report documents any laboratory analytical results collected

since release discovery. Primary responsibility for review of a 14-Day Report resides with the UST-LUST Section (SIRU and TICE unit).

e. The major function of a **90-day report for a confirmed release** (AAC R18-12-261(D)) is to provide information from any activities that occurred since release discovery. A 90-day report documents the laboratory analytical results of samples analyzed and received since release discovery. Depending on risk to human health and the environment as indicated by the sample results and other reportable items, a Corrective Action Plan may be required at this time. Primary responsibility for review of a 90-day report resides with the UST-LUST Section (SIRU and SLU).

f. The major function of a **LUST Site Characterization Report** (AAC R18-12-2672(D)) is to provide a characterization of the full extent and distribution of all chemicals of concern within each contaminated media resulting from a UST release. A LUST Site Characterization Report documents laboratory analytical results that assist in determining the full extent and distribution of all chemicals of concern within each contaminated media. Depending on the risk to human health and the environment as indicated by the sample results and other reportable items, a Corrective Action Plan may be required at this time. Primary responsibility for review of a LUST Site Characterization Report resides with the UST-LUST Section (SIRU and SLU).

g. The major function of a **Periodic Site Status Report** (AAC R18-12-263(G)) is to provide information from any activities that occurred since the previous reporting period. A Periodic Site Status Report documents laboratory analytical results from samples collected since the last report. Periodic Site Status Reports submittals are required after approval of a LUST Site Characterization. Periodic Site Status Report submittals are required until ADEQ approves a LUST Case Closure Report. Primary responsibility for review of a Periodic Site Status Report resides with the UST-LUST Section (SIRU and SLU).

h. The major function of a **Corrective Action Completion Report** (AAC R18-12-263.03) is to demonstrate that there is no unacceptable risk to human health and the environment due to a release(s) at a UST facility. The Corrective Action Completion Report documents laboratory analytical results from samples necessary to demonstrate a release meets LUST case closure requirements. Primary responsibility for review of a Corrective Action Completion Report resides with the UST-LUST Section (SIRU and SLU).

Supporting documentation relevant to data generation and data quality must be attached to the final report, both in a hard-copy and electronic format. Generally, the report has all field documentation attached in a hard-copy format. Also, the report has a copy of all laboratory data packages attached in hard-copy format.

The documentation of all environmental data collection activities must meet the following minimum requirements:

- Documentation of data must be direct, prompt, and legible. All reported data must be uniquely traceable to the raw data. Documentation of all data reduction formulas must occur.

- All original data records include, as appropriate, a description of the data collected, units of measurement, unique sample identification, station or location identification (if applicable), name (signature or initials) of the person collecting the data, and date of data collection.
- Any changes to the original (raw data) entry must not obscure the original entry. The person making the change must document the rationale and initial and date the change.

In addition, EPA's 2007 ***Guidance for Preparation of Standard Operating Procedures for Quality-Related Operations*** is a guidance for developing SOPs for data collection. SOPs should be included as an appendix of all planning documents and reports (see Figure A2) submitted to ADEQ's UST Program. Any QA/QC reports (see Sections C2.2 and C2.3), if produced, should be included as an appendix of all planning documents and reports submitted to ADEQ's UST Program. The field team – ADEQ staff, ADEQ contractors, or Owner/Operator contractors - should document the rationale for any deviations from an SOP and include that documentation in all planning documents and reports submitted to ADEQ's UST Program.

A4.2.2 Planning Documentation and Report Approval

After review of planning document, report, and/or comments received during any required public comment period, ADEQ UST Program staff level personnel will take one of two actions through written correspondence to the responsible party. These actions are:

a. If the planning document or report is fully satisfactory, Staff Level personnel will draft an approval letter for review. The Unit Supervisor is responsible for Final Approval of the letter.

b. Where there are deficiencies in a Planning Document or Report, Staff Level Personnel will draft a comment letter, indicating the plan deficiencies and suggesting corrections for re-drafting of the plan. The Unit Supervisor will issue Final Approval to the comment letter. Technical Support is available at all stages of the process for consult.

For a TOO planning document, SLU personnel receives TOOs from different contractors bidding on the ADEQ solicitation. The SLU reviews the TOOs and give recommendations to the ADEQ Contracts and Procurement Section. The ADEQ Contracts and Procurement Section selects a contractor partly based on the SLU recommendations

Figure A2 details the review process for submitted planning documents and reports within ADEQ's UST Program.

During the review process, a facility is welcome to request a technical assistance meeting between ADEQ's UST Program personnel, and, if desired, the contractors involved with the project to further discuss any deficiencies in any of the planning documents or reports.

A4.2.3 Field Documentation

Though largely discussed elsewhere in this document, the environmental consultant is required to maintain certain levels of field documentation to help demonstrate compliance with approved methods and assist reviewers in making QA/QC conclusions. Examples of required field documentation can

include field logs, monitoring well sampling logs and chain-of-custody forms for environmental samples. Requests for field documentation and the analytical laboratory data package are part of the independent data validation. Submittal of hard copy field documentation is part of the required report.

A4.2.4 Laboratory Analytical Package

A detailed data package produced by the analytical laboratory allows for review of analytical methods through data verification and validation processes and to determine appropriateness of data quality. Other sections of this QA Program Plan discuss the specific content requirements for laboratory data packages. The laboratory data package can be in an electronic format, with the exception of the chain of custody forms and the laboratory analytical sheets, which should be included in hard-copy format.

Typical data packages include the following information (also listed in Table D1 of this plan):

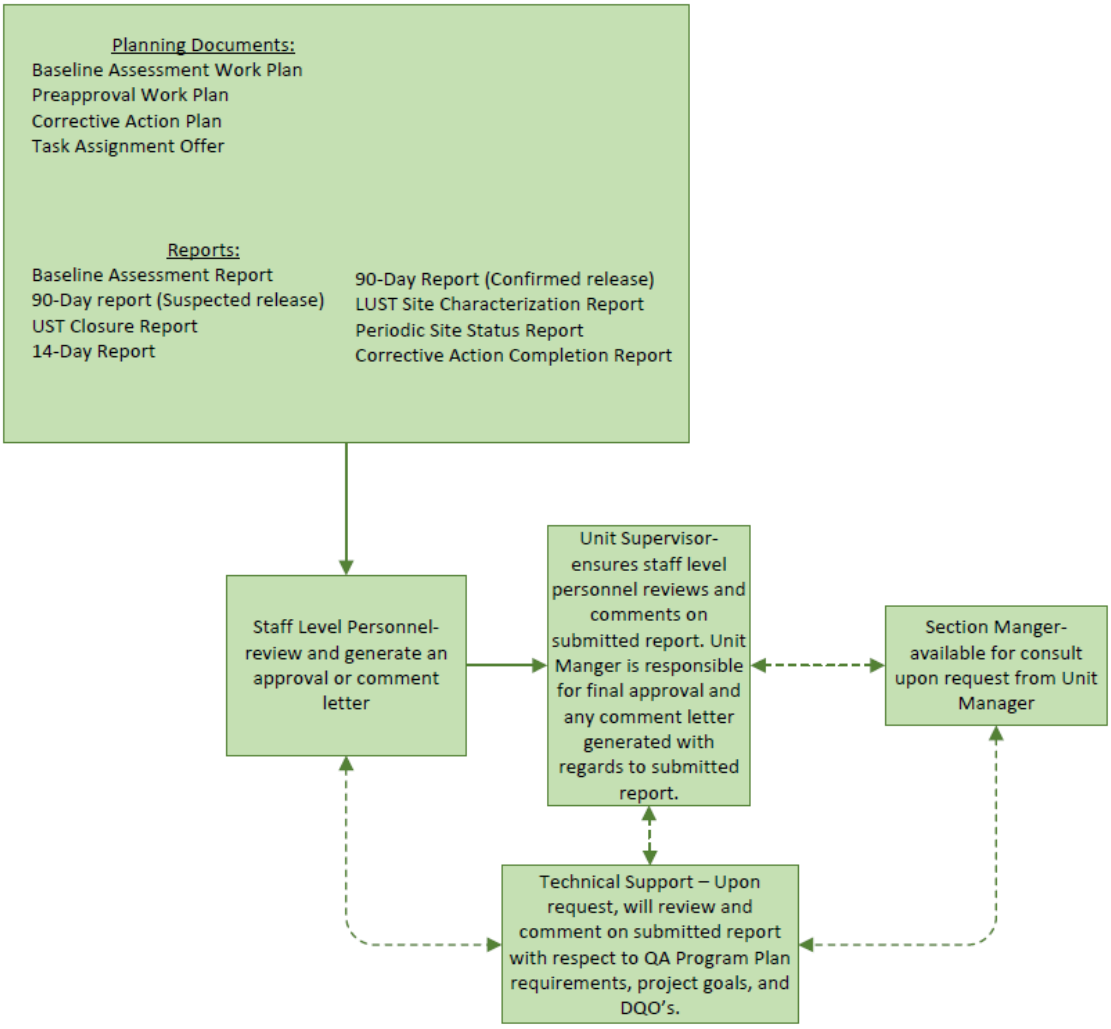
- Holding times
- Calibration
- Blanks
- Surrogate recovery
- Matrix spike and matrix spike duplicate recovery
- Laboratory control sample or blank spike
- Internal standard performance
- Field duplicate sample analysis
- Temperature
- Overall assessment of data for an SDG

A5: Problem Definition/Background

The ADEQ UST Program administers RCRA Subtitle I requirements for underground storage tanks through Arizona's Revised Statutes and Administrative Code. The Subtitle I regulations establish a system for installation, operation and closure of UST systems in addition to detecting, investigating and performing corrective actions of released substances from UST systems. In practical terms, this means regulating a large number of UST systems. In administering RCRA Subtitle I, ADEQ's UST Program also:

- Conducts compliance and complaint inspections to ensure that UST systems are safely managed and properly managed;
- Tracks UST system registrations and registration fees.

Figure A2: Submitted Document Review Process



A6: Program/Task Description

Please see Sections A.4.1.2 (Staff Level Personnel ADEQ UST Program), A4.2 and A5 for details on the ADEQ's UST Program and Task Descriptions.

A7: Quality Objectives and Criteria for Measurement

This section is broken into two parts, consistent with EPA Region 9 guidance for QA Program Plans. The

first section documents regulatory levels that are specific to the ADEQ; these regulatory levels serve as the driver for site assessments and cleanup. The second section discusses MQOs and data quality indicators (DQIs) under ADEQ's UST Program.

DQIs, as defined by EPA, involve precision, accuracy, representativeness, completeness, comparability, and sensitivity, also known as "PARCCS" parameters. Utilization of DQIs is part of the data evaluation processes. In general, project data quality needs (i.e. measurement quality objectives (MQOs)) determine PARCCS parameters. The extent to which program or project QC results meets MQOs determines whether data are acceptable for the intended use.

MQOs are the acceptance thresholds or goals for project data, usually based on the individual DQIs for each matrix and analyte group or analyte. MQOs are project-or method-specific quality acceptance criteria established to support project-specific DQOs, as well as decisions made based on the quality of the data. MQOs define whether the data are usable and meet project needs. Like DQOs, MQOs can be quantitative or qualitative statements.

MQOs specify what the QC acceptance criteria are for each analysis. AAC R9-14-615 (see Appendix A) details QA requirements for ADHS licensed laboratories. Regardless of how the laboratory evaluates performance, the laboratory's acceptance criteria must meet the needs of each project. This QA Program Plan provides general requirements, but individual planning documents (see A4.2 Planning and Reporting Documentation) will provide project-or site-specific requirements. Tables A1 through A3 are examples of the QC data from laboratories ADEQ typically receives.

Compound (Laboratory Method - EPA Method 8260B)	Matrix Spike (% Recovery Limits) Matrix Spike Duplicate (Relative % Difference)	Laboratory Control Sample (% Recovery Limits) Laboratory Control Sample Duplicate (Relative % Difference)	Method Blank Result (µg/l) Method Detection Limit (µg/l)	Surrogates (% Recovery Limits)
Benzene	68-131 32	68-130 20	ND 2.0	
Carbon Tetrachloride	65-147 35	60-150 25	ND 5.0	
PCE	67-131 31	70-130 20	ND 2.0	
TCE	66-132 29	70-130 20	ND 2.0	
Dibromofluoromethane				70-130
Toluene				70-130
4-Bromorfluorobenzene				70-130

PCE: tetrachloroethylene
TCE: trichloroethylene
ND: non-detect
µg/L: micrograms per liter
%: percent

Table A1. Typical QC data from laboratories. This is an example for water samples using EPA Method 8260B.

Compound (Laboratory Method - EPA Method 8310)	**Matrix Spike (% Recovery Limits)** **Matrix Spike Duplicate (Relative % Difference)**	**Laboratory Control Sample (% Recovery Limits)** **Laboratory Control Sample Duplicate (Relative % Difference)**	**Method Blank Result (mg/l)** **Reporting Limit (mg/l)**
Naphthalene	10-143	38-126	ND
	50	18	0.20
Benzo[a]pyrene	18-134	48-137	ND
	50	32	0.010
Chrysene	23-136	69-128	ND
	50	31	0.020
Dibenz[a,h]anthracene	21-137	73-130	ND
	49	31	0.010
Surrogate % Recovery Limits	2-Chloroanthracene 18-128	2-Chloroanthracene 62-124	2-Chloroanthracene 18 -128

mg/L: milligrams per liter
%: percent

Table A2. Typical QC data from laboratories. This is an example for soil samples using EPA Method 8310.

Compound (Laboratory Method 8081AZ)	**Matrix Spike (% Recovery Limits)** **Matrix Spike Duplicate (Relative % Difference)**	**Laboratory Control Sample (% Recovery Limits)** **Laboratory Control Sample Duplicate (Relative % Difference)**	**Method Blank Result (µg/l)** **Method Detection Limit (µg/l)**
4,4-DDT	10-161	61-126	ND
	20%	35%	0.007
Aldrin	10-143	43-120	ND
	20%	33%	0.009
Endrin	10-147	67-122	ND
	20%	35%	0.007
Heptachlor	10-157	51-124	ND
	20%	33%	0.008
Surrogate % Recovery Limits	Decachlorobiphen 10 -103%		
Surrogate % Recovery Limits	TCMX(S) 10-132%		

µg/L: micrograms per liter
%: percent

Table A3. Typical QC data from laboratories. This is an example for water samples using EPA Method 8081A.

A7.1 Regulatory Levels

The ADEQ has authority to require owners and operators to conduct corrective/remedial actions at the site of a release. A remedial action is defined at ARS § 49-281 and a corrective action is defined at ARS § 49-1001 and described at ARS § 49-1005. The terms are similar in that each refers to actions intended to stop, minimize and mitigate damage to the public health and the environment. Therefore, ADEQ has the authority to set regulatory levels for soil, groundwater and surface water.

Discussed below are two areas of Arizona's regulations. These two areas are (1) the release reporting regulations, which govern the initiation of corrective actions, and (2) the establishment of regulatory levels specific to site media.

A7.1.1 ADEQ Release Reporting Regulations

The State of Arizona has adopted regulations that govern the reporting of releases of pollutants, contaminants, petroleum products and hazardous substances. These regulations are contained in the AAC Title 18. Specifically, the regulations for release notification and reporting for ADEQ's UST Program is located in AA.C. Title 18, Chapter 12, Article 2 (see R18-12-260). The enabling authority for these regulations is contained in several statutes adopted by the Arizona Legislature. Title 49 – The Environment of the Arizona Revised Statutes (ARS) - contains provisions for the regulation of Water Quality, Air Quality, Solid Waste Management, Hazardous Waste Disposal and Underground Storage Tanks.

These enabling authorities allow Arizona to adopt reporting requirements that would be protective of state water resources and would also be consistent with federal hazardous waste requirements. The model for the State release reporting regulations comes from two federal sources: (1) reportable quantities of hazardous substance as contained in CERCLA and (2) reportable quantities of petroleum product described in RCRA Subchapter IX.

A7.1.2 Establishment of Media-Specific Regulatory Levels

The ADEQ has authority to require owners and operators to conduct corrective/remedial actions at the site of a release. A remedial action is defined at ARS § 49-281 and a corrective action is defined at ARS § 49-1001. The terms are similar in that each refers to actions intended to stop, minimize and mitigate damage to the public health and the environment. Therefore, ADEQ has the authority to set regulatory levels for soil, groundwater and surface water.

Remediation Standards for Soils
AAC Title 18, Chapter 7 Article 2 (Soil Remediation Standards) establishes remediation standards for soils. ADEQ has three standards for soil: Background, Pre-determined and Site Specific. Appendix D contains the weblink for Arizona's Soil Remediation Standards rule which details how each standard is established. The weblink for Soil Remediation Standards is http://www.azsos.gov/public_services/Title_18/18-07.htm. Appendix B also contains a table that list regulatory levels for chemicals found in common petroleum products.

Water Quality Standards for Groundwater and Surface Water
AAC Title 18, Chapter 11 (Water Quality Standards) establishes remediation standards for groundwater and surface water. Articles 1 and 4 establish water quality standards for surface water and aquifer water, respectively. Appendix D contains the weblink for Arizona's Water Quality Standards rule. The weblink for Water Quality Standards is http://www.azsos.gov/public_services/Title_18/18-11.htm. Appendix B also contains a table that list regulatory levels for chemicals found in common petroleum products.

Please note that for those chemicals that do not have an established Aquifer Water Quality Standard, the Narrative Aquifer Water Quality Standards (AAC R18-11-405) apply.

A7.2 Measurement Quality Objectives and Data Quality Indicators

Analysis involves the characterization of samples based on chemical and/or physical properties. Analyses result in generating raw data from instrumental analysis, chemical analysis, or physical testing. The analytical methods used will be specific, sensitive enough to answer the question posed by the UST Program objectives and meet the data quality goals associated with those objectives.

MQOs are the project or program QC criteria defined for various data quality indicators (DQIs). During the planning phase, these set pre-determined limits on the acceptability of the data in regards to accuracy /bias, and precision, completeness and sensitivity.

ADEQ Project Managers may consult with the ADEQ QA/QC Manager or QA/QC Representatives, or research a variety of published or written materials, to aid them in selecting or developing measurement technologies. The ADEQ QA/QC Manager or QA/QC Representatives shall maintain a file of in-house procedures and practices used in the measurement process. ADEQ's QA/QC Manager or QA/QC Representatives use DQO's and professional knowledge to identify appropriate analytical procedures.

DQIs, as defined by EPA, involve precision, accuracy, representativeness, completeness, comparability, and sensitivity, also known as "PARCCS" parameters. Utilization of DQIs is part of the data evaluation processes. In general, project data quality needs (i.e. the MQOs) determine PARCCS parameters. The extent to which program or project QC results meets MQOs determines whether data are acceptable for the intended use.

Each DQI helps interpret and assess specific data quality needs for each sample medium/matrix and for each associated analytical operation. The following summaries contain a description of each DQI along with a brief summary of information, related to assessing each DQI:

<u>Precision</u>
Precision is the degree of agreement among repeated measurements of the same parameter under the same or similar conditions. Reporting precision as either relative percent difference (RPD) or relative standard deviation (RSD) depends on the end use of the data. Collection and analysis of field duplicate samples assists in assessing field precision. Laboratory matrix spike/matrix spike duplicate (MS/MSD) analyses is the basis for laboratory precision.

<u>Accuracy</u>
Accuracy is the extent of agreement between an observed or measured value and the accepted reference, or true, value of the parameter. For example, the objective for accuracy of the field sample collection procedures is to ensure that samples stay unaffected by sources external to the sample, such as sample contamination by ambient conditions or inadequate equipment decontamination procedures. Evaluating the results of equipment blank samples for contamination is an assessment of sampling accuracy. Pervasive contamination found in equipment blank results will prompt further investigation or reanalysis of samples. Laboratories assess accuracy by determining percent recoveries from the analysis of laboratory control samples (LCSs) or standard reference materials.

Representativeness
Representativeness is a qualitative term that describes the extent to which a sampling design adequately reflects the environmental conditions of the site. It also reflects the ability of the sample team to collect samples and laboratory personnel to analyze those samples in such manners that the data generated accurately and precisely reflect the conditions at the site.

Completeness
Completeness is the measure of the quantity of valid data obtained from a measurement system compared to the quantity expected under normal conditions. While a completeness goal of 100 percent (%) is desirable, achieving an overall completeness goal of 90% is more realistic under normal field sampling and laboratory analysis conditions.

Comparability
Comparability is a confidence measure of comparisons between data sets. The ability to compare data sets is particularly critical when comparing a set of data for a specific parameter to historical data for the purpose of determining trends. Ensuring adherence to property-specific Site Assessment Plans and properly handling and analyzing all samples will satisfy the comparability of field data.

Sensitivity
Sensitivity is the ability of a method or instrument to detect a parameter at a specific measured level of interest. For example, the sensitivity measurements of the field instruments that measure temperature, pH, conductivity, and turbidity of groundwater occurs by analyzing calibration check solutions, where appropriate, that equate to the lower end of the expected concentration range.

Sensitivity relates to the reporting limit. In this context, sensitivity refers to the capability of a method or instrument to detect a given analyte at a given concentration and reliably quantitate the analyte at that concentration. The investigator should be concerned that the instrument or method can detect and provide an accurate analyte concentration that is not greater than an applicable standard and/or screening level. Analytical results for samples that are non-detect for a particular analyte that have reporting limits greater than the applicable cleanup standards and/or screening levels cannot be used to demonstrate compliance with the applicable cleanup standards and/or screening levels.

The issue of analytical sensitivity may be one of the most difficult to address as it pertains to data usability evaluations. Samples contaminated with sufficient quantity of material may require diluting prior to laboratory analysis. Dilution is a leading cause of reporting limits exceeding applicable criteria. However, there may be instances where such exceedances are insignificant relative to the site specific DQOs. As an example, the project may be on-going and/or other compounds are “driving” the cleanup such that not meeting applicable criteria for all compounds at that particular juncture is not an issue.

A8: Special Training/Certification

A8.1 Responsibilities

ADEQ’s Unit Supervisors are responsible for ensuring each staff member involved with collecting or analyzing environmental data has the necessary technical, quality assurance, and project management

training required for his or her assigned tasks and functions. Section Managers are also responsible for ensuring that technical staff maintains the necessary level of proficiency to effectively meet ADEQ's QA/QC responsibilities. ADEQ's QA/QC Manager or QA/QC Representatives will serve as the Agency resource for arranging for, and assisting in, defining QA/QC training needs on a regular basis to update Program staff with developing QA/QC issues.

A8.2 Identification of Training Needs

Core training will be coordinated through the QA/QC Manager or QA/QC Representatives in conjunction with various Division supervisory personnel. Intermediate and advanced skill training will be arranged when the appropriate Agency staff identify the need. The QA/QC Manager or QA/QC Representatives, in conjunction with Program management, will identify continuing professional training requirements and address those requirements utilizing external resources for the latest technological advances and evolution in industry standards.

A8.3 Implementation of Training Requirements

ADEQ staff members are encouraged by their managers/supervisors to draw upon their educational background, experience, technical training, and on-the-job training to enhance their understanding and performance of QA-related procedures.

ADEQ's training program will offer, or arrange for through a third-party vendor, courses on the following subject matter on a schedule and frequency suited to meet the needs of ADEQ's staff with QA responsibilities:

- An Orientation to Quality Assurance Management
- Establishing Data Quality Objectives
- How to Perform a Preliminary Data Review
- Public and Confidential Records Management

In house QA training will be provided to the appropriate UST Section staff by senior technical staff. The senior technical staff has extensive experience with EPA's QA/QC program which includes the attendance of EPA training courses. In addition, they will be encouraged to attend meetings and seminars, and to take formal training, in accordance with ADEQ's training policy, to enhance their understanding of Program specific QA requirements within the Programs they work. ADEQ's QA/QC Manager or QA/QC Representatives will maintain a record of all QA training taken by staff and managers responsible for environmental data generation. In addition, all planning documents and reports listed in Figure A2 are required (AAC R18-12-264) to have an Arizona Professional Registrant's signature and seal.

A9: Documents and Records

A9.1 QA Program Plan Revisions

Throughout the life of ADEQ's UST Program, there may be changes to program requirements, or modifications to the way environmental data are collected, or changes to the definitions of enforcement activities. Therefore, this QA Program Plan is a dynamic document that is subject to revision, as needed. ADEQ UST Program personnel, Technical Support and QA/QC personnel will examine and revise this QA Program Plan on an as needed basis. Re-submittal of this plan to the EPA Region 9 QA manager for review, though, will occur once every five years or as otherwise needed. Dissemination of approved revisions include personnel on the Distribution List (page 6).

A9.2 Environmental Data Documentation

This QA Program Plan and referenced policy, guidance, and SOPs include written procedures for all methods and procedures related to the collection, processing, analysis, reporting, and tracking of environmental data. All data generated for and submitted to ADEQ's UST Program, including data from split sampling and inspections, must be of sufficient quality to withstand challenges to their validity, accuracy and legibility. To meet this objective, standardized formats and prescribed procedures are utilized. The documentation of all environmental data collection activities must meet the following minimum requirements:

- Document data directly, promptly, and legibly. All reported data must be uniquely traceable to the raw data. Document all data reduction formulas.
- All original data records include, as appropriate, a description of the data collected, units of measurement, unique sample identification, station or location identification (if applicable), name (signature or initials) of the person collecting the data, and date of data collection.
- Any changes to the original (raw data) entry must not obscure the original entry. Document the reason for the change. The person making the change initials and dates the change.

Discussions of other specific documentation requirements are throughout this QA Program Plan and referenced SOPs.

A9.2.1 Field Documentation and Forms

Completion of appropriate field documentation and forms for each sample is the responsibility of the field personnel. Field personnel accomplish the following: 1) maintain records for each field activity to ensure that samples and data are traceable and defensible; 2) document field records on field forms or in designated field logbooks to provide a secure record of field activities, observations and measurements during sampling; and 3) record field data and observations in real time on activity-specific data forms. Section "B5.1 – Quality Control in the Field" provides a more complete description of the types of recorded field information.

A9.2.2 Project Files

ADEQ's UST Program personnel are responsible for the maintenance of the project file. The project file will consist of all site documents specifically listed in Section A4.2 of this QA Program Plan. Additionally, ADEQ's UST Program personnel will collect and include in the project file all other relevant project documentation in the file. These additional documents may include any official correspondence that does not correspond to any of those previously listed documents. The project file will also include all information not related to data generation, including documentation of all public involvement or community notification efforts.

A9.3 Routine Records Management Quality Assurance

ADEQ Records Management Process addresses the system employed by the Agency for handling documents. This plan outlines the roles and responsibilities for management and staff concerning chain of custody procedures and records management.

ADEQ document control procedures require that documents generated, or obtained, by Agency personnel are accounted for when a project is completed. ADEQ's Records Management System dictates the procedures for checking-in and checking-out files for ADEQ staff, external clients, and the public.

ADEQ managers/supervisors/directors ensure achievement that the objectives of the Records Management Process. These objectives include the following:

- Prevent the creation of unnecessary records in any media;
- Promote the continuous development of filing systems and structures that allow for the efficient organization, maintenance, and retrieval of records;
- Ensure that records of continuing value are preserved, but that valueless or noncurrent information is disposed of or transferred to storage in a timely manner in accordance with ADEQ and/or ADHS records retention requirements;
- Ensure that the acquisition and use of all direct paper to microform systems and equipment, or electronic digital imaging, are technically feasible, cost-effective, and most importantly, satisfy Program needs;
- Preserve and protect information that is vital to the essential functions or mission of the organization. Preserve and protect information that is essential to the legal rights and interests of individual citizens and the government.

GROUP B: DATA GENERATION AND ACQUISITION

B1: Sampling Design/Experimental Design

ADEQ's UST Program conduct initial site investigations to determine if site media are contaminated. Further investigations follow to determine characteristics of the contamination if the initial phase of the investigation finds evidence of contamination. Characterization includes evaluating the threat posed by the contamination and determining potential solutions for cleanup of the contamination. This QA Program Plan documents the planning, implementation, and assessment procedures for data generated for and submitted to ADEQ's UST Program. It describes specific applications of QA and QC activities throughout the course of investigations and cleanup.

An ADEQ UST Program site investigation routinely involves one or more of the following activities: a background investigation on the history of site use, a field investigation that includes sample collection and analysis, an evaluation of cleanup options and costs and an assessment of the usability of resulting data. Typically, the first step is to conduct an investigation of site history to identify past uses of the property, including types and amounts of chemicals that may have been used onsite and any disposal activities that may have contributed to contamination.

This QA Program Plan includes requirements for measurements collected for a typical facility. The conceptual site model (CSM) largely dictates the specific design and extent of a facility site investigation, resource needs, and the required level of data quality and QC. Planning documents outline and describe project-specific DQOs and sampling design.

The following sections describe the sampling and analysis requirements under the UST Program. Site-specific information required in planning documents includes the number and location of samples, types of samples to be collected, measurement parameters, sampling frequencies, design of sampling networks for monitoring and the time period over which sampling activities are to occur. Review and approval by ADEQ UST Program personnel is required for all project-specific planning documents. *In addition, Arizona Administrative Code requires Owner/Operators and any ADEQ led projects to document sampling events, including split samples and samples of opportunity, in the subsequent required report (e.g. R18-12-262(D)(7) and R18-12-263(G)(3)).*

Section B5.1 has additional discussion on sampling and equipment decontamination procedures.

B1.1 Sampling Design

A sampling design specifies the number and location of samples collected at a site. Study objectives guide sampling design strategies. Sampling design strategies should factor in the conditions unique to the site, including data gaps in the CSM, exposure potential, projected site reuse, and available resources. As noted above, identification of sampling design strategies occurs during the systematic planning process and the project-specific planning document contains descriptions of the sampling design strategy.

Typical designs for the collection of samples at UST Program sites include biased sampling, statistically based sampling, one-time events, and ongoing (multi-phase) events. Biased sampling specifies sampling

locations based on the judgment of the field team leader and sampling plan designer. Statistically based sampling designs use random or systematic sampling locations designed to avoid bias, as with sampling of stockpiled soils, when determining background concentrations of metals in soil, or determining site specific remediation standards for soil.

A key distinction in sampling design is between judgmental sampling (also called authoritative or biased sampling), in which sample numbers and locations are selected based on expert knowledge of the problem, and probability-based sampling, in which sample numbers and locations are selected based on randomization and each member of the target population has a known probability of being included in the sample. Judgmental sampling has advantages for UST Program investigations and is used in all UST Program sampling except when the objectives of the investigation are of a statistical nature as in those instances mentioned in the above paragraph.

Probabilistic sampling typically takes more effort to implement than judgmental sampling. However, a probability-based sampling design has the advantage of allowing the use of statistical tests, which permit specification of confidence and uncertainty of the results. Probability-based designs do not preclude the use of expert knowledge or the use of existing data to establish the sampling design. An efficient sampling design is one that uses all available prior information to stratify the site (in order to improve the representativeness of the resulting samples) and set appropriate parameters. Common types of probabilistic sampling designs include simple random, stratified, systematic and grid, composite, and others. Section 2 of EPA's 2002 ***Guidance on Choosing a Sampling Design for Environmental Data Collection*** explains the difference between these types of probabilistic sampling designs.;

Please note that a single sampling event may not provide an adequate characterization of the contamination onsite, especially when the CSM contains significant data gaps. In these situations multi-event sampling may be helpful. The systematic planning process should help identify the need for this sort of investigation.

Additional information on the development of sampling strategies is available in ADEQ's 2014 ***Site Investigation Guidance Manual***, EPA's 2002 ***Guidance on Choosing a Sampling Design for Environmental Data Collection***, EPA's 2006 ***Guidance on Systematic Planning Using the Data Quality Objectives Process***, and EPA's 2007 ***Guidance for Developing Standard Operating Procedures***.

B1.1.1 Sample Types and Matrices

Sample types typically include surface soil, subsurface soil, groundwater and surface water. Some sites require sampling of sediment, pore water, sludge, air (soil gas or vapors) and other non-routine matrices such as building materials. Samples collected can be discrete (grab) or, although infrequently for UST systems, composite samples for background analysis of metals and stockpiled soil. Discrete samples are useful for identifying and quantifying chemicals in areas of a site where there is suspected contamination. The number of discrete samples should be determined during the systematic planning process. For UST systems with a waste oil component, composite samples are useful for identifying the average background concentrations of contaminants (usually metals) across a site. Composite samples are composed of more than one discrete sample collected from different locations. Submittal to the analytical laboratory as a single sample occurs after mixture of the samples into a single homogeneous sample. Multi-increment

(MI) samples represent a specific type of composite sample (see Incremental Sampling Methodology, Interstate Technical Regulatory Committee (ITRC) February 2012 http://itrcweb.org/ism-1/). The goals established during the systematic planning process determine the number of composite samples and the number of individual samples within a composite sample.

Background samples should be collected from the same media as site samples, from areas on or near the site that are unlikely to be contaminated by site-related chemicals. Analysis of background samples for the same parameters as the site samples assists in determining background concentrations of chemicals. Typically, collection of background data for naturally occurring inorganic chemicals, such as metals, occurs. The typical assumption for manmade organic chemicals background concentrations is 0%. It is the responsibility of the applicant to demonstrate if there is an "anthropogenic background" for organic chemicals that is unrelated to site activities.

B1.1.2 Sampling Locations and Frequencies

Identification of sampling locations and schedule for sampling occurs during the systematic planning process. The sampling duration and frequency or whether the work will be done in phases is also determined during the systematic process. For instance, if initial investigations indicate that contaminant levels in soils are below regulatory thresholds, no additional sampling would be required. If initial investigations indicate contaminant levels in soils are above regulatory thresholds, additional sampling would be required during characterization, remedial, and post remedial activities.

Please note that release confirmation activities at a UST facility are different than investigation activities. Release confirmation activities indicate whether or not there are contaminants at the most likely release areas. If the release confirmation process confirms detectable levels of contamination, investigations are required, whether or not those levels are above or below cleanup standards.

B1.1.3 Parameters of Interest

The measurements to be collected at a site depend on the characteristics and history of the site. This QA Program Plan provides QA/QC information for parameters and media typically analyzed for ADEQ UST Program sites. Unusual parameters and matrices will necessitate preparation of a project-specific planning document. Section B2 of this QA Program Plan discusses this topic in more detail.

B1.1.4 Sampling Event Planning

Advance planning for field sampling events is required to ensure that the necessary arrangements are in place and that equipment is ready. A.A.C. R18-12-280 contains sampling requirements for soil, groundwater, and surface water with respect to sample collection methodology, sample handling, and sample analytical methods. Listed are considerations when planning a sampling event:

1) Sample Handling and Custody Procedures — Field personnel will make arrangements with the appropriate laboratory for proper sample containers and custody procedures (described further in Section B3).

2) Equipment — Prior to collection of any sample, field personnel will ensure that all sampling

equipment has been properly assembled, decontaminated, calibrated and is functioning properly prior to use. Field personnel must use equipment according to manufacturer's instructions and decontaminate equipment according to the EPA SOP-Sampling Equipment Decontamination (see Appendix D of this QA Program Plan).

3) Field Forms — Prior to the sampling event, field personnel will assemble all necessary field forms, such field log books, soil and groundwater sampling forms, and boring logs. Site specific needs establish the need for developing site specific forms.

4) Health and Safety — Field personnel will ensure that all site-specific health and safety procedures are considered and that personal protective equipment (PPE) is gathered.

5) Investigation-Derived Waste — Field personnel will plan for the generation of investigation-derived waste (IDW), and should assemble the appropriate IDW containers prior to the sampling event.

6) Field Audits — Field personnel will plan to conduct periodic field system audits for ongoing sampling events.

7) Paperwork and Permits — Field personnel will also ensure prior to the sampling event that other applicable paperwork is in order, such as permits and access agreements.

B2: Sampling Methods

The systematic planning process and project-specific planning documents establish site-specific sampling methods as well as the numbers and types of samples collected. Details of sample collection methods will depend upon site conditions, equipment limitations, chemicals of concern, sample matrices, and cost. Collection methods will follow an ADEQ or EPA approved sampling protocol, unless unforeseen circumstances do not allow for an approved collection method. The following sections present general information on sampling methods for various media, including surface water, groundwater, drinking water, soil, soil vapor, sediment, pore water, sludge, air, and non-routine matrices such as building materials.

Additional methods proposed to use need approval of ADEQ's UST Program. General guidelines for field sampling are included in the EPA Standard Operating Procedure (SOP) on General Field Sampling Guidelines (see Appendix D). EPA SOPs for field sampling methods are available for download at https://clu-in.org/publications/db/db_search.cgi?title=1&submit_search=1&cat=18.

B2.1 Soil Samples

Soil samples collected at UST Program sites may include surface and subsurface samples. Sample types may be discrete or, if determining background metals concentrations or sampling stockpiled soil, composite samples. There are a variety of acceptable methods for collection of soil samples and selection of an appropriate method will depend on site conditions and the sampling design. Methods commonly

used to collect soil samples include drilling soil borings, digging test pits, sampling via hand auger, and digging with a shovel or trowel. Additional information on the collection of soil samples can be found in EPA's 1992 ***Preparation of Soil Sampling Protocols: Sampling Techniques and Strategies*** and in the referenced EPA SOP for soil sampling (see Appendix D of this QA Program Plan).

B2.2 Groundwater Samples

Groundwater sample collection is typical during ADEQ's UST Program site investigations and cleanups. Collection of groundwater samples may be one-time or ongoing and periodic. Groundwater sample collection can occur from soil borings, temporary well points, monitoring wells, and existing wells (e.g., municipal or community supply wells, domestic water wells, irrigation wells, or industrial supply wells). Shallow, intermediate, deep, and perched aquifers contain groundwater.

Groundwater samples collected from soil borings at specific depth intervals assist in location selection for future monitoring wells. Collection of these one-time samples using a direct-push groundwater sampling method is typical. Appendix D of this QA Program Plan contains an SOP for direct-push groundwater sampling.

Groundwater sample collection from permanently installed monitoring wells is typical. Proper installation according to state regulations (see ARS Title 45, Chapter 2, Article 10) and proper development according to an Arizona Department of Water Resources (ADWR), ADEQ, or EPA-approved protocol of monitoring wells is required. Field logbooks and subsequent reports must note non-standard wells or problems encountered during well installation and sampling. EPA SOPs describe groundwater monitoring well sampling, monitoring well installation and monitoring well development (see Appendix D of this QA Program Plan).

The following is a procedures list to use when sampling residential water supplies or water-supply wells of any kind:

- Obtain permission to access property and obtain samples for analysis
- Inspect the water system to locate the tap nearest to the wellhead. Samples should be collected prior to any treatment units (e.g., ultra-violet light, reverse osmosis, etc.), if possible.
- Purge the water lines to flush the plumbing and holding tanks before collecting samples from drinking water, irrigation, or industrial wells so that the sample collected is as representative as possible. Remove any faucet aerators and reduce water flow before collecting samples.

B2.3 Surface Water Samples

Surface water sample collection is typical during ADEQ's UST Program site investigations and cleanups when evaluating whether contaminants have migrated to nearby surface water bodies. Physical evidence such as odors, organic films on water surfaces, and soil discoloration in the vicinity of surface water are indicators of possible contamination. Surface water samples include representative liquid samples collected from streams, brooks, rivers, lakes, ponds, lagoons, seeps, estuaries, drainage ways, sewers, channels, wetlands, surface water impoundments, and other surface water bodies. Sample collection

occurs at the surface or at depth within the water body. Surface water samples will be collected in general accordance with the EPA SOP for surface water sampling (see Appendix D of this QA Program Plan).

B2.4 Pore Water Samples

Pore water is water contained within the upper few centimeters of sediments just below the surface water/sediment interface. This interface is the hyporheic zone. Typical equipment utilized for sampling of this zone are seepage meters and push-point pore water samplers or lysimeters. Discharge of groundwater to surface water through the hyporheic zone is unlikely to be homogeneous; therefore, determining locations for pore water sampling can involve additional investigative steps.

B2.5 Sediment Samples

Sediment sample collection occurs for the analysis of biological, chemical, or physical parameters in sediments. There are many factors to consider when choosing sediment sampling equipment including, but not limited to, site access, sample volume requirements, sediment texture, target depth for sediment collection, and flowing versus standing water. In general, use of piston samplers are best for soft, fine-grained sediments where sediments at depth are required. Grab/dredge samplers are best for coarse, shallow sediments and where large volumes of sediment are required. EPA's SOP for sediment sampling (see Appendix D of this QA Program Plan) provides additional information on the collection of sediment samples.

B2.6 Sludge Samples

Sampling of sludge could involve a number of different situations and will likely depend upon site conditions. Therefore, project-specific planning documents will detail collection of sludge samples. Catch basins and drywells are common settings for sludge sampling.

B2.7 Air/Soil Vapor Samples

Collection of air samples is typical at sites where vapor inhalation of contaminants is or may be an exposure issue. Collection of soil vapor samples is routine to investigate releases of volatile organic compounds (VOCs). Air sampling and soil vapor sampling is more complex than soil or water sampling because of the reactivity of chemical compounds in the gas matrix and sample interaction with the sampling equipment and media. A number of factors, including site conditions, sampling objectives, chemicals of concern, analytical methods, and cost, forms the basis for selecting air and soil vapor sampling equipment. Methods to sample air at active facilities include, but are not limited to, soil gas sampling or sampling with flux chambers. Typical sampling containers include tedlar bags, stainless steel Summa canisters, gas tight syringes, and glass sorbent traps used with sampling pumps. Sources of information for air and soil vapor sampling and analysis are: http://www.airtoxics.com in EPA's SOP for general air sampling guidelines (Appendix D) and ADEQ's Soil Vapor Sampling Guidance (http://www.azdeq.gov/environ/waste/download/svsg.pdf).

B3: Sample Handling and Custody

Chain of custody procedures differ among laboratories. Title 9, Chapter 14, Article 6 of the Arizona Administrative Code (R9-14-615) details the necessary documentation for sample control activities at an ADHS licensed laboratory. Identification of custody procedures of the analyzing laboratory occurs prior to field activities. Field personnel must make arrangements with the appropriate laboratory for proper sample containers, preservatives, holding times and chain of custody forms. The custody of a sample must be traceable from the time of sample collection to the reporting of results. Chain of custody procedures provide a mechanism for documenting information related to sample collection and handling. Completion of a chain-of-custody form must occur after sample collection and prior to sample shipment or release. Cross-checking of the chain-of-custody form, sample labels and field documentation is necessary to verify sample identification, date and time sample was collected, type of analyses, number of containers, sample volume, preservatives and type of containers. Additional information on sample handing and custody procedures is in EPA's SOPs for specific sample collection methods. Appendix D of this QA Program Plan references SOPs and forms for sample handling, custody (chain-of-custody forms), and transport.

B4: Analytical Methods

All analytical methods used to analyze samples must comply with relevant requirements of applicable federal or state programs for which they were collected, such as the CWA, SDWA, RCRA, Clean Air Act, or use other EPA-approved alternate methods. The most recently approved methods under the CWA and SDWA are located in the Code of Federal Regulations under 40 CFR Part 136. The EPA website at https://www.epa.gov/hw-sw846/sw-846-compendium contains the current approved methods under RCRA SW-846. Exhibit 1 of Title 9, Chapter 14 of the Arizona Administrative Code details ADHS approved methods with corresponding analytes.

Table B1 lists the classes of analytes that typically are the greatest interest during ADEQ's UST Program site investigations, as well as the ADEQ's preferred analytical methods. This table provides a starting point for selecting analytical methods for ADEQ's UST Program site investigations. Additional methods may be available and appropriate; consult with ADEQ's UST Program or Exhibit 1 of Title 9, Chapter 14, Article 6 (http://apps.azsos.gov/public_services/Title_09/9-14.pdf) of the Arizona Administrative Code for alternate methods. The project-specific planning document should identify analytical methods and equipment, decontamination procedures, waste disposal requirements, and performance requirements.

B5: Quality Control

QC requirements are integral to the success of a QA program. QC covers the overall system of technical activities that measure the performance of a process against defined standards to verify that they meet predefined requirements. Because errors can occur in the field, laboratory, or office, it is necessary for QC to be part of each of these functions. This QA Program Plan describes and defines the general quality objectives of ADEQ's UST Program. Project-specific planning documents define site-specific quality objectives. This approach to quality system management ensures conducting quality activities throughout

the data generation process but allows for the flexibility to tailor quality-related activities to individual site specific data needs.

QA and QC parameters apply to the two primary types of data — definitive and non-definitive data — regardless of whether the data collection activity is associated with field measurements or laboratory measurements. Non-definitive data are frequently collected during the first stage of a multi-phase screening investigation, using rapid, less precise methods of analysis with less rigorous sample preparation. Non-definitive data can provide analyte identification and quantification, although both may be relatively imprecise. Typically, confirmation of 5 to 10 percent of non-definitive samples or all critical samples occurs using analytical methods, QA/QC procedures, and criteria associated with definitive data. Non-definitive data without associated confirmation data are of unknown quality. Qualitative, non-definitive data identify the presence of contaminants and classes of contaminants and can help focus the collection of definitive data, which is generally the more expensive of the two. Some data uses, such as risk assessments, require definitive data.

Use of EPA's 2007 ***Guidance for Preparation of Standard Operating Procedures for Quality-Related Operations*** is typical for developing SOPs. SOPs should be included as an appendix of all planning documents and reports (see Figure A2) generated for and submitted to ADEQ's UST Program. The project field team should document reasoning for any deviations from an SOP and include that documentation in all planning documents and reports generated for and submitted to ADEQ's UST Program. Please note that, in Arizona, the Arizona Department of Health Services (ADHS) is responsible for reviewing the standard operating procedures developed by and used for environmental laboratories. ADHS is responsible for licensing of environmental laboratories (Title 9, Chapter 14, Article 6 – Licensing of Environmental Laboratories).

B5.1 Quality Control in the Field

Description of detailed QC parameters for each step of field work should also include specific corrective actions for difficulties encountered in the field. Evaluation of field sampling procedures requires the collection and evaluation of field QC samples. To provide a means of assessing data quality resulting from the field sampling program, collection and submittal to the analytical laboratory includes rinsate blanks, field duplicates, and extra volume for matrix spikes and matrix spike duplicates. Subsequent paragraphs contained in this section of this QA Program Plan note collection frequencies for field QC samples.

Field QC requirements and documentation of all field sampling and observations are critical for providing a historical record for analysis of the usability of the data produced. The official field log book will contain documentation of field activities that involve the collection and measurement of environmental data. Recording related field activities as explained below can require developing additional forms.

SOPs delineate the step-by-step approach that field personnel must follow in collecting samples, taking field measurements, decontaminating equipment, handling IDW, and calibrating instruments. Most qualified sampling contractors and State and Federal certified laboratories develop SOPs and analytical methods as part of their overall QA program. Use of EPA's 2007 ***Guidance for Preparation of Standard Operating Procedures for Quality-Related Operations*** is typical for developing SOPs. SOPs should be included as an appendix of all planning documents and reports (see Figure A2) generated for and

submitted to ADEQ's UST Program. The project field team should document reasoning for any deviations from an SOP and include that documentation in all planning documents and reports (see Figure A2) generated for and submitted to ADEQ's UST Program.

Each sampling SOP documents specific procedures for cleaning non-disposable equipment. The group/person responsible for sampling prepares sampling SOPs. All sampling tools will be decontaminated before sampling begins and between sample locations. Soil and water sampling tools, including stainless-steel spoons, bowls, hand augers, split spoons, pumps and Hydropunch equipment, will be decontaminated by scrubbing in a solution of potable water and non-phosphate detergent (Alconox or Liquinox). *Manufacturer verification regarding phosphate content of Alconox is needed as not all Alconox detergents are phosphate free.* EPA SOPs call for use of a 10 percent nitric acid (for metal analytes) or a solvent such as acetone for organic compound analytes (see Appendix D). The tools are then double-rinsed with distilled water. Each sampling SOP documents specific procedures for cleaning non-disposable equipment. The group/person responsible for sampling prepares sampling SOPs. A temporary decontamination pad will be constructed near the site and a high-pressure steam cleaner will be used to clean the end of the rig and all augers, drill rods, and core samplers. The procedures outlined in the SOP for IDW prescribe containment and disposal procedures for decontamination fluids.

B5.1.1 Field Instrument/Equipment Inspection and Calibration

Sampling and analysis generally requires the use of different pieces of equipment and tools in the gathering of environmental data. A field preventive maintenance protocol involves ensuring that all field equipment has been properly calibrated, charged, and inspected prior to and at the end of each working day and that replacement parts are available.

Inspection of all field equipment is required to determine if it is adequate and appropriate for the media, parameters, and required testing. Data may be generated onsite through the use of real-time equipment, such as photoionization detectors (PIDs), organic vapor analyzers, and pH meters. A more detailed analysis may call for relevant, later assessments of the usability of data generated by a mobile laboratory.

For field-testing and mobile laboratories, examination of equipment occurs to ensure that it is in working condition and properly calibrated. The team is required to track the transfer of samples. Staff calibrate field instruments according to the method and schedule specified in an SOP. The manufacturer's operating manual usually forms the basis for these types of SOPs. Calibration of field equipment occurs more often than specified in the SOP when using equipment under adverse or extreme field conditions.

B5.1.2 Field Documentation

The field team should record field activities in indelible ink, in a permanently bound notebook with pre-numbered pages or on a preprinted form. For each sampling event, the field team must provide the site name, physical location, date, sampling start and finish times, names of field personnel, level of protection, documentation of any deviation from protocol, and signatures of field personnel. For individual samples, field teams should ensure that field logbooks document the exact location and time the sample was taken, any measurement made (with real-time equipment), a physical description of the sample, sample ID number, sampling depth, sample volume, sample type, and the equipment used to collect the sample. This information can be critical to later evaluations of the resulting data's usability.

Complete and accurate documentation is necessary to demonstrate that field measurement and sampling procedures are in accordance with this QA Program Plan and any project specific planning document. Field personnel will use permanently bound field logbooks with sequentially numbered pages to record and document field activities. The logbook will list the contract name and number, the project name, the site name, and the names of subcontractors, the service client, and the project manager. At a minimum, the field logbook must document the following information:

- Name and affiliation of all on-site personnel or visitors
- Weather conditions during the field activity
- Summary of daily activities and significant events
- Notes of conversations with coordinating officials
- References to other field logbooks or forms that contain specific information
- Discussions of problems encountered and their resolution
- Discussions of deviations from the project-specific planning document or other governing documents
- Description of all photographs taken

The contractors performing field work should develop field forms to record field activities.

Labeling individual samples occurs in the field. Labels should include sample location, sample number, date and time of collection, sample type, sampler's name, and method used to preserve the sample, if applicable. Sample preservation involves the treatment of a sample usually through the addition of a compound that adjusts pH to retain the sample properties, including concentrations of substances, until analysis of the sample. The field team should create a table listing the total number of samples, types of sample matrices, all analyses planned for each sample differentiating critical measurements and other information that may be relevant to later assessments of the data usability. Typically, report submittals to ADEQ contain copies of field forms that contain field data..

B5.1.4 Rinsate Blanks

Rinsate blanks help evaluate the potential for cross-contamination of samples during collection. Collection of rinsate blanks occurs at a rate of one per day per matrix when using non-dedicated and non-disposable sampling equipment in the field. Collection of equipment rinsate blanks occurs by passing organic-free water through or over the decontaminated sampling equipment and collecting the rinse water in appropriate sample containers.

Rinsate blank analysis is for the same parameters as the associated field samples. Rinsate blanks should not contain detectable concentrations of target analytes greater than the Project Required Quantitation

Limit (PRQL) for the compound. Any detection of target analytes in a rinsate blank will result in an investigation to determine effect on overall data usability and affected results will be qualified as estimates or as non-detects at an elevated PRQL as appropriate.

B5.1.5 Field Duplicate Samples

Collection of field duplicate water and air samples occurs simultaneously in separate containers. The purpose of field duplicates is to allow evaluation of the contribution of random error from sampling to the total error associated with the data. One set of field duplicates will be collected and submitted for every twenty field samples collected (and at least one per sampling day if less than twenty are collected) for water, soil, and air. The following sections describe field duplicate precision.

B5.1.6 Matrix Spike/Matrix Spike Duplicates (Field Requirements)

Double sample volume should be collected at a rate of one per twenty samples per matrix (minimum of once per sampling event) to ensure that the laboratory has sufficient volume to perform matrix spikes and matrix spike duplicates (MS/MSDs).

B5.1.7 Inter-laboratory Split Samples (Field Requirements)

Inter-laboratory split samples are field duplicates (liquid matrices) or split samples (solid matrices) submitted to both the primary laboratory and a secondary or QC laboratory. Collection of inter-laboratory split samples occurs simultaneously with a sample from the same source under identical conditions into separate containers. Results from the split samples help assess laboratory performance by comparison of qualitative and quantitative results from the two laboratories, including indications of matrix interferences such as elevated PRQLs. In order to provide useful information, however, the split sample must be directly associated with the original (primary) sample to evaluate laboratory performance. Field personnel determine the association and maintain the association during the data import process. Both ADEQ and UST Owner/Operator contractors may collect these samples as a way to check on laboratory performance.

B5.2 Quality Control in the Laboratory

Compliance monitoring on ADHS licensed laboratories is conducted by ADHS as described in Title 9, Chapter 14, Article 6 of the Arizona Administrative Code (AAC R9-14-605 – Compliance Monitoring). ADEQ also conducts Technical Systems Audits on ADHS licensed laboratories (ADEQ contract laboratories and contract laboratories of contractors who submit analytical data to ADEQ). The primary goals of TSAs will be to review the laboratory organization, operation, and capabilities; determine the reliability of data; and note corrective action for any apparent deficiencies. The ADEQ QA/QC Manager or QA/QC Representatives selects auditors for TSAs based on their technical proficiency in the subject area. The designated auditors will be responsible for planning and conducting the audit, and reporting the findings to the laboratory manager and to the ADEQ QA/QC Manager or QA/QC Representatives.

B5.3 Data Quality Indicators (DQIs)

Identifying DQIs and establishing Quality Control (QC) samples and Measurement Performance Criteria (MPC) to assess each DQI, as introduced in Section 1.7, are key components of project planning and

development. These components demonstrate an understanding of how "good" the data need to be to support project decisions and help to ensure there is a well-defined system in place to assess that data quality once data collection/generation activities are complete.

When faced with addressing data quality needs in a project-specific planning document, one of the first terms you may come across is DQIs. DQIs (Precision, Accuracy/Bias, Representativeness, Comparability, Completeness, and Sensitivity) include both quantitative and qualitative terms. Each DQI helps interpret and assess specific data quality needs for each sample medium/matrix and for each associated analytical operation. Section A7.2 of this QA Program Plan explains the principles along with a brief summary of information related to assessing each DQI. In addition to Section A7.2 of this QA Program Plan, ADEQ has established the following policies, procedures, and/or guidance for sample collection and analytical techniques. These procedures, where relevant, apply to all analytical data generated for use by ADEQ's UST Program. These procedures apply unless approved for special exceptions and/or deviations outlined in a project-specific planning document. Appendix F contains the following documents in their entirety.

- ADEQ Temperature/Preservation Guidance;
- Substantive Policy 0154 - Addressing Spike And Surrogate Recovery As They Relate To Matrix Effects In Water, Air, Sludge And Soil Matrices Policy; and
- Substantive Policy 0170 - Implementation of EPA Method 5035 - Soil Preparation for EPA Method 8015B, 8021B and 8260B.

B6: Instrument/Equipment Testing, Inspection and Maintenance

All field and laboratory analytical instruments should be tested, inspected, and maintained according to the manufacturer's guidelines and recommendations. Data collected from improperly functioning equipment is not used. ADEQ contractors and Owner/Operator contractors typically are the ones that collect field data and are responsible for the correct operation of their equipment. ADEQ staff, on rare occasion, does collect field data. ADEQ staff should follow the equipment manufacturers operating manual for ensuring proper operation of any utilized equipment.
Maintenance of records for equipment testing, inspection, and maintenance occurs in a bound logbook for each piece of equipment. Recorded in the logbook are the date, time, name of inspector, equipment inspected, and the results of testing and inspection. Inspection occurs on all equipment or systems requiring periodic maintenance.

Preventive maintenance for most field equipment is carried out in accordance with procedures and schedules recommended in (1) the equipment manufacturer's literature or operating manual or (2) SOPs that describe equipment operation associated with particular applications of the instrument. However, critical measurements for field equipment may require more stringent testing, inspection, and maintenance procedures.

Segregation of an out of order field instrument occurs and is clearly marked and not used until completing repairs. Notification to the field team leader of equipment malfunctions occurs for the purpose of repair or equipment substitution. Unscheduled testing, inspection, and maintenance occurs on equipment whose condition is suspect. Reporting in the daily field QC report occurs for any significant problems with field equipment.

ADEQ's UST Program can request equipment testing, inspection, and maintenance logs for all contractor equipment.

B7: Instrument/Equipment Calibration and Frequency

Calibration of all analytical instrumentation is required to ensure that the analytical system is operating correctly and functioning at the sensitivity that is required to meet project-specific DQOs. Calibration on each instrument occurs with standard solutions appropriate to the instrument and analytical method in accordance with the methodology specified and at the QC frequency specified in laboratory or field sampling SOPs.

B7.1 Field-Based Instruments

Calibration of field equipment, if used, occurs at the beginning of the field effort and at prescribed intervals. The calibration frequency depends on the type and stability of equipment, the intended use of the equipment, and the recommendation of the manufacturer. Detailed calibration procedures for field equipment are available from the specific manufacturers' instruction manuals. General guidelines are included in SOPs. Recording all calibration information occurs in a field logbook or on field forms. In addition, there is a label on the field equipment that specifies the scheduled date of the next calibration. If this type of identification is not feasible, equipment calibration records will be readily available for reference. Field-based analytical instruments, such as turbidometers and pH electrodes, must be calibrated following manufacturers' instructions and frequency recommendations (or following appropriate SOPs) before they may be used for collecting data.

ADEQ contractors and Owner/Operator contractors typically are the ones that collect field data and are responsible for the correct operation of their equipment. ADEQ staff, on rare occasion, does collect field data. ADEQ staff should follow the equipment manufacturers operating manual for ensuring proper operation of any utilized equipment.

B7.2 Laboratory Instruments

Conducting calibration and maintenance of analytical instruments is in accordance with the QC requirements identified in each laboratory SOP and in QA manuals, along with the manufacturers' instructions. Discussed below are general requirements.

The history of calibration and maintenance for instruments in the subcontract laboratory is an important aspect of the project's overall QA/QC program. As such, trained personnel implement all initial and continuing calibration procedures by following the manufacturer's instructions and in accordance with applicable EPA protocols. This ensures the equipment is functioning within the tolerances established by the manufacturer and the method-specific analytical requirements.

The laboratory will obtain calibration standards from commercial vendors for both inorganic and organic compounds and analytes. Stock solutions for surrogate standards and other inorganic mixes are from reagent-grade chemicals or as specified in the analytical method. Expiration dating, proper labeling,

proper refrigeration, and freedom from contamination requires special attention. Recording documentation on receipt, mixing and use of standards occurs in the appropriate permanently bound laboratory logbook. Subcontractor laboratory QA plans may provide additional specific handling and documentation requirements for the use of standards.

After the instrument calibration to verify the preparation and concentration of the calibration standards, analysis of the verification standards for initial calibrations occurs. The verification standards for continuing calibrations should be analyzed (as per method requirements) to verify the calibration of the analytical system over time.

Calibration of analytical balances occurs annually according to manufacturer's instructions and have a calibration check before each use by laboratory personnel. Personnel hardbound logbooks with pre-numbered pages document the balance calibration checks.

Monitoring for proper temperature of all refrigerators and incubators occurs by measuring and recording internal temperatures on a daily basis. At a minimum, calibration according to manufacturers' instructions of thermometers used for these measurements occurs annually.

The subcontract laboratories will maintain an appropriate water supply system that is capable of furnishing American Society for Testing Materials (ASTM) Type II polished water to the various analytical areas.

ADEQ, Owner/Operators, and any hired contractors should ensure that their support laboratories properly calibrate their instruments. To do this, ADEQ and Owner/Operators typically perform partial data validation (see Table D1) on laboratory analytical reports submitted to them from subcontracted laboratories. Depending on the outcome of the partial data validation, the data is used qualitatively, quantitatively, or not at all.

B8: Inspection/Acceptance of Supplies and Consumables

The laboratory shall inspect supplies and consumables prior to their use in analysis. The provided materials description in the method establishes a guideline for the acceptance criteria of these materials. Monitoring for purity of reagents occurs by analysis of LCSs. An inventory and storage system for these materials shall assure use before manufacturers' expiration dates and storage under safe and chemically compatible conditions.

Analytical laboratories are required to provide certified clean containers for all analyses. These containers must meet EPA standards described in EPA's 1992 ***Specifications and Guidance for Obtaining Contaminant-Free Sampling Containers***.

Procedures for receiving supplies and consumables in the field are similar. When receiving supplies, the project manager or field team leader will log the supplies into a supply logbook and then inspect all items against the acceptance criteria. Personnel note any deficiency or problem in the field logbook and return deficient items for immediate replacement.

B9: Non-direct Measurements

Environmental data generation typically involves planning, sampling, analysis, investigation, and data review. In planning their investigations, project teams generally use existing data to develop sampling designs and to decide how much and what type of data to collect. The term "existing data" is synonymous with "secondary data" and "non-direct measurements". Existing data may come from a number of sources, including other studies, government databases, etc. The original purpose for collecting these secondary data may be very different from that of the current investigation. Also, these secondary data may have been collected using different sampling methods (composite vs. grab, random vs. hot spot sampling), and/or analytical methods than those selected for the current investigation.

Basing decisions on existing data may result in errors if secondary data were not generated for the same purpose or using the same methods as the current investigation. Biased data can impact final conclusions. Therefore, before using secondary data, project team members should evaluate the data to identify any limitations on their use. Also, to ensure transparency in decision making, project team members clearly document criteria and reasons for including and excluding certain data from use. Failure to clearly document why data are included or excluded can result in the appearance of biased data selection and diminish the product's credibility.

Sources of secondary data include the following:

- Environmental indicator data obtained from federal/state/local databases and records
- Existing sampling and analytical data from a previous investigation of the area
- Computer model simulations and applications pertaining to other studies
- Historical data (e.g., from organization's/facility's corporate records and/or federal/state local records pertaining to previous monitoring events, site investigations, etc.)
- Background information/data from organization's/facility's corporate records and/or federal/state/local records pertaining to site-specific industrial processes, process by-products, past and current chemical uses, raw material and finished product testing, waste testing and disposal practices, and potential chemical breakdown products
- Data generated to verify innovative technologies and methods
- Data obtained from computer databases (such as manufacturers' process/product information, waste management or effluent information, and EPA or state data bases)
- Literature files/searches
- Publications
- Photographs
- Topographical maps
- Meteorological data

B10: Data Management

Field staff record field data generated for ADEQ's UST Program, such as sample ID and latitude/longitude coordinates, on field data sheets or hand-held computers. If used, ADEQ or Owner/Operator contractor field staff report field data to the Project Manager through submission of field notebooks or field sampling data sheets. Inclusion of originals/copies of field data also accomplishes this reporting.

Laboratory analytical reports will include QC results and any other necessary analytical information which enable reviewers to determine data quality. Submittal of laboratory data to the ADEQ or Owner/Operator Project Manager occurs by both printed and electronic form. Reporting of rapid turnaround data from the laboratory to the Project Manager occurs if requested, but rapid turnaround is generally not required. For review, ADEQ or Owner/Operator keeps copies of field data sheets (Appendix contains sample data sheets), a copy of chain-of-custody forms, original preliminary and final lab reports, and electronic media reports. The field crew must retain original field logs. The contract laboratory shall retain chain-of-custody forms. The contract laboratory will retain copies of the preliminary and final data reports.

Table B1. Common Contaminants at UST Facilities and Recommended Methods for Analysis of Soil, Groundwater or Materials Samples

	Analysis and Test Methods for Soil or Groundwater			
	VOCs	**PAHS**	**Tetra ethyl lead (organic lead)**	**Metals (RCRA 8)**
Test Method	**8260B plus TICs[1]**	**8310 or 8270C SIM**	**California HML-939M or equivalent[3]**	**6000/7000 Series**
Unleaded Gasoline includes all Oxygenated Gasoline using either MTBE or Ethanol	•	•		
Regular (Leaded) Gasoline	•	•	•	
Diesel & Biodiesel	•	•		
Jet Fuel	•	•		
Aviation Gas	•	•	•	
Used Oil	•	•		•
New Oil & Heating Oil	•	•		
Kerosene	•	•		
Solvents	•			
Hazardous Substance[2]				
Unknown	•	•	•	•

If a soil sample contains concentrations of VOCs and/or PAHs greater than the minimum reporting limit, contact ADEQ at 602.771.4289 to report a suspected release.

[1]EPA Method 8260 B Volatile Organic Compounds- the entire list is to be reported by the laboratory including the tentatively identified compounds (TICs) in the ADEQ UST Program Analytical Data Information Sheet

[2]Analyze for compounds specific to the hazardous substance(s) released.

[3]If an UST system storing gasoline was in service prior to 1996, the soil and/or groundwater samples must analyze for Tetra ethyl lead.

Please note that when requesting compound specific analyses and the sample is petroleum based, the laboratory will be informed as such

Please note that Appendix 1 of Title 9 (Health Services), Chapter 14 (Department of Health Services Laboratory) in the Arizona Administrative Code contains a listing of ADHS approved methods for several analytes in different mediums (see Appendix A of this QA Program Plan).

GROUP C: ASSESSMENT AND OVERSIGHT

C1: Assessments and Response Actions

Assessment and response actions are part of the quality system for ensuring and documenting that procedures required by this QA Program Plan are being followed during the generation of data to be included in all planning documents and reports (see Figure A2) generated for and submitted to ADEQ's UST Program.

C1.1 Purpose/Background

During the planning process, many options regarding sampling, sample handling, sample analysis, and data reduction are evaluated. Selection of specific options depends on the nature of the corrective action or monitoring activity. This section of the QA Program Plan describes the internal and external checks necessary to ensure correct implementation of all elements. In addition, needed checks ensure adequate data quality and implementation of timely and effective corrective actions. Documenting all internal assessments is a critical component of the quality system.

C1.2 Assessment Activities and Program Planning

ADEQ employs several QA assessment tools designed to provide a better understanding of the components of, and the basis for improving, the ADEQ Quality Management System. Internal (Programmatic) and External QA audits are one of the principal tools for determining the effectiveness of the ADEQ QA/QC components. QA audit frequency and scheduling will vary with the type of review conducted.

C1.2.1 Assessment of Subsidiary Organizations

A. Management System Reviews (MSRs)

An MSR is an independent assessment of a Program's QA management practices and data collection procedures. Generally, the ADEQ QA/QC Manager or QA/QC Representatives performs the MSR. The MSR will qualitatively assess a program to determine if the ADEQ Quality Management System is adequate to ensure the quality of the Program's data. MSRs address the effectiveness of management controls in achieving and assuring data quality, the adequacy of resources and personnel devoted to QA functions, the effectiveness of training and assessments, and the applicability of data quality requirements. While MSRs can identify significant QA concerns and areas of needed improvement, they also point out noteworthy accomplishments.

Most MSRs will examine the following elements:

- Assessment of the overall effectiveness of the QA management system, as measured by its adherence to the approved QMP
- Procedures for developing Data Quality Objectives (DQOs);
- Procedures for developing and approving QA Program Plans;

- Effectiveness of existing QA Program Plan guidance;
- Procedures for developing and approving SOPs;
- Procedures, criteria, and schedules for conducting QA audits;
- Tracking systems for assuring that the QA Program is operating effectively, and that corrective actions disclosed by QA audits have been taken;
- Responsibilities and authorities of various line managers and QA personnel for implementing the QA program;
- Degree of management support;
- Level of financial and other resources committed to implementing the QA Program

The ADEQ QA/QC Manager or QA/QC Representatives utilizes EPA's 2003 ***Guidance on Assessing Quality Systems (Management Systems Review Process)*** for conducting MSRs.

The following lists the objectives of reviews for any ADEQ related Quality Assurance Programs:

- Identify any data quality problems;
- Identify benchmark practices for use in other Agency Programs;
- Propose recommendations for resolving quality problems;
- Confirm implementation and effectiveness of any recommended corrective actions.

C1.2.2 Assessment of Program Activities

Technical Systems Audits (TSAs)
The purpose of a Technical Systems Audit is to assess the sampling and analytical quality control procedures used to generate environmental data. TSAs entail a comprehensive, on-site evaluation of the field equipment; sampling and analyses procedures; documentation; data validation; and training procedures for collecting or processing environmental data.

TSAs occur for both laboratory and field activities:

Laboratory TSAs
TSAs occur on entities that submit analytical data to ADEQ or Owner/Operators that include analytical data in their required reporting. These entities are the ADEQ contract laboratories, and contract laboratories of Owner/Operator contractors. The primary goals of TSAs will be to review the laboratory organization, operation, and capabilities; determine the reliability of data; and note corrective action for any apparent deficiencies. ADHS, rather than ADEQ, is responsible for licensing environmental laboratories and can conduct audits and inspections at environmental laboratories. ADEQ's QA\QC staff can work with ADHS to identify laboratories to audit/inspect.

Field TSAs
Oversight of field operations is an important part of the quality assurance process. The QA/QC Manager or QA/QC Representatives will conduct QA audits of field sampling activities, both for its own field operations, and on those contractors that collect samples for the UST Program State Lead Unit. ADEQ will specify frequency and procedures for conducting field TSAs within specific Program areas. When project-specific planning documents are reviewed, and also during any MSRs or other QA audits,

ADEQ's QA/QC Manager or QA/QC Representatives will determine the necessity of field TSAs.

Specific items observed during the audit may include:

- Availability of approved project plans such as the project-specific planning document and Health and Safety Plan (HASP) to all project members
- Documentation of personnel qualifications and training
- Sample collection, identification, preservation, handling and shipping procedures
- Decontamination procedures used to clean sampling equipment
- Equipment calibration and maintenance
- Completeness of logbooks and other field records (including nonconformance documentation)

Performance Evaluations

Use of Performance Evaluation (PE) samples help assess the ability of a laboratory, or field measurement system, to provide reliable data. PE samples are for laboratories providing analytical services, directly or indirectly, for ADEQ and will be traceable, whenever possible, through the National Institute of Standards and Technology (NIST). The evaluation consists of providing a reference "blind" or "double blind" sample, to the laboratory for analysis. A PE sample contains known concentrations of chemical constituents, or pollutants, of interest and will normally be in the appropriate media (e.g., soil, water, air). The analytical results obtained by the laboratory are compared to the known concentrations of the chemical constituents contained in the PE sample(s), as a means of determining if the laboratory demonstrated its ability to properly identify, and quantify, pollutants within established, or calculated, control limits.

ADEQ's UST Program schedules PE samples on an as-needed basis depending on the laboratory. All PE studies performed for ADEQ, whether required on a regular basis or performed on a one time basis, will be coordinated through or requested from the ADEQ QA/QC Manager or QA/QC Representatives. For external projects requiring PEs, the Task/Work Assignment, Task/Delivery Order, or similar document needs to outline the specific details of the PE so the associated costs can be included in the contractor proposal. The results of PEs provide a means for assessing overall data integrity, and for use as criteria for selecting candidates for on-site evaluations.

Audits of Data Quality

EPA 2001 Guidance for Quality Assurance Project Plans defines an audit of data quality (ADQ) as "a qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality". This assessment primarily involves an evaluation of the completeness of the documentation of field and analytical procedures and quality control results. Also, it usually involves tracing the paper trail accompanying the data from sample collection and custody to analytical results and entry into a database. This technique is

the common verification process involved in entering data residing in large regulatory databases.

Results of both Data Quality Assessments (DQAs) and data quality audits can be used in at least two ways. One use is in making recommendations for changes in the design and performance of data collection efforts and in the use and documentation of QC procedures. A second use is as a guide for the planning and acquisition of supplemental data for the project and potentially for other related projects. Problems identified through DQAs may trigger the need for an MSR to determine management deficiencies or a TSA to identify technical problems.

Data Quality Assessments (DQAs)*

A DQA refers to the process used to determine whether the quality of a given data set is adequate for its intended use. DQAs may occur on selected projects and/or data generation processes. The purpose of this type of evaluation is to determine whether the data collected are acceptable to the decision-maker or end user. Assessments generally take place during the data generation process. As data accumulates, aspects of the project such as surveillance of field and laboratory operations, consistency of the data with MQOs, successfully completing performance evaluation sample studies, and so forth, helps assess whether the data are valid and acceptable. ADEQ disregards rejected or questionable data in its decision making, except in limited circumstances, such as a rough site screening.

Once data are of known and acceptable quality, then evaluation of the results in the context of the Data Quality Objectives for the project occurs. For most circumstances, sample results involves a 1:1 sample comparison to regulatory standards or laboratory detection limits. An assessment also occurs as to whether there is a sufficient quantity of data to support program or project decisions, and whether the original sampling design was appropriate. Alternatively, the ADEQ UST Program typically use statistics on sample results when determining background concentrations for metals in soils, typically lead and arsenic and stockpiled soil. EPA's 2006 ***Data Quality Assessment - A Reviewers Guide*** and EPA's 2006 ***Data Quality Assessment - Statistical Methods for Practitioners*** discusses the types and uses of statistical analyses. In some cases for metals background level determinations, the data may suggest that additional data are required to achieve a higher statistical confidence level. This could be because of overlooking too many invalidated data points or missing a vital sampling area not previously considered important. In other cases, an assessment might show that data of a different type are required, or that the sensitivity of the instrument used in the measurement was not adequate to meet project objectives.

If necessary, ADEQ's QA/QC Manager or QA/QC Representatives can review data generated by the contract laboratories, for the ADEQ UST Program. These data review activities should use checklists, standard operating procedures, and standardized qualification codes to indicate data quality.

* Data generated for and submitted to ADEQ's UST Program have DQA's performed on them on an on-going basis.

Peer Reviews

Peer reviews are not strictly an internal QA function; rather, they are technical scientific reviews that evaluate assumptions, calculations, methods and conclusions. The ADEQ will use internal expertise to evaluate different technical aspects of the reports produced by contractors and Owner/Operators.

C1.3 Documentation of Assessments

This section identifies the organization and the person(s) that will perform the assessments, as well as the documentation of information collected during the audit.

C1.3.1 Number, Frequency and Types of Assessments

Once every four years every major Agency Program attempts an MSR. TSA's occur if specifically requested by ADEQ's Project/Case Manager, the findings of another audit or review necessitate another, or if the ADEQ QA/QC Manager or QA/QC Representatives plans one. Results will be reported to the audited organization in the form of a written report within 14 calendar days of the completion of the audit, or a mutually agreed upon alternative. Written comments by ADEQ's Project/Case Manager must be supplied to ADEQ's QA/QC Manager or QA/QC Representatives within 14 calendar days of receipt of the audit findings, or a mutually agreed upon alternative. Copies of the TSA Audit Final Report will be stored in the project file and also with ADEQ's QA/QC Manager or QA/QC Representatives. Distribution of additional copies occurs as appropriate.

C1.3.2 Assessment Personnel

ADEQ's QA/QC Manager or QA/QC Representatives normally conducts MSRs and TSAs and focuses on ADEQ's UST Program's adherence to the approved Agency Quality Management Plan (QMP) and its QA Program Plan.

C1.3.3 Schedule of Assessment Activities

See Section C1.3.1 above.

C1.3.4 Reporting and Resolution of Issues

Addressing nonconformance to practices and procedures outlined in this QA Program Plan or a project-specific planning document submitted to ADEQ by an Owner/Operator should happen in a timely manner to ensure correction of nonconforming issues or deficiencies. The ultimate responsibility to ensure that all issues and deficiencies are satisfactorily resolved rests with the Unit Supervisors and Section Manager. Arizona Administrative Code allows Owner/Operators to satisfactorily correct deficiencies in a planning document.

ADEQ's UST Program will have 30 days to prepare a written response to the reviewer's assessment memorandum. If the evaluation report recommends corrective actions, ADEQ's UST Program should address these recommendations and include a schedule for making any appropriate changes in its quality assurance procedures. The ADEQ Leadership team uses these reviews to gauge the effectiveness of the Agency QMP and of ADEQ's UST Program approach to data quality management.

C2: Reports to Management

Effective management of environmental data collection requires (1) timely investigation and review of all

activities and (2) open communication, interaction, and feedback among all project participants. This section outlines the reporting requirements for activities conducted under the UST Program, including Owner/Operator led projects.

C2.1 Purpose/Background

Required reports provide a structure for evaluating the management of program schedules, assessing the effect of deviations from approved program or project-specific planning document on data quality, and determining the potential uncertainties in decisions made based on the data. Senior technical staff, case/project managers, and the QA/QC Representative review these reports and provide summaries on any identified data quality issue. Typically, these summaries are in memo form for specific projects or, for program concerns, presented orally at unit or section meetings where discussion occurs. Required reports keep managers and project members informed on the performance of QA/QC activities. Data quality summaries by ADEQ staff provide the results of project-specific audits, list any significant problems and discuss the solutions and corrective actions implemented or to be implemented to resolve QA/QC problems.

C2.2 Frequency, Content and Distribution of Reports

Field, technical, laboratory or QA personnel generate QA/QC reports. These QA/QC reports are in written memo or oral form, depending on the problems observed. A summary of the information included in these QA reports is normally included in ADEQ's required reporting (See Figures A2).
The contractor field team will record daily activities in a field log book to summarize activities throughout the field investigation. This daily log book will describe sampling and field measurements, equipment used, subcontractor personnel on site, QA/QC and health and safety activities, problems encountered, corrective actions taken, deviations from the QA Program Plan or project-specific planning document, and explanations for the deviations. The field team leader prepares the daily log book and submits it to ADEQ's UST Program, if requested. The final report for field investigations will summarize the content of the daily log book.

The required reports submitted for the project should include discussion of the following QA/QC report elements, if appropriate:

- Sampling and support equipment that were used, other than those specified in the approved QA Program or project-specific planning document
- Preservation or holding-time requirements for any sample that were not met
- QC checks (field and laboratory) that were found to be unacceptable
- Analytical requirements for precision, accuracy, or method detection limit/practical quantitation limit (MDL/PQL) that were not met
- Sample collection protocols or analytical methods specified in the QA Program Plan that were not met
- Any activity or event that affected the quality of the data

- Any corrective actions that were initiated as a result of deficiencies
- Any internal or external systems or performance audits that were conducted

The QA/QC report contains an emphasis on evaluating whether project MQOs and data are of adequate quality to support the required decisions stated in the project DQOs.

The following example contains a list of recommended topics for use in developing a comprehensive QA/QC report, if necessary. The information listed below should be contained within a QA/QC report, if appropriate.

Title Page – The following is required information:
Time period of the report;
Laboratory name, address and phone number; and
Preparer's name and signature

Table of Contents – Should be included if the report is more than ten pages long

Audits – in table form, summarize all project specific audits performed during the specified time period

Performance audits must include the following
Date of the audit
System tested
Person(s) administering the audit
Parameters analyzed
Reported results
True values of the samples (if applicable)
If any deficiencies or failures occurred, summarize the problem area and the corrective action

System audits must include the following:
Date of the audit
System tested
Person(s) administering the audit
Parameters analyzed
Results of tests
Parameters for which results were unacceptable (include the reported and true values, if applicable)
Explanation of the unacceptable results. Include probable reasons and the corrective action.

Copies of documentation such as memos, reports, etc., shall be enclosed

Significant QA/QC Problems

Identify the problem, and the date found
Identify the individual who reported the problem
Identify the source of the problem
Discuss the solution and corrective actions taken to eliminate the problem

Corrective Actions Status

Discuss the effectiveness of all corrective actions taken during the specified time frame as well as any initiated during the previous report period.
Discuss any potential additional measures to implement as the result of any corrective action.

C2.3 Identify Responsible Organizations and Individuals

The facility owner, operator, property owner, or state government – either directly or through its contractor - is responsible for preparing planning documents and reports and incorporating any comments received from ADEQ's UST Program personnel. These parties are responsible for ensuring that a complete environmental laboratory report is included in all planning documents and reports, if applicable, generated for and submitted to ADEQ's UST Program. Section A4.1 of this QA Program Plan describes organizational and individual roles and responsibilities in detail. A list of planning documents and reports is included in Figure A2. Section A4.2.1 of this Program Plan describes expectations of ADEQ's required planning documents and reports.

GROUP D: DATA REVIEW

D1: Data Verification, Validation and Investigation

This section describes the planned procedures to review, verify and validate field and laboratory data. This section also discusses procedures for verifying that data are sufficient to meet DQOs and MQOs for the project.

D1.1 Purpose/Background

Data verification, validation, and assessment ensures that environmental programs and decisions are supported by the type and quality of data needed and expected for the intended use.

D1.2 Data Verification

Data verification is the process of evaluating the completeness, correctness, conformance, and compliance of a specific data set against the method, procedural or contractual requirements. Data verification evaluates adherence to data generation sampling protocols, SOPs, analytical methods, and project specific planning documents. Verification also involves examining the data for errors or omissions. Field and laboratory staff can verify that the work is producing appropriate outputs.

D1.3 Data Validation

Data validation is a systematic process for reviewing a body of data against a pre-established set of acceptance criteria defined in this QA Program Plan and in project-specific planning documents. Data validation is an analyte-and sample-specific process. It extends data evaluation beyond data verification and determines the analytical quality of a specific data set.

ADEQ's UST Program performs a partial validation on selected analytical data routinely generated for and submitted to ADEQ's UST Program. This partial validation involves examining the data package to determine if it meets MQOs for precision, accuracy and sensitivity. Discrepancies noted during the verification step is the basis for partial validation. For example, perhaps some, but not all, surrogates in a method requiring an organic extraction are outside method defined acceptance criteria, but other QC data such as precision of the measurements and blank data are acceptable. This might lead to a review that centered on surrogate recoveries. The intent of the partial validation is to qualify data and alert the user to the data limitations. Full data validation may occur for results used in court cases.

D1.4 Data Quality Assessment

A DQA refers to the process used to determine whether the quality of a given data set is adequate for its intended use. DQAs may occur on selected projects and/or data generation processes. The purpose of this type of evaluation is to determine whether the data collected are acceptable to the decision-maker or end user. Assessments generally take place during the data generation process. As data accumulates, aspects of the project such as surveillance of field and laboratory operations, consistency of the data with MQOs, successfully completing performance evaluation sample studies, and so forth, helps assess

whether the data are valid and acceptable. ADEQ disregards rejected or questionable data in its decision making, except in limited circumstances, such as a rough site screening.

Once data are of known and acceptable quality, then evaluation of the results in the context of the Data Quality Objectives for the project occurs. For most circumstances, sample results involves a 1:1 sample comparison to regulatory standards or laboratory detection limits. An assessment also occurs as to whether there is a sufficient quantity of data to support program or project decisions, and whether the original sampling design was appropriate. Alternatively, the ADEQ UST Program typically use statistics on sample results when determining background concentrations for metals in soils, typically lead and arsenic and stockpiled soil. EPA's 2006 ***Data Quality Assessment - A Reviewers Guide*** and EPA's 2006 ***Data Quality Assessment - Statistical Methods for Practitioners*** discusses the types and uses of statistical analyses. In some cases for metals background level determinations, the data may suggest that additional data are required to achieve a higher statistical confidence level. This could be because of overlooking too many invalidated data points or missing a vital sampling area not previously considered important. In other cases, an assessment might show that data of a different type are required, or that the sensitivity of the instrument used in the measurement was not adequate to meet project objectives.

If necessary, ADEQ's QA/QC Manager or QA/QC Representatives can review data generated by the contract laboratories, for the ADEQ UST Program. These data review activities should use checklists, standard operating procedures, and standardized qualification codes to indicate data quality.

* Data generated for and submitted to ADEQ's UST Program have DQA's performed on them on an on-going basis.

D2: Approaches to Verification, Validation and Assessment

Data verification and validation confirms the integrity of the data generated over the life of the project. The process for determining if the data satisfy program-defined requirements involves evaluating and interpreting the data, in addition to verifying meeting QC requirements. The systematic planning approaches described in ADEQ's Waste Programs Division Site Investigation Guidance Manual – the DQO Process and the Triad Approach - should produce data that provide answers to critical study questions. The ADEQ UST Program utilizes the Triad Approach, which contains some elements of the DQO Process.

EPA's 2002 ***Guidance on Environmental Data Verification and Data Validation*** presents the process for verifying and validating data. Section 5 of this EPA guidance provides tools and techniques for data verification and validation: https://www.epa.gov/quality/agency-wide-quality-system-documents.

D2.1 Approaches to Data Verification

Project team personnel, whether they are ADEQ contractors, ADEQ staff, or Owner/Operators, will verify field data through reviews of data sets to identify inconsistencies or anomalous values. Any inconsistencies discovered will be resolved as soon as possible by seeking clarification from field personnel responsible for data collection. To obtain defensible and justifiable data, all field personnel will be responsible for following the sampling and documentation procedures described in the project-specific

planning document.

Laboratory personnel will verify analytical data at the time of analysis and reporting and through subsequent reviews of the raw data for any non-conformances to the requirements of the analytical method. Laboratory personnel will make a systematic effort to identify any outliers or errors before they report the data. Outliers are corrected if found to be the result of errors. The case narrative section of the analytical data package clearly identifies outliers not attributed to errors in analysis, transcription, or calculation. The laboratory must verify all analytical data generated for and submitted to ADEQ's UST Program.

Verified data are checked for a variety of topics including transcription errors, correct application of dilution factors, appropriate reporting of dry weight versus wet weight, and correct usage of conversion factors, among others. Verified data may have laboratory qualifiers. Verified data are one output of this process.

A second output from the verification process is documentation, which may include a certification statement signed by the laboratory manager and included in the data package. Narratives on technical issues, non-compliance and any corrective action taken are included in the laboratory data package. Records from field activities are likely to be logbooks or handwritten notes, all of which require dates and signatures.

A laboratory QA manual use is to assist in accepting, rejecting, or qualifying the data generated by the laboratory. ADEQ, though, makes the decision on whether or not to use the data. The laboratory management is responsible for validating the data generated by the laboratory. The laboratory personnel must verify that the measurement process was "in control" (i.e., all specified MQOs for the DQIs were met, or acceptable deviations are explained) for each batch of samples before proceeding with analysis of a subsequent batch. In addition, each laboratory must establish a system for detecting and reducing transcription and/or calculation errors prior to reporting data. When deviations are noted, the laboratory shall submit data that have acceptable deviations explained. When there are unmet QA requirements, re-analysis of the sample occurs when possible. Only the results of the reanalysis will be submitted, provided these results are acceptable.

D2.2 Approaches to Data Validation

Data validation determines the analytical quality of data within a specific data set; it is an analyte-and sample-specific process based on achieving the MQOs set forth in the planning documents for the project. Validation assesses whether data quality goals specified in the planning phase have been achieved. Unlike data verification, a qualified person not affiliated with the laboratory performs data validation. The Unit Supervisor, staff level personnel or, upon request, Technical Support performs data validation of analytical data generated for and submitted to ADEQ's UST Program.

The level of data validation depends on the size and complexity of the project and the project's decisions. Basically, data validation is the process of evaluating the available data against the project MQOs. ADEQ's UST Program performs cursory validation on data generated for and submitted to them. ADEQ's UST Program notifies the QA/QC Manager or QA/QC Representatives if there is a need for full data validation, although full data validation would be a rare occurrence in the UST Program. Table

D-1 summarizes criteria for data validation.

The personnel validating the data should be familiar with the project-specific MQOs. So, the validator should have access to the QA Program Plan, project-specific planning documents, SOPs, and approved analytical methods. The validator must identify these and other project records, obtain records produced during data verification, and validate the records by determining whether the data quality meets goals established in the planning documents.

Data validation generally includes the following steps:

Validation of Field Data

1 Evaluate field records for completeness and consistency

2 Review field QC information

3 Summarize deviations and determine effects on data quality

4 Summarize number and type of samples collected

Validation of Laboratory Data

1 Assemble planning documents and data for validation. Review data records to determine method, procedural and contractual QC compliance or noncompliance

2 Review verified, reported sample results collectively for the data set as a whole, including laboratory qualifiers

3 Summarize data and QC deficiencies and evaluate the impact on overall data quality

ADEQ uses the most up-to-date Arizona Data Qualifiers when applying qualifiers to data. These qualifiers are located on the ADHS and ADEQ websites or at the following weblink: http://www.azdeq.gov/function/programs/download/azdatqa.pdf.

ADEQ, its contactors, and Owner/Operators typically perform partial data validation (see Table D1) on laboratory analytical reports submitted to them from subcontracted laboratories. Depending on the outcome of the partial data validation, qualitative or quantitative use of the data occurs.

If necessary, a decision letter to the party responsible for performing corrective actions summarizes any field or laboratory data that did not meet the quality goals established in the planning documents.

D2.3 Approaches to Data Assessment

The purpose of a data assessment is to integrate all aspects of data generation to determine the usability of the data. The final step in the process is to compare the data obtained to the DQOs established by the program in its QA Program Plan or in project-specific planning documents. Aspects of the sampling

program evaluated during the data assessment include sampling design, sample collection procedures, and sample handling. The process also includes a review of analytical procedures (both field and laboratory) and QC procedures. ADEQ and Owner/Operator contractors and environmental laboratories, respectively, maintains field and laboratory instrument calibration logbooks. Appropriate ADEQ personnel (Unit Supervisors, staff level personnel, Technical Support and/or QA/QC Manager or QA/QC Representatives) and Owner/Operators review the logbooks on an as needed basis. The following paragraphs provide criteria for evaluating all aspects of data assessment.

D2.3.1 Sampling Design

Samples should conform to the type and location specified in the project-specific planning document. Staff must note any deviations from the sampling design and its likely effect on the usability of the data for its intended purpose. Section B1.1 of this QA Program Plan discusses an overview of sampling design. ADEQ's 2014 Waste Programs Division Site Investigation Guidance Manual provides further information on sampling designs. EPA also provides guidance in its 2002 ***Guidance on Choosing a Sampling Design for Environmental Data Collection***: https://www.epa.gov/quality/agency-wide-quality-system-documents.

D2.3.2 Sample Collection Procedures

The data reviewer (i.e. typically the field team leader from the contracted environmental consultant) should verify use of the appropriate specified methods during sampling. The reviewer should:

1 Evaluate the field records for consistency
2 Review QC information
3 Summarize deviations and determine their effect on data quality
4 Summarize the samples collected
5 Prepare a field data verification summary

Improper field practices can compromise the usability of a data set. Specific issues to look for include mislabeling of sample containers, problems with field instruments, improper documentation (such as failure to properly fill in the log book), improper collection of VOC samples (such as leaving a cap off a container or collecting VOC samples from a well-mixed composite sample), biasing sampling locations or forgetting to obtain location information for each sample, improper purging of monitoring wells, improper decontamination procedures, or intentionally cutting corners by collecting many samples from one location to save time.

For preparation of the field data verification summary, the field team leader evaluates field records and notebooks for consistency with field methods and procedures described in project-specific planning document. This assures proper following of procedures or that deviations from the procedures still yield data of acceptable quality. The verification summary should include observations on (1) the consistency and completeness of field records, (2) the adequacy of field QC information, (3) any deviations project-specific planning document procedures and the probable effect of the deviations on data quality and (4) the number and types of samples collected and how this compares with specifications in the project-specific planning document. The final deliverable to ADEQ's UST Program personnel for review

typically incorporates the different parts of the data verification summary. ADEQ UST Program personnel can request from the UST facility Owner/Operator copies of field records and notebooks for their own review on an as needed basis.

Most qualified sampling contractors and State and Federal certified laboratories develop SOPs and analytical methods as part of their overall QA program. These entities typically develop SOPs following EPA's 2007 ***Guidance for Preparation of Standard Operating Procedures for Quality-Related Operations***. The field team should document which SOPs they are using in the field and any deviations from an SOP. Appendix D lists references and weblinks to EPA generated SOPs.

D2.3.3 Sample Handling

QA personnel perform the following: 1) confirm handling of samples were in accordance with protocols required in the QA Program Plan and project-specific planning document; 2) confirm utilization of sample containers and preservation methods as appropriate for the nature of the sample and type of data generated from the sample; and 3) check chain-of-custody records and storage conditions to ensure the representativeness and integrity of the samples.

D2.3.4 Analytical Procedures

Section B4 of this QA Program Plan identified the requirements of analytical methods used to generate the data. Verification of each sample ensures implementation of specified procedures used to generate the data. Acceptance criteria for these data follow those used in data validation with suitable codes to characterize any deviations from the procedure.

D2.3.5 Quality Control

Section B5 of this QA Program Plan specifies performing the QC checks during sample collection, handling, and analysis. Here, the QA reviewer confirms evaluation of results for QC samples against acceptance criteria (i.e., MQOs) specified in Section B.

D2.3.6 Calibrations

Section B7 of this QA Program Plan addressed the calibration of instruments and equipment and the information required to ensure that the calibrations (1) were performed within an acceptable timeframe prior to generation of measurement data; (2) were performed in proper sequence and included the proper number of calibration points; (3) were performed using standards that bracketed the range of reported measurements (i.e., were within the linear working range of the instrument); and (4) had acceptable linearity checks to ensure the measurement system was stable when the calibration was performed. The environmental consultant performing the field work for the UST facility Owner/Operator is responsible for the calibration of all field sampling equipment. Contracted environmental laboratories are responsible for the calibration of all laboratory equipment used to analyze samples associated with all samples collected for the data generated for and submitted to ADEQ's UST Program. Personnel record all equipment and instrument calibrations into an appropriate logbook and ensures availability of the logbook to ADEQ's UST Program personnel upon request.

D2.3.7 Data Reduction and Processing

Internal checks by laboratory staff should verify the integrity of the raw data generated by the analyses. Electronic data deliverables (EDDs) automatically produced by the laboratory should help minimize data entry errors. The steps in data reduction need clear documentation for properly assessing the validity of the analysis.

Data should be cross-checked to confirm consistency or comparability in analytical methods and detection limits, units of measurement, compatibility of file types or software, and other critical factors that affect data interpretation and its influence on conclusions and recommendations.

D3: Reconciliation with Data Quality Objectives

After the verification and validation of data, evaluation of the data against project DQOs occurs. Implementation of the DQA process completes the data life cycle by providing the assessment needed to determine achievement of project objectives.

The DQA process has a fundamental premise - data quality is meaningful only when it relates to the intended use of the data. Data quality does not exist in a vacuum; a reviewer needs to know the context and use of a data set in order to establish a relevant yardstick for judging whether or not the data are acceptable. By applying the DQA process, a reviewer can answer four important questions:

1 Can someone make a decision (or estimate) with the desired level of certainty, given the quality of the data?

2 How well did the sampling design perform?

3 Is data expected to support the same intended use with the desired level of certainty for a similar study using the same sampling design strategy?

4 Is it likely that sufficient samples were taken to enable the reviewer to see an effect if there really were an effect? That is, is the quantity of data sufficient?

D3.1 Purpose/Background

This section outlines methods for evaluating the results obtained from the sampling and analysis. Use of scientific and statistical evaluations of the data determine if the data collected are of the right type, quantity, and quality to support their intended use and to adequately address the primary study questions.

Please note that ADEQ's UST Program rarely employs statistical evaluations of data generated for and submitted to them for their use. This is because judgmental sampling is most always the appropriate sample collection method for situations encountered at UST sites. For the rare occasion when a project needs a statistical evaluation (e.g. sampling to determine background concentrations of metals), confidence intervals (step 3 of the "Five Steps of Statistical DQA" in Section D3.2 below) is the statistic

that would most likely best fit the project. If needed, a contractor can perform a statistical evaluation other than confidence intervals in accordance with the DQA process outlined in this QA Program Plan.

D3.2 Reconciling Results with Program Objectives or DQOs

For inadequately defined DQOs, the analyst may need to review the planning documents and sampling design and use professional judgment to determine whether quantitative or qualitative use of the data is justified. When using statistics on sample results (e.g. when determining background concentrations for metals), the analyst will also define the statistical hypotheses to be tested and establish tolerable limits on decision errors.

For those DQOs that are qualitative (e.g. when collecting soil vapor samples in a grid pattern at abandoned UST sites to decide if there are any potential release areas at that site), ADEQ and Owner/Operators will still systematically assess data quality and data usability. This DQA – Four Steps of DQA for Qualitative DQOs - include the following:

1. A review of the sampling design and sampling methods to verify that these were implemented as planned and are adequate to support project objectives;

2. A review of project-specific MQOs for precision, accuracy, representativeness, completeness, comparability and quantitation limits to evaluate whether acceptance criteria have been met;

3. A review of project-specific DQOs to assess whether they have been achieved by the data collected; and

4. An evaluation of any limitations associated with decisions based on the data collected. For example, if data completeness is only 90 percent compared to a project-specific completeness objective of 95 percent, the data may still be usable to support a decision, but at a lower level of confidence.

For those scenarios when statistics are used for comparing sample results against a value (e.g. regulatory threshold), EPA guidance documents for data evaluation (EPA 2006) describes an iterative five-step process called the “Five Steps of Statistical DQA”. These five steps are:

1 Review the DQOs and sampling design described in the project planning documents.

2 Conduct a preliminary data review or exploratory data analysis to understand the character and structure of the data set and to evaluate whether there are any previously unseen anomalies in the data not noticed during data verification and validation. Should further investigation of outliers or other anomalies occur prior to continuing with statistical testing?

3 Select a statistical test. Choose appropriate statistical tests based on the characteristics of the data and the questions that the investigation was intended to address.

4 Verify the assumptions of the statistical tests and assess the effect that violations of test assumptions may have on the result (i.e., is the test sufficiently robust to provide a valid result at

a reasonable level of confidence?) and consider other factors (i.e., Are there effects of seasonality that must be considered? Would alternative statistical tests be better suited to the data than the tests proposed in the planning documents?).

5 Draw conclusions from the data. Using multiple lines of evidence, the results of statistical tests and professional judgment, the data analyst should be able to provide conclusions and recommendations for the site. The conclusion, in some cases, can detail a need for more data for the purpose of better answering the primary study questions.

*Use of statistics for ADEQ's UST Program occurs when determining background concentrations of metals in soils, sampling stockpiled soil, and determining site specific remediation standards.

D3.2.1 Review DQOs and Sampling Design

Step 1 of the DQA process should (1) document or define the project specific DQOs, (2) verify that the hypothesis is consistent with project objectives, and (3) identify any deviations from the sampling plan and assess the potential effect of the deviations.

A review of the objectives of the study occurs in order to provide a context for analyzing the data. If implementation of a systematic planning process occurs before the data are collected, this step reviews the study objectives and evaluates for completion of project goals and adequacy of answers to the study questions. If there was no clear planning process prior to data collection, the reviewer should develop a concise definition of the problem (Step 1) and of the methodology of how the data were collected (DQO Step 2). These two steps should provide the fundamental reason for collecting the environmental data and identify all potential actions that could result from the data analysis.

The project-specific planning document should clearly detail the design and sampling strategy. The overall type of sampling design and the manner in which data collection occurs typically constrains data use and interpretation. The data analyst should assess whether features of the design support or contradict the stated objectives of the study. Were there deviations from the planned design? What might be the effect of these deviations? Are data adequate to address the primary study questions? How do these objectives translate into statistical hypotheses (null and alternative hypotheses)? *Section B1.1 of this document discusses sampling designs in greater detail.

Regardless of the type of sampling scheme, the reviewer should review the description of the sampling design and look for design features that support the project objectives. For example, if the goal of the study is to make a decision about the average (defined here as the arithmetic mean) concentration of a contaminant in a stockpiled soil, then composite samples may be an appropriate sampling design. On the other hand, if the goal of the study is to find contaminant source areas at an abandoned UST site, one needs caution when compositing samples to avoid "averaging away" hot spots.

The reviewer should also look for potential problems in the implementation of the sampling design. For example, if data collection involved simple random sampling, can the reviewer be confident that the sampling locations or data point were truly random? Careful assessment of significant or substantial

deviations needs to occur. Small deviations from a sampling plan, though, probably have minimal effect on the conclusions drawn from the data set. Finally, the reviewer should verify that the data are consistent with the project-specific planning document and the overall objectives of the study.

D3.2.2 Conduct Preliminary Data Review

Step 2 of the DQA process reviews graphical representations of the data and calculates some basic statistical quantities. By reviewing the data both numerically and graphically, the reviewer can understand the structure of the data, and thereby identify appropriate use of the data.

Statistical quantities numerically describe the data. The quantities that are typically calculated include the arithmetic or geometric mean, the median and other percentiles, and the standard deviation. These quantities provide estimates of characteristics for the sample population and allow one to make inferences about the population from which the data were drawn. Graphical representations permit the reviewer to identify patterns and relationships within the data, confirm or disprove assumptions and identify potential problems.

The preliminary data review allows the reviewer to understand the structure and characteristics of the data set and the population from which these data were drawn. Graphical depictions of the data permit the analyst to identify anomalies that may require further investigation or perhaps even reanalysis by the laboratory. Output from DQA Step 2 typically includes (1) tables of summary statistics and (2) graphs and/or statistical plots of the data.

D3.2.3 Select Statistical Test

Under Step 3 of the DQA process, the data analyst selects the most appropriate statistical test or method for evaluating the data. The basis for selection of the statistical method are the sampling plan used to collect the data, the type of data distribution, and the assumptions (and any deviations from these assumptions) made in setting the DQOs. The results of this evaluation assist in formulating conclusions about other aspects of the data set or the stated null hypothesis. EPA DQA guidance provides a discussion (with mathematical formulas and examples for conducting statistical tests) of the process for statistically evaluating environmental data. Chapter 3 of EPA's 2006 ***Data Quality Assessment: Statistical Methods for Practitioners*** details technical information that reviewers can use to select appropriate procedures.

For the occasion when a UST Program project needs a statistical evaluation, confidence intervals (step 3 of the "Five Steps of Statistical DQA" in Section D3.2 above) is the statistic that would most likely best fit the UST Program project. For example, the project's objective may be to estimate the average level of pollution for a particular contaminant. A reviewer can describe the desired (or achieved) degree of uncertainty in the estimate by establishing confidence limits within which one can be reasonably certain that the true value will lie. When interpreting a confidence interval statement such as "The 95% confidence interval for the mean is 19.1 to 26.3", the implication is that the best estimate for the unknown population mean is 22.7 (halfway between 19.1 and 26.3), and that we are 95% certain that the interval 19.1 to 26.3 captures the unknown population mean.

If the project-specific planning document specified a particular statistical procedure, the reviewer should use the results of the preliminary data review to determine if the procedure is appropriate for the data

collected. If not, then the reviewer should document why the procedure is inappropriate and then select a different method. Chapter 3 of EPA's 2006 ***Data Quality Assessment: Statistical Methods for Practitioners*** provides alternatives for several statistical procedures. If there is not a particular procedure specified, then the reviewer should select a statistical test or method based on the study objectives, results of the preliminary data review, and key assumptions necessary for the method.

All statistical tests make assumptions about the data. For instance, the t-test, which is a parametric test used to compare two data sets, assumes that each data set approximates a normal distribution and that the two data sets have approximately equal variance. In contrast to parametric tests like the t-test, nonparametric tests make much weaker assumptions about the distributional form of the data. However, both parametric and nonparametric tests assume that the data are derived from statistically independent samples. Common assumptions of statistical tests include distributional form of the data, independence, dispersion characteristics, approximate homogeneity, and the basis for randomization in the sampling design. For example, the one-sample t-test assumes random and independent samples, an approximately normal distribution, no outliers, and no more than a small percentage of non-detections.

Statistical methods are "robust" if they are insensitive to small or moderate departures from the assumptions. However, some tests rely on the data meeting certain key assumptions in order for the test results to be valid. The reviewer should note any sensitive assumptions where relatively small deviations could jeopardize the validity of the test results.

After completing Step 3 of the DQA process, the data analyst or reviewer should have selected appropriate statistical tests and noted the critical assumptions of the statistical tests.

D3.2.4 Verify Assumptions of Statistical Tests

The validity of a statistical test or method depends on the key assumptions underlying the test and whether the data violate these assumptions. Minor deviations from assumptions are usually not critical if the statistical technique is sufficiently robust to compensate for such deviations.

If the data do not show serious deviations from the key assumptions of the statistical method, then the DQA process continues to Step 5, 'Draw Conclusions from the Data'. However, it is possible that if there is one or more questionable assumptions, the chosen most appropriate test for the data could require re-evaluation. It is true that some deviations do not invalidate the results of a statistical test, but confirmation takes place in Step 4 of the DQA process. For example, deviation from normality may not be seriously important for a large sample size, but could be critically important for a small sample size.

This step in the DQA process is an important check on the validity and reliability of the conclusions that are drawn. Outputs from this step include documentation of the method used to verify assumptions and verification that the test results are valid. Additionally, the reviewer should provide a description of any corrective actions taken.

D3.2.5 Draw Conclusions from Data

Step 5 of the DQA process represents the culmination of the planning, implementation, and investigation phases of the project operations. In this step, the data analyst draws conclusions that address the project

objectives. All of the analysis and review conducted in Steps 1 through 4 should ensure that the conclusions drawn in Step 5 adequately address project objectives in a scientifically defensible manner.

Step 1 is a review (or retrospective development) of project objectives and sampling design evaluation. Step 2 is a review of the sampling scheme implementation and development of the preliminary picture with respect to the data set. Step 3 is a selection of appropriate statistical tests. Finally, Step 4 verifies the underlying assumptions of the statistical test.

Conclusions drawn in the final step of the DQA process allow the reviewer or data analyst to present valid statistical results with a specified level of significance. This step plainly states the confidence and power of the tests, along with the study conclusions. Finally, the data analyst provides an assessment of the overall performance of the sampling design and identifies any needed additional data (i.e. data gaps are identified).

Application of professional judgment to draw conclusions without relying on formal statistical testing occurs when judgmental sampling is the selection method for sample collection or when few samples are collected. UST Program investigations utilize judgmental sampling in the vast majority of circumstances. Or, there can be application of statistical tests but with the recognition that the results may present a biased "worst-case scenario". For example, if the data from biased samples (e.g., selective sampling of visibly stained soils) are used in a one-sample statistical test to compare concentrations against a regulatory threshold, and test results show that concentrations do not exceed the threshold, then a conclusion can be drawn. If test results show that concentrations do exceed a regulatory threshold, then, in formulating conclusions, the reviewer should balance the test results against the knowledge of the use of biased data toward the sampling of "hot spots".

D4: Revisions to the QA Program Plan

Throughout the life of ADEQ's UST Program, there may be changes to program requirements, or modifications to the way environmental data are collected, or changes to the definitions of enforcement activities. Therefore, this QA Program Plan is a dynamic document that is subject to revision, as needed. ADEQ UST Program personnel, Technical Support, and QA/QC personnel will examine and revise this QA Program Plan annually. Re-submittal of this plan to the EPA Region 9 QA manager for review, though, will occur once every five years or as otherwise needed. Dissemination of approved revisions include personnel on the Distribution List (page 6).

Table D1 – Criteria for Partial and Full Data Validation

Analytical Group	Criteria for Partial Data Validation	Criteria for Full Data Validation
Organic Analyses	● Holding times ● Calibration ● Blanks ● Surrogate recovery ● Matrix spike and matrix spike duplicate recovery ● Laboratory control sample or blank spike ● Internal standard performance ● Field duplicate sample analysis ● Temperature ● Overall assessment of data for an SDG	● Holding times ● Gas Chromotography/Mass Spectroscopy tuning ● Calibration ● Blanks ● Surrogate recovery ● Matrix spike and matrix spike duplicate recovery ● Laboratory control sample or blank spike ● Internal standard performance ● Field duplicate sample analysis ● Compound identification ● Target compound list identification ● Compound quantitation and reported detection limits ● Tentatively identified compounds ● System performance ● Temperature ● Overall assessment of data for an SDG
Inorganic Analyses	● Holding times ● Calibration ● Blanks ● Matrix spike recovery ● Matrix duplicate sample analysis ● Laboratory control sample or blank spike ● Field duplicate sample analysis ● Temperature ● ICP serial dilution ● Overall assessment of data for an SDG	● Holding times ● Calibration ● Blanks ● ICP interference check sample ● Matrix spike recovery ● Matrix duplicate sample analysis ● Laboratory control sample ● Field duplicate sample analysis ● Graphite furnace atomic absorption QC ● Sample result verification ● Temperature ● ICP serial dilution ● Detection limits ● Overall assessment of data for an SDG

Notes:
ICP Inductively coupled plasma (emission spectroscopy)
SDG Sample delivery group
QC Quality Control

APPENDICES

Appendix A Arizona Administrative Code for Department of Health Services Laboratories
Appendix B Arizona Administrative Code for Soil Remediation Standards and Water Quality Standards
Appendix C Analytical Data Information from ADEQ's website
Appendix D Standard Operating Procedures
Appendix E Field Forms
Appendix F ADEQ Specific Quality Assurance Guidance and Policies

Appendix A Arizona Administrative Code for Department of Health Services Laboratories

Below is the hyperlink to the Arizona Administrative Code for Title 9 (Health Services) Chapter 14 (Department of Health Services Laboratories):

http://apps.azsos.gov/public_services/Title_09/9-14.pdf

Appendix B **Arizona Administrative Code for Soil Remediation Standards and Water Quality Standards**

Below is the hyperlink to the Arizona Administrative Code for Title 18 (Environmental Quality) Chapter 7 (Department of Environmental Quality Remedial Action) Article 2 (Soil Remediation Standards):

http://apps.azsos.gov/public_services/Title_18/18-07.pdf

Below is the hyperlink to the Arizona Administrative Code for Title 18 (Environmental Quality) Chapter 11 (Department of Environmental Quality Water Quality Standards):

http://apps.azsos.gov/public_services/Title_18/18-11.pdf

The following are tables that detail cleanup standards for common chemicals found in petroleum products. Please refer to the provided Arizona Administrative Code hyperlinks for information on chemicals not listed in the tables.

Arizona Department of Environmental Quality UST Program

May 2016

Tier 1 Cleanup Standards: Petroleum Products

CHEMICAL OF CONCERN	Aquifer Water Quality Standard Groundwater (µg/L)	Soil (mg/Kg)		
		Child Care or School 2007 SRLs	Residential 2007 SRLs	Spreadsheet minimum GPL- 2007 (soil leaching) *Saturation in soil
VOCs				
1,3-Butadiene		0.058	0.58	
1,2-Dibromoethane (EDB)	0.05	0.029	0.29	
1,2-Dichloroethane (DCA)	5	0.28	2.8	0.23
1,2,4-Trimethylbenzene			52	
1,3,5-Trimethylbenzene			21	
Benzene	5	0.65	0.65	0.70
n-Butylbenzene			240	
sec-Butylbenzene			220	
tert-Butylbenzene			220	
Carbon disulfide		360	360	
Cumene (isopropylbenzene)			92	
Cyclohexane			140	
Cyclohexanone		310,000	310,000	
Ethylbenzene	700		400	82*
n-Hexane			110	
Methyl ethyl ketone (MEK)			23,000	
Methyl isobutyl ketone (MIBK)			5,300	
Methyl tert-butyl ether (MTBE)* see MTBE interim groundwater policy	*Tier 1: 94 or 21	32	320	
Methylcyclohexane			230	
n-Propylbenzene			240	
Toluene	1,000		650	159*
Xylenes (total)	10,000		270	31*

Arizona Department of Environmental Quality UST Program

June 2016

Tier 1 Cleanup Standards: Petroleum Products

PAHs				
Acenaphthene			3,700	
Anthracene			22,000	
Benz[a]anthracene		0.69	6.9	
Benzo[a]pyrene	0.2	0.069	0.69	
Benzo[b]fluoranthene		0.69	6.9	
Benzo[k]fluoranthene		6.9	69	
Chrysene		68	680	
Dibenzo[a,h]anthracene		0.69	6.9	
Fluoranthene		2,300	2,300	
Fluorene			2,700	
Indeno[1,2,3-c,d]pyrene		0.69	6.9	
Naphthalene			56	
Pyrene			2,300	
Other Organic Compounds				
Tetraethyl lead			0.0061	
1,1-Biphenyl			350	
Carbazole		27	270	
2-Methylphenol (a-creosol)			3,100	
3-Methylphenol			3,100	
4-Methylphenol			310	
Inorganic Compounds				
Antimony	6	31	31	35
Arsenic	50 (MCL is 10)	10	10	290
Beryllium	4	150	150	23
Cadmium	5	39	39	29
Lead	50	400	400	290
Mercury	2	23	23	12
Molybdenum		390	390	
Selenium	50	390	390	290
Vanadium		78	78	

Appendix C **Analytical Data Information from ADEQ's website**

Below is the hyperlink to an ADEQ information data sheet titled "*Analytical Data Information*".

http://legacy.azdeq.gov/environ/waste/ust/download/Program_Analytical_Data_July_2016.pdf

The following pages are that information data sheet in its entirety:

ADEQ UST Program
Analytical Data Information
June 2016

Soil and Groundwater Analysis

Volatile Organic Compounds (VOCs)

Soil Remediation Levels (SRLs) were established in 1997 and of the petroleum-related compounds of concern, only 4-ethyltoluene and propylene don't have SRLs. All petroleum-related compounds of concern should have been part of any UST investigation once the SRLs were adopted in 1997. Arizona Department of Health Services (ADHS) issued Information Update #52 in 1998 in regards to what compounds are to be reported using EPA Method 8260B. ADHS issued Information Update # 106 in 2010 regarding additions to the standard 8260 VOC list.

The ADHS issued Information Update #119 on May 15, 2014 to include the most recent additions to the 8260B analyte list. Currently, twenty four (24) compounds found in petroleum products are included in the 8260B target analyte list for both soil and groundwater. The entire 8260B compounds list needs to be reported {including the target analyte list]. The six compounds identified with an asterisk (*) may be reported as a tentatively identified compound (TIC), depending upon the laboratory used. **VOCs should be evaluated for all UST projects (gasoline, diesel, etc.).**

1,3-Butadiene*	Benzene	1,2-4-Trimethylbenzene
n-butyl benzene	Toluene	1,3,5-Trimethylbenzene
Sec-butyl benzene	Ethyl benzene	MTBE (methyl tert butyl ether)
Tert-butyl benzene	Xylenes	1,2-DCA (1,2-dichloroethane)
Carbon disulfide	Methyl cyclohexane*	Dicyclopentadiene*
Cumene (Isopropyl benzene)	Naphthalene	n-Hexane
Cyclohexane*	n-propylbenzene	p-isopropyl toluene
4-ethyltoluene*	Propylene (Propene)*	EDB (1,2-dibromoethane/ ethylene dibromide)

Where do you find some of these compounds?

Diesel fuel contains higher concentrations of **1,3-butadiene** than gasoline.

Leaded *or* regular gasoline - ***between 1920s and the early 1990s***

Ethylene dibromide/1,2-dibromoethane (EDB)/1,2-dichloroethane (1,2-DCA) EDB and 1,2-DCA are lead scavengers which were added to prevent the build up of lead oxide deposits in internal combustible engines. EDB analysis in soil can be done using EPA Method 8260B. If the laboratory's reporting limit is not below the residential Soil Remediation Level of 0.29 mg/Kg, EPA Method 8011 should be used for analysis. EDB analysis in groundwater (source well and any wells with previous detections of EDB) should be conducted using EPA Method 504.1 or EPA Method 8011 to reach a reporting limit below the Aquifer Water Quality Standard (AWQS) of 0.05 µg/L if the reporting limit using EPA Method 8260B is above the AWQS. EDB is persistent in groundwater due to the physical weathering process of both EDB and 1,2-DCA, which is slow and can last decades and beyond.

Tetraethyl lead [TEL] is a component of leaded gasoline. The first ban of leaded gasoline occurred in 1985. Leaded gasoline was sold until approximately 1995 but it made up only 0.6% of total gasoline sales. **TEL analysis is required for known or suspected (based on the year the UST was installed) leaded gasoline sites and aviation fuel sites.** Tetraethyl lead has had a Soil Remediation Level since 1997 and should have been included in UST investigations for gasoline releases that occurred prior to 1995. For soil analysis, the laboratory reporting limit target is the Residential Soil Remediation Level which is 0.0061 mg/Kg. Inorganic lead or toxicity characteristic leaching procedure (TCLP) lead data is **not**

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acceptable to evaluate tetraethyl lead. There is no AWQS for tetraethyl lead and the AWQS for lead is **not** an acceptable regulatory standard for tetraethyl lead in groundwater.

Unleaded gasoline-pre 2004

Methyl tertiary butyl ether (MTBE) was first used in 1979 in some gasoline blends, but in exceedingly small concentrations. In Arizona, MTBE was primarily used until approximately 2004 to satisfy the 1990 Clean Air Act amendments, which required oxygenated additives to reduce pollution from vehicle exhaust systems. By 2003, California banned MTBE and began using ethanol as the oxygenated additive. By 2004, Arizona was receiving over 60% of its gasoline from California.

Unleaded gasoline releases- after approximately 2004

Ethanol is the current oxygenated additive in gasoline (E10, E15, E20, E85, E95 fuels) and is miscible in water unlike conventional petroleum fuels. Ethanol can be analyzed as part of EPA Method 8260B, but the laboratory detection limit in groundwater may be too high to give consistent, quantitative results. If requested, the laboratory can modify EPA Method 8260B by following the method as defined by the EPA in the SW-846 8000 series methods dated December 1996 or later updates. Most of the modifications are for instrument calibration. Dissolved gases which include methane, ethane and ethylene can be analyzed in groundwater by using the Standard Operating Procedure for method RSK-175 which was developed by the EPA Robert S. Kerr Research Laboratory. Aqueous samples are analyzed for the dissolved gases using a headspace Gas Chromatography/Flame Ionization Detection (GC/FID) technique. **This data provides additional information to support the presence of ethanol in the groundwater since methane concentrations increase as ethanol degrades. Methane generation may be delayed for months to years after the gasoline release and may persist for years after the ethanol is no longer present in the groundwater.**

Premium and super (mid) grades of unleaded gasoline contain **dicyclopentadiene**.

Polycyclic aromatic hydrocarbons (PAHs)

PAHs should be evaluated for all gasoline, diesel, aviation gas (not Jet A), waste oil and unknown contaminant sources. Analyze for PAHs using EPA Method 8310 or Method 8270C-SIM. Many of the PAHs may or may not be present at detectable levels in gasoline or diesel. As mentioned in the ADHS' Information Update #119, the following PAHs have SRLs, so they are to be reported.

Acenaphthalene	Dibenz[ah]anthracene	Pyrene	Benzo(k)fluoranthene
Benzo(b)fluoranthene	Indeno [1,2,3-cd] pyrene	Anthracene	
Chrysene	Benz(a)anthracene	Napthalene	
Fluorene	Fluoranthene	Benzo(a)pyrene	

Inorganic Metals

Waste oil sites, or sites with unknown sources of petroleum should also include the Resource Conservation and Recovery Act (RCRA) 8 metals by EPA Method 6010 etc.

Note: The petroleum product stored in USTs may have changed over the systems' lifetime. All petroleum-related analyses should be performed if UST history is not thoroughly known.

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Soil Vapor Analysis

ADEQ's Soil Vapor Guidance document dated May 2011 is available for reference. Projects should be discussed with ADEQ staff to ensure appropriate data quality objectives are met.

Volatile Organic Compounds

ADHS issued the most recent information update in November 2011 for compounds to be added to the EPA Method TO-15 (the original list was dated July 1999). The compounds listed need to be included on the EPA Method TO-15 target compound list. The laboratory may need to report some of the compounds as a TIC (tentatively identified compound). All TO-15 target compounds need to be reported. All TICs need to be reported which will include the leak detection tracer compound (1,1-difluoroethane also known as 1,1-DFA).

Acetone	4-Ethyltoluene	Trichlorotrifluoroethane (F-113)
Dichlorodifluoromethane (F-12)	Bromodichloromethane	Methyl cyclohexane
Dichlorotetrafluoroethane (F-114)	Cis-1,2-Dichloroethene	n-octane
Isopropyl alcohol (2-propanol)	Cyclohexane	Nonane
Propene (Propylene)	Dibromochloromethane	Isopropyl benzene (Cumene)
1,2-4-Trimethylbenzene	Ethyl Acetate	n-propyl benzene
1,2-Dichlorobenzene	Heptane	Tert-butyl benzene
1,3,5-Trimethylbenzene	Tetrahydrofuran	Sec-butyl benzene
1,3-Dichlorobenzene	Trans-1,2-Dichloroethene	n-butyl benzene
Trans-1,3-Dichloropropene	Trichlorofluoromethane (F-11)	Naphthalene
		Ethanol (most unreported analyte)

Fixed Gases

For suspected releases related to operating service stations (or to assist is differentiating a new release from an older release), soil vapor samples can be analyzed for fixed gases (methane, oxygen, nitrogen, carbon dioxide and carbon monoxide) by EPA Method 3C or equivalent.

General Information

Field Protocols

Soil

Soil samples for VOC analyses must be field preserved per EPA Method 5035 or subsampled using an Encore® or Terracore™ type sampling device. Soil samples are **not** to be submitted to a laboratory in brass sleeves or glass jars for VOC analysis.

Soil sample collection should begin between 0 and 15 feet to evaluate for possible ingestion and dermal contact risk. **PAHs and TEL samples do not need to be collected at each depth that VOC samples are collected.** For PAH and TEL, collect additional samples at lithology changes, the deepest sample depth and also at the highest PID readings, at a minimum.

Groundwater

Compliance sampling is required for LUST case closure evaluation. For compliance sampling, groundwater wells must be purged and appropriately sampled (low flow is an option). Compliance sampling may not be

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necessary during the monitoring phase of a project. This decision is project-specific and should be discussed with the ADEQ project manager.

If groundwater has recently been treated with oxidizing agents, most laboratories recommend collecting the samples in un-preserved Volatile Organic Analysis (VOA) vials to limit matrix interference and compound recovery problems due to the oxidizing agents. The holding time is seven (7) days for these unpreserved samples. Unpreserved samples can always be collected from wells if the holding time can be met.

Each sample matrix set should include duplicate samples (10% of total sample number). The appropriate blank sample(s) [equipment or trip blanks] should be collected as appropriate for the project.

Monitored Natural Attenuation-
The following parameters should be included: alkalinity, carbonate, bicarbonate, hydroxide, sulfate, nitrate and dissolved manganese.

Laboratory Information
Chain of Custody forms
The chain of custody form should indicate EPA Method 8260B (Arizona Full List) plus TICs or the target analyte list should be submitted along with the chain of custody form so the laboratory reports the correct data set.

Detection limits
For all data sets, the laboratory should be reporting both the reporting level (RL) and the method detection limit (MDL). If the compound is present below the RL but above the MDL, the laboratory should report the concentration as estimated and use the EPA flag of "J" and/or the ADEQ data qualifier of E4 on another appropriate data qualifier. The laboratory detection limits and the reporting limits need to be below the lowest applicable regulatory standard. **If data is reported as less than the laboratory detection limit and the laboratory detection limit is higher than the applicable regulatory standard, then the concentration exceeds the applicable standard and should be reported accordingly and not as 'Non Detect".**

Laboratory certification
The laboratory performing VOC and PAH analyses must be certified by ADHS for the applicable method(s) and laboratory certification must be valid on the analysis date.

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Guidance Documents

The Waste Programs Division Site Investigation Guidance is available at the following link: http://www.azdeq.gov/environ/waste/download/10.16.2014_Final_Draft_SI_guidance_document.pdf

The ADEQ's Soil Vapor Guidance document dated May 2011 is available at the following link: http://www.azdeq.gov/environ/waste/download/svsg.pdf

The Tier 1 Cleanup Standards- Petroleum Products table lists Aquifer Water Quality Standards, Soil Remediation Levels and Groundwater Protection Limits. It is available at the following link: http://www.azdeq.gov/environ/waste/ust/download/cleanup.pdf

The Arizona Department of Health Services (ADHS) issued Information Update #119 (VOCs in 8260B) on May 15, 2014 and it is available at the following link: http://www.azdhs.gov/documents/preparedness/state-laboratory/lab-licensure-certification/technical-resources/information-updates/information-update-119.pdf

ADHS issued an update in November 2011 for VOCs to be added to the EPA Method TO-15 (the original list was dated July 1999). The information update is available at the following link: http://www.azdhs.gov/documents/preparedness/state-laboratory/lab-licensure-certification/technical-resources/information-updates/2011.pdf

Appendix D **Standard Operating Procedures**

This appendix contains references and web addresses for numerous standard operating procedures (SOPs) from the U.S. Environmental Protection Agency (EPA). General sampling guidelines are included in the EPA SOP on General Field Sampling Guidelines. SOPs delineate the step-by-step approach that field personnel must follow in collecting samples, taking field measurements, decontaminating equipment, handling IDW and calibrating instruments. Most qualified sampling contractors and State and Federally certified laboratories develop SOPs and analytical methods as part of their overall QA program. SOPs should be developed following "Guidance for Preparation of Standard Operating Procedures for Quality-Related Operations" (EPA 2007). The field team should document which SOPs they are using in the field and any deviations from an SOP.

EPA SOPs for field sampling methods are available for download at:

https://clu-in.org/publications/db/db_search.cgi?title=1&submit_search=1&cat=18

Field personnel will ensure that all sampling equipment has been properly assembled, decontaminated and calibrated, and is functioning properly prior to use. Equipment will be used according to manufacturer's instructions, and should generally be decontaminated according to the EPA SOP for Sampling Equipment Decontamination.

The following list provides references and web addresses for a variety of SOPs provided by the EPA:

Analysis of Polynuclear Aromatic Hydrocarbons (PAHs) in Air by GC/MS **Published 03/13/2002**

The objective of this Standard Operating Procedure (SOP) is to provide guidance on the requirements for the analysis of Polynuclear Aromatic Hydrocarbons (PAH) compounds in air samples using gas chromatography/mass spectrometry (GC/MS).

Download (667KB/29pp/PDF)

Analysis of Polynulear Aromatic Hydrocarbons (PAHs) in Dust by GC/MS-SIM **Published 03/14/2005**

This Standard Operating Procedure (SOP) outlines the preparation and analysis of polynuclear aromatic hydrocarbons (PAHs) in dust matrices using gas chromatography/mass spectrometry (GC/MS) in the select ion monitoring (SIM) mode.

Download (467KB/29pp/PDF)

Data Validation Procedures for Routine Volatile Organic Analysis **Published 01/13/2004**

To establish a protocol for evaluation and validation of the volatile organic compound data generated by the Response Engineering and Analytical Contract laboratory as well as VOC data generated by subcontracted labs.

Download (1KB/53pp/PDF)

Description and Identification of Soils

Published 02/23/2004

The intent of this SOP is to establish a consistent method for describing oils that are to be sampled and analyzed in the course of a site investigation. Soil descriptions and identifications provide key information when investigating HW sites.

Download (187KB/18pp/PDF)

Determination of Granular Soil Permeability (Constant Head)

Published 06/27/2003

Outlines the procedure for the determination of the coefficient of permeability by a constant-head method for granular soils.

Download (572KB/14pp/PDF)

Drum Sampling

Published 11/16/1994

Provide technical guidance on implementing safe and cost-effective response actions at hazardous waste sites containing drums with unknown contents.

Download (806KB/32pp/PDF)

Field Analysis of Volatile Oorganic Compounds in Tedlar Bag AIR Samples by GC/MS (Triad GC/MS - Based on EPA TO-15A)

Published 01/19/2006

Describes the field gas GC/MS analysis of air sample colleceted in Tedlar bags. This procedure generates field screening data in ppbv and is based on EPA Compendium Method TO-15.

Download (360KB/17pp/PDF)

GC/MS Analysis of Sorbent Tubes and Canisters (EPA TO-15 and TO-17)

Published 03/24/2006

The purpose of this Standard Operating Procedure (SOP) is to outline the steps for the analysis of air samples collected on either sorbent tubes or in SUMMA® canisters by Gas Chromatography/Mass Spectrometry (GC/MS).

Download (2KB/34pp/PDF)

General Air Sampling Guidelines

Published 11/16/1994

Provides guidance in developing and implementing sampling plans to assess the impact of hazardous waste sites on ambient air.

Download (219KB/27pp/PDF)

Groundwater Well Sampling

Published 04/16/2001

Provides general information on sampling groundwater wells and ensures that the sample is representative of the particular groundwater zone being sampled.

Download (464KB/21pp/PDF)

Handling Potentially High Hazard Environmental Samples

Published 10/24/1994

To describe safe lab practices for the preparation and analysis of samples which may contain unknown concentrations of hazardous materials. It will focus on the practices for a mobile High Hazard lab.

Download (271KB/11pp/PDF)

Indoor Air Analysis of Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry

Published 06/03/2002

The objective of this Standard Operating Procedure (SOP) is to provide guidance on the requirements needed to analyze Volatile Organic Compounds (VOCs) in air samples using gas chromatography/mass spectrometry (GC/MS).

Download (606KB/25pp/PDF)

Investigation-Derived Waste Management

Published 10/21/1994

IDW includes soil cuttings, drilling muds, purged groundwater, decontamination fluids (water and other fluids), disposable sampling equipment, and disposable personal protective equipment (PPE).

Download (104KB/9pp/PDF)

Low Level Methane Analysis for Summa Canister Gas Samples

Published 12/16/1994

Intended for use when analyzing Summa canister gas samples for low parts per million volume levels of methane.

Download (166KB/5pp/PDF)

Manual Water Level Measurements

Published 12/10/2002

Set guidelines for the determination of the depth to water measurements in an open borehole, a cased borehole, a monitor well, or a piezometer.

Download (106KB/8pp/PDF)

Mobile Laboratory VOC GC/MS Analysis of WTC Tedlar Bag Air Samples

Published 11/19/2001

Describe the Gas Chromatography/Mass Spectrometry (GC/MS) analysis of air samples collected using Tedlar bags. The methods are applicable to the analysis of Volatile Organic Compounds (VOCs).

Download (333KB/13pp/PDF)

Monitor Well Development

Published 09/06/2001

The purpose of monitor well development is to ensure removal of fine grained sediments (fines) from the vicinity of the well screen. The most common well development methods are: surging, jetting, overpumping, and bailing.

Download (214KB/7pp/PDF)

Monitor Well Installation

Published 07/12/2001

Methods used for the installation of the wells. Monitor well installation creates a permanent access for the collection of samples to assess groundwater quality and the hydrogeologic properties of the aquifer, in which contaminants may exist.

Download (313KB/16pp/PDF)

Operation of the Hapsite Field Portable Gas Chromatograph/Mass Spectrometer (GC/MS) (Triad GC/MS - Based on EPA/TO-15A)

Published 01/26/2006

Describe the operation of the Inficon HAPSITE field-portable gas chromatograph/mass spectrometer (GC/MS).

Download (1KB/47pp/PDF)

Procedures for Automated Summa Canister Cleaning

Published 12/31/2008

Intended for use when cleaning polished stainless steel SUMMA type or glass-lined Silco type canisters.

Download (497KB/14pp/PDF)

Processing Air Samples with the Portable Sample Concentrator

Published 12/22/1994

Define the means of processing air samples with a portable sample concentrator. The sample concentrator is a field portable sorption tube concentration device used to concentrate dilute air samples prior to chromatographic analysis.

Download (277KB/13pp/PDF)

Quality Assurance/Quality Control Samples

Published 08/11/1994

Describe typical Quality Assurance/Quality Control (QA/QC) samples that are collected in the field, or prepared for or by the laboratory. The QA/QC samples identified in this SOP are representative for soil, water and air matrices.

Download (198KB/12pp/PDF)

Retrieving Meteorological Information

Published 12/04/1994

The objective of this Standard Operating Procedure (SOP) is to define the protocol for retrieving meteorological information to be used as inputs to categorize on-site field conditions in 'real-time.'

Download (64KB/5pp/PDF)

Routine Analysis of Semivolatiles in Soil/Sediment by GC/MS (EPA/SW-846 Methods 3500B/3541/8000B/8270C) (EPA/SW-846 Methods 3600C/3640A - Optional)

Published 01/23/2006

Outlines the preparation and analysis of base/neutral/acid extractable (BNA) compounds in soil/sediment matrices using a gas chromatograph/mass spectrometer (GC/MS).

Download (574KB/34pp/PDF)

Routine Analysis of Semivolatiles in Water by GC/MS (EPA/SW-846 Methods 3500B/3510C/8000B/8270C)

Published 01/23/2006

Outlines the preparation and analysis of base/neutral/acid (BNA) compounds in water matrices using a gas chromatograph/mass spectrometer (GC/MS).

Download (671KB/32pp/PDF)

Sample Documentation

Published 09/14/2002

Define the procedures for preparing and maintaining documentation which provides the details of field sampling activities.

Download (596KB/19pp/PDF)

Sample Packing and Shipment

Published 11/30/2000

Summarize requirements for the packaging, marking/labeling, and shipping of environmental and hazardous materials samples.

Download (429KB/16pp/PDF)

Sample Storage, Preservation and Handling

Published 08/11/1994

Provide general guidelines for the storage and preservation of water and soil/sediment samples.

Download (214KB/7pp/PDF)

Sampling Equipment Decontamination

Published 08/11/1994

Provide a description of the methods used for preventing, minimizing, or limiting cross-contamination of samples due to inappropriate or inadequate equipment decontamination.

Download (427KB/22pp/PDF)

The following list provides references and web addresses for a variety of SOPs provided by ASTM:

ASTM D 5088- 02(2008) Standards Practice for Decontamination of Field Equipment Used at Waste Sites

ASTM D 5679-95a. 1995. Standard Practice for Sampling Consolidated Solids in Drums or Similar Containers

ASTM D 5680-95a. 1995. Standard Practice for Sampling Unconsolidated Solids in Drums or Similar Containers.

ASTM D 5743-97. 1997. Standard Practice for Sampling Single or Multilayered Liquids, With or Without Solids, in Drums or Similar Containers

ASTM D 6063-96. 1996. Standard Guide for Sampling of Drums and Similar Containers by Field Personnel

ASTM D6232 - 2008 Standard Guide for Selection of Sampling Equipment for Waste and Contaminated Media Data Collection Activities

Appendix E **Field Forms**

Contractors and ADEQ staff working on projects associated with ADEQ's UST Program are expected provide their own field log sheets and field forms for common tasks, such as drilling and logging borings, drilling and installing monitoring wells, and sampling environmental media. Daily field logbook entries also constitute part of the record and should be included as an appendix to site assessment reports prepared for ADEQ's UST Program.

Include chain-of-custody form copies along with the analytical data from the laboratory in a separate appendix in the investigation report. Sampling sheets filled out during sample collection should correlate with the information reported on the chain-of-custody forms.
\
Samples of field forms are provided on the following pages. The list of these forms is as follows:

1. ADEQ QA/QC checklist for Soil Vapor Sampling
2. RBCA Tier 3 Submittal Checklist
3. Groundwater Sampling Field Form

Arizona Department of Environmental Quality QA/QC checklist for Soil Vapor Sampling

Sampling Company

1 Date: _____ Start time: _____ _____ ☐ ☐

2 Company Name: _____ Sampler's Name: _____

Consulting Firm:

3 Company Name: _____ Project Name: _____

4 Project Manager: _____ Project Number: _____

Well's Information

5 Location: _____ Client ID: _____ Permanent ☐ Temporary ☐

6 Address: _____

7 ADEQ File Identification #(s) _____

8 Describe the probe location: _____

9 Probe Depth: _____ inch Probe ID: _____ inch **Probe volume: 0 inch^3 (0) mls**

10 Probe type: Tygon ☐ Teflon ☐ Vinyl ☐ PVC ☐ Metal ☐ Other: _____

11 Is probe tested in the lab before installed? Y ☐ N ☐ NA ☐ Don't know ☐

12 Comments: _____

Weather Conditions

13 Temperature: _____ C^0 ☐ F^0 ☐

14 Has there been significant rain or snow recent to the sampling event? Y ☐ N ☐

15 If Yes to Question 14 Date _____ Amount of Precipitate _____ inches

Soil Conditions Information

16 Was a soil sample collected and analyzed for volumetric moisture content? Y ☐ N ☐ attach results if yes

If yes, attach results

If no, is the apparent moisture content dry ☐ moist ☐ saturated ☐

17 What is soil type encountered at sample location? _____

18 Was sample collected beneath a surface cover (e.g. parking lot, sidewalk, road, building, other)? Y ☐ N ☐

19 Describe the surface cover , if any _____

20 Was the sample collected near a subsurface conduit? Y ☐ N ☐

Describe subsurface conduit, if any _____

Sampling Train

21 Sample container: Canister : 1.0 L ☐ 6.0 L ☐ Silanized: Y ☐ N ☐

Other: _____

Tedlar bag: Y ☐ N ☐ Gas tight syringe Y ☐ N ☐

22 Flow restrictor: On 1000 mL/min ☐ 500 mL/min ☐ 200 mL/min ☐ Other: _____

One min = Taking one minute to fill one liter canister.

23 Tubing type: Tygon ☐ Teflon ☐ Vinyl ☐ PVC ☐ Other: _____

24 Tubing used from probe top to canister: Length: _____ inch ID _____ inch

25 **Tubing volume: 0 inch^3 (0) mls**

26 Are all parts of Sampling Train tested in the lab before sampling? Y ☐ N ☐

Page 1 of 2

Probe Purging Before Sampling

27 Total volume: probe(v) + tubing(v) = Probe volume 0 + Tubing volume 0 = 0 mls

28 Total volume to be purged (mls): 1x 0 ☐ 1.5x 0 ☐ 2x 0 ☐ 3x 0 ☐

29 Purging pump #: _____ Purging flow rate: ml/min Purging time: mins seconds

30 Gauge reading: < 5 inHg ☐ Other: _____ Comments: _____

31 Syringe Purging: NA ☐ Dedicated Syringe ☐ Re-used Suringe ☐ Volume _____

32 Is there condensation evident in the sampling train? Y ☐ N ☐

33 Post sample collection - Is there condensation evident in the sampling container? Y ☐ N ☐

34 **Leak Test** Y ☐ N ☐ If Yes, fill in the blanks blow:

35 Tracer compound: _____ Trade name: _____ Tested before use: Y ☐ N ☐

36 Locations applied: Probe top ☐ Sampling train: ☐ Other: _____

37 **Field Duplicate** Y ☐ N ☐ If Yes, fill in the blanks blow:

38 Used the Duplicate Splitter? Y ☐ N ☐ If no, describe the procedure: _____

Other Information

39 Identify the equipment and method used to install probe and collect sample _____

40 What was the equilibration time between probe installation and withdrawal of any soil vapor? _____

41 Sample storage /shipping temperature _____

42 Sample storage /shipping container _____

43 Sample transportation mode(s) _____

44 Was an equipment blank taken? Y ☐ N ☐ Was Tank air or Nitrogen used? _____

Note: Ambient air should not be used

45 Was a field blank taken? Y ☐ N ☐

46 Was a background (upwind ambient) sar Y ☐ N ☐

47 Are there any potential VOC sources other than the identified release nearby?

Groundwater/active fueling station/ dry cleaners/ dry wells/ other - please describe _____

48 **Well (Probe) Inspection Note:** _____

ADEQ Arizona Department of Environmental Quality

UST Corrective Action Program Checklist

RBCA Tier 3 Submittal Checklist
Soil Vapor Surveys

In accordance with A.A.C. R18-12-263.01

UST Facility Name _____ Assigned UST Facility ID 0-0_____ Assigned LUST Release ID _____

Regulated substance released: ☐ E10 ☐ Gasoline (with MTBE) ☐ Gasoline (Leaded) ☐ Diesel ☐ Used Oil ☐ Jet Fuel ☐ Other _____

ADEQ Soil Vapor Sampling Guidance Document (revised May 2011) http://azdeq.gov/environ/waste/download/svsg.pdf

Yes	No	Report Submittal
☐	☐	Report/letter summarizing field activities
☐	☐	Field notes
☐	☐	QA/QC Soil Vapor Survey Checklist includes each vapor sampling point
☐	☐	Laboratory analytical data including QA/QC data for EPA Method TO-15 including all 31 AZ compounds http://azdeq.gov/environ/waste/ust/download/Program_Analytical_Data_July_2014.pdf
☐	☐	Sample location map
☐	☐	Detection Summary Table with soil vapor results reported in µg/m3 and leak detection compound reported in ppbv
☐	☐	Screening Level Johnson & Ettinger Model [forward calculation] indoor air simulation results* http://www3.epa.gov/oeampubl/team2model/part-two/onsite/JnE_lite_forward.html

Yes	No	Field Procedures
☐	☐	Sample depth no greater than 5 feet bgs, no shallower than 3 feet bgs Note: Deeper sampling depth may be necessary due to site specific issues - check with UST program Note: Geotechnical data can be collected and used in the model instead of default values
☐	☐	Field duplicate(s) collected at a rate of 1 per 20 samples
☐	☐	Ambient air (background sample collected upwind at the site)
☐	☐	Equipment blank(s) or field blank(s) collected daily (use Nitrogen or clean tank air only in the field; The equipment blank may also be provided by the laboratory)
☐	☐	Purge and sample rate ≤200 ml/min Note: Over purging can happen under concrete so the rate can be reduced to 100 ml/min
☐	☐	Temporary probes (correct internal volume purged)
☐	☐	Permanent probes (correct number of internal purge volumes)
☐	☐	Summa canisters certified clean

Screening Level Johnson & Ettinger Model

*Chemical of concern to be modeled are the maximum concentration of each chemical that exceeds 1/10th of EPA Regional Screening Level Resident Air Supporting Table (lowest value reported). This is done to evaluate cumulative risk of all chemicals of concern. [Use the resident air table with Target Risk = 10-6 and THQ = 1.0]. Toxicity information (reference concentration and unit risk factor) must be updated in the model using information found in the most current EPA Regional Screening Level resident air table.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

Use High Indoor Air Prediction for determining cumulative cancer risk and cumulative hazard risk for petroleum related chemicals of concern, and non-petroleum related chemicals of concern for a conservative approach. The Best and Low Indoor Air Prediction may be used depending upon site specific conditions.

The User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings, revised February 22, 2004 prepared by Environmental Quality Management, Inc. for the US EPA provides information on what parameters can be updated in the model for site specific conditions.

ATC GROUP SERVICES LLC	Monitor Well Purging and Sampling Log	FLD-103
		Revision 1.0
		Mar-13

Branch: #10105 - Tempe, Arizona	Date: 12/29/15	Page of
Representative(s): JM/JMC	Project: Speedy's	
	Location: 866 Navajo Boulevard, Holbrook, Arizona	
Contact Information:	Project No: Z034000008	Phase No: 01
Well ID: MW-1L	Contractor: None	
	Weather: Clear	Temperature: 30

Purging & Sampling Instrumentation & Method

Water Level Meter (Model/ID):	Interface Probe (Model/ID): Keck
Water Quality Meter (Model/ID): YSI / Oakton / Horiba	Decontamination Method: Alconox

Purging Method: ____ PVC Bailer ____ Vacuum Truck ____ Submersible Pump ____ Peristaltic Pump Other: Bladder

____ 3 Well Volumes X Low Flow ____ Micro Purge Intake Depth (feet below TOC): 19

Sampling Method: ____ Teflon Bailer ____ Disposable Bailer X Dedicated Tubing Other: ____

Casing Volume Information	Purging Calculations
Casing Diameter: 2"	Casing Volumes (CV)
Casing Multiplier (CM)(gallons/foot): 0.16 (mL/ft) 605	WC ____ x CM ____ = ____ (CV)(gal) x 3.0 CV (gal) = ____ PV

Monitoring Measurements

Depth to LNAPL (feet): —	Total Well Depth / Screened Interval (feet bTOC): 21.7 / 16.7-21.7
Depth to Water (DTW)(feet): 13.44	Water Column (WC)(feet):
LNAPL Thickness (ft): —	Purging Start Time: 1510 End Time: 1525

Purging Data

Time (24 Hours)	DTW (Feet)	Cum. Vol. Purged (ml)	Temp (°C) (±3°)	Specific Cond. MS (µS/cm) (± 3%)	Dissolved Oxygen (mg/L) (± 10%)	pH (± 0.1)	ORP (mV) (± 10 mV)	Other
1513	13.44	300	18.8	6.30	5.28	7.55	-12	
1516	13.60	600	20.6	6.47	4.58	7.20	38	
1519	13.60	900	20.6	6.40	5.00	7.19	61	
1522	13.60	1200	20.5	6.40	5.03	7.19	67	
1525	13.60	1500	20.5	6.42	5.01	7.19	64	

Sample Data

Sample ID: MW-1L	Time of Sample: 1525	Filtered (yes/no)	Preservatives	Analytical Parameters
Container Types, Volumes, & Quantities:				
3x 40mL VOA		No	HCl	VOC EPA 8260B
3x 40mL VOC		No	HCl	Methanol EPA 8015MEETAC

Well Recovery Data

Maximum Drawdown (DTWm)(feet):	Approximate Flow Rate (GPM): 100 ml/min
Recovery Type: X Fast ____ Slow	% Recovery =

Purge Water Disposition (Attach Drum Inventory Log - FLD 106): Purge water returned to well following sample collection.

Comments:

Appendix F **ADEQ Specific Quality Assurance Guidance and Policies**

- ADEQ Temperature/Preservation Guidance (see next page);
- Substantive Policy 0154 - Addressing Spike And Surrogate Recovery As They Relate To Matrix Effects In Water, Air, Sludge And Soil Matrices Policy; and
- Substantive Policy 0170 - Implementation of EPA Method 5035 - Soil Preparation for EPA Method 8015B, 8021B and 8260B.

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

DATE: January 24, 2002

ADEQ TEMPERATURE/PRESERVATION GUIDANCE POLICY

To help assure the validity and documentation of data generated for use by ADEQ, the QA Unit requires that the elements listed below be fulfilled. If the requirements listed below are not fulfilled, the data *may* be considered unacceptable for compliance or enforcement purposes.

Temperature Documentation Requirements

The documentation of the presence of "wet" ice with samples is not a substitute for measuring temperature. At a minimum, the temperature of a temperature blank must be recorded for each cooler upon sample receipt. The preferred procedure for documenting sample temperature is to record the temperature on the chain of custody.

It is, however, *recommended* that the temperature of each sample be recorded upon sample receipt. The measurement of a temperature blank is not required if each sample temperature is documented.

The sole use of "blue" ice is strongly discouraged for use by laboratories generating data that will be submitted to ADEQ. "If 'blue' ice is used, it should be frozen at the time of sampling, the sample should be chilled before packing, and special notice must be taken at sample receipt to be certain the required temperature (4C) has been maintained." ***Manual for the Certification of Laboratories Analyzing Drinking Water***, page IV-3, section 6.2. There must be documentation substantiating that the "blue" ice was frozen at the time of sampling and that the sample was chilled before packing.

The QA Unit acknowledges that all samples may not have time to equilibrate to 4±2°C due to an insufficient time between sample collection and sample submittal to the laboratory. The rejection of data in these situations will not be automatic. Each of these occurrences will be evaluated on an individual basis to determine if a good faith effort has been made to maintain the samples at the required temperatures.

Chemical Preservation Requirements

All pH adjustments performed by the laboratory must be recorded.

The pH of a sample must be recorded by the laboratory either upon receipt or before analysis, as appropriate to the specific method. Recording the pH of a sample may be documented on the chain of custody or some other appropriate form.

In lieu of a laboratory verifying that a sample has been preserved to the appropriate pH in the field, written documentation such as a laboratory copy of a sampler's field notes also provides adequate documentation of proper preservation.