UST-Leaking Underground Storage Tank Section
QUALITY ASSURANCE PROGRAM PLAN

Prepared by

UST-Leaking UST Section
May 2022
Revision 02

A.1 TITLE AND APPROVAL PAGE

Quality Assurance Program Plan for UST-Leaking UST Section

The Arizona Department of Environmental Quality (ADEQ) has prepared this Quality Assurance Program Plan (QAPP) 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, and the *ADEQ Quality Management Plan* dated April 2022.

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

Arizona Department of Environmental Quality

Signature: Laura L. Malone (Sep 16, 2022 09:48 PDT) Date: _____
Laura L. Malone, Director, Waste Programs Division
E-mail: malone.laura@azdeq.gov

Signature: _____ Date: _____
Ana I. Vargas, Deputy Director, Waste Programs Division
E-mail: vargas.ana@azdeq.gov

Signature: _____ Date: 9/9/2022
Debi Goodwin, QA Specialist
E-mail: goodwin.debi@azdeq.gov

Signature: _____ Date: _____
Paula Panzino, Quality Assurance Manager, Director's
Office E-mail: panzino.paula@azdeq.gov

EPA Region 9

Signature: Audrey L Johnson (Sep 16, 2022 15:15 PDT) Date: _____
Audrey L. Johnson, Manager, Quality Assurance Branch
Lab Services & Applied Science Division
johnson.audreyL@epa.gov

DISTRIBUTION LIST

ADEQ UST-Leaking UST Section Staff
ADEQ Quality Assurance Manager
EPA Region 9 Quality Assurance Branch Manager

A.2 TABLE OF CONTENTS

Contents

TABLES

FIGURES

APPENDICES

	Standards, Petroleum Chemicals of Concern, Substantive Policy for UST Release Confirmation and UST Program Analytical Data Information
Appendix C	ADEQ Specific Quality Assurance Guidance and Policies
Appendix D	Standard Operating Procedures
Appendix E	ADEQ Field Forms

ACRONYMS AND ABBREVIATIONS

A.A.C.	Arizona Administrative Code
ADEQ	Arizona Department of Environmental Quality
ADHS	Arizona Department of Health Services
ADQ	Audit of Data Quality
A.R.S.	Arizona Revised Statutes
ASTM	American Society for Testing and Materials
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CMS	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
ISU	UST Information and Support Unit
ITRC	Interstate Technical Regulatory Council
LCS	Laboratory Control Sample
LPU	Leak Prevention Unit
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
MIS	Multi-increment sampling
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
SL	State Lead Program
SOP	Standard Operating Procedure
TICE	Tanks Inspection, Compliance, and Enforcement Unit
TOO	Task Order Offer
TSA	Technical System Audit
UST	Underground Storage Tank
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound
VS	Value Stream
WPD	Waste Programs Division

Version No.	Revision Date	Name of QA Specialist	Summary of Changes
1	10/2016	Debi Goodwin	QAPP update
2	10/2021	Debi Goodwin	5-year QAPP update

SECTION A PROGRAM MANAGEMENT

A.4 PROGRAM ORGANIZATION

This Quality Assurance Program Plan (Program Plan) establishes the requirements for collecting data as part of the UST-Leaking UST Section (UST Program) Value Stream projects. The purpose of the Program Plan is to establish quality assurance (QA) and quality control (QC) standards and procedures to be applied to UST projects to produce data that are scientifically valid and defensible, and of known and documented quality.

ADEQ's UST Program operates within the Waste Programs Division (WPD) of 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 Resource Recovery Conservation and Recovery Act (RCRA), the Clean Water Act (CWA) and from cooperative work agreements through CERCLA. The UST Program is one component of the WPD and consists of full-time employees and managers/supervisors.

ADEQ's Director has delegated day-to-day responsibility for overseeing the Quality Management Plan to ADEQ's Quality Assurance Manager (QAM). The QAM functions as the Agency's technical QA expert. The QAM has developed a team of QA specialists made up of designated QA/QC personnel from each of the agency's three environmental Divisions and the QAM resides in the Office of Environmental Excellence for reasons of autonomy. The QA Team began biweekly meetings in August 2018. The QAM is not routinely involved with the day-to-day activities of the hazardous waste program or in any of the planning phases of a project or in the review/approval of Site Assessment Plans (SAPs). However, the QAM can be requested to assist in the review of quality assurance and control practices when necessary.

ADEQ's Quality Management System (QMS) requires that all environmental monitoring and measurement efforts mandated or supported by the United States Environmental Protection Agency (EPA) have in place a centrally managed Quality Assurance Program Plan (QAPP). ADEQ's QMS is being implemented to satisfy the policy and program requirements of the EPA Order CIO 2105-P-01-0 which provides requirements for the conduct of quality management practices, including quality assurance (QA) and quality control (QC) for environmental data generation, as a non-EPA organization performing work on behalf of EPA.

The content of this Program Plan fulfills the US EPA requirement for programs receiving Federal grant monies and environmental monitoring and measurement efforts mandated or supported by US EPA have in place a centrally managed Program Plan.

ADEQ's UST Program maintains procedures to ensure the precision, accuracy, completeness, comparability and representativeness of data generated for environmental programs operated under the UST Program. The units within the UST Program associated with data collection are the Tanks Inspections, Compliance and Enforcement Unit (TICE), Corrective Action Unit (CAU), and the Leak Prevention Unit (LPU). The UST Program also has a senior technical team (Operational Excellence Team [OET], which is also known as the Operational and Technology

Unit), which is unique to this ADEQ program, but does not generate data. The remaining unit in the UST Program is the Information and Support Unit, which does not generate data applicable to this QAPP.

Examples of activities within ADEQ's UST Program include, but are not limited to: the inspection of UST facilities, complaint investigations, and corrective actions at UST facilities. ADEQ can require the UST owner/operator to conduct the sampling or ADEQ contractors under the State Lead program, or on rare occasions designate agency personnel to collect such samples and/or documenting field collection activities. A UST facility can be a facility that is currently in operation or has a history of operating USTs as described in Arizona Revised Statutes (A.R.S.) Title 49, Chapter 6 found at https://www.azleg.gov/arsDetail/?title=49.

Those activities will occur within a framework that is well-defined by specific documentation requirements as prescribed under rule. 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.

The majority (greater than 98%) of the sample collection is done by consultants hired by the UST owner/operator, or by consultants hired by UST Project Managers under the state-wide Tanks Contract. The respective consultants collect data, generate reports and perform data validation according to their corporate Standard Operating Procedures (SOPs) and Quality Assurance Plan for UST project. UST Project Managers do review submitted reports for completeness and accuracy of the data. Additional data validation can be performed by the UST Project Manager and the OET, as necessary.

Under this organizational structure, the Section Manager is responsible for overall management, direction, coordination and guidance for the UST Program. The Section Manager is responsible for overseeing the entire UST-Leaking UST program and budget. The Units are led by supervisors who, along with their staff, carry out program tasks. The Administrative Assistant reports directly to the Section Manager.

Unit Managers are responsible for their individual program's overall development of the sampling design and protocols discussed in this QAPP, as well as ensuring protocols are followed. On a routine basis, the Unit Managers coordinate with their staff and contractors to review field and laboratory roles and responsibilities, sampling and field measurement requirements, analytical requirements, sampling schedule and requirements for field and laboratory documentation. This coordination minimizes potential problems that could occur. The Value Stream Managers are also responsible for ensuring that any amended versions of the QA program plan are provided to the EPA for approval and then distributed to the appropriate individuals and organizations.

Staff level personnel consist of Environmental Hydrogeologists, Engineers, Scientists, and Inspectors. Their responsibilities with QC may involve: inspecting regulated facilities for regulatory compliance, reviewing planning documents and reports submitted by the UST owner/operators or ADEQ-hired consultants, to investigate and remediate soil and groundwater contamination. On rare occasions, soil, groundwater and/or soil gas samples may be collected

directly by ADEQ staff during site characterization activities or during facility inspections. ADEQ's UST Inspectors can conduct announced or unannounced inspections to ensure a UST facility maintains compliance with regulatory requirements.

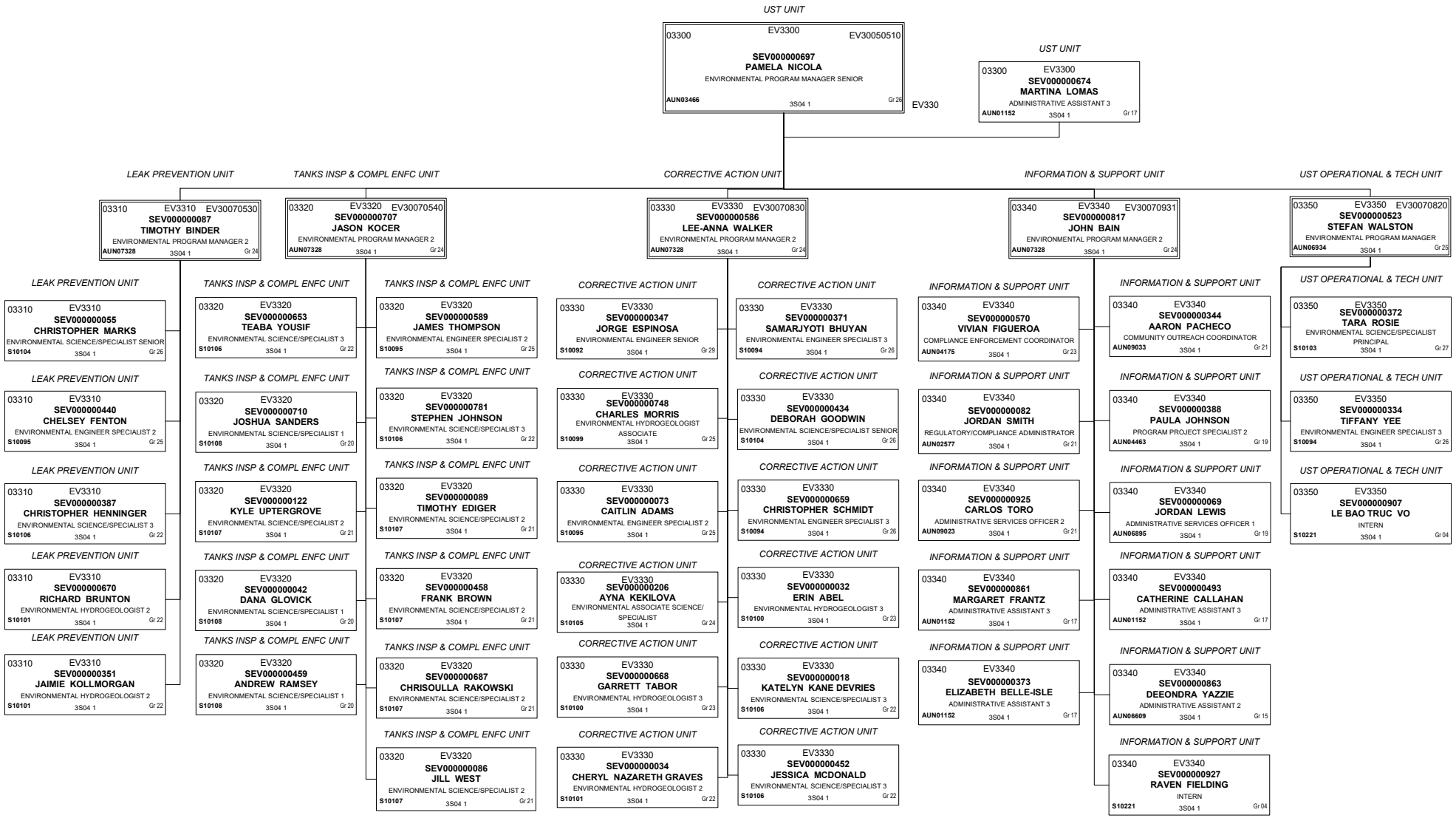
Some UST Project Managers oversee UST closure and site investigation/remediation projects conducted by ADEQ within the State Lead financial assistance program. Their duties include hiring and oversight of a consultant from the Tanks Contract, review submittals including data quality review, and preparation of determination letters. A few UST Project Managers oversee consultants hired to perform corrective actions at orphaned sites under the Leaking UST Grant provided by the EPA.

Some UST Project Mangers oversee projects where the UST owner/operators are responsible for data collection and report submittal. The UST owner/operators hire consultants to generate environmental data, which includes a registrant of the Arizona Board of Technical Registration of an appropriate discipline to seal all documents requiring professional judgment, as required under A.R.S. §32-101 and Arizona Administrative Code. (A.A.C.) R18-12-264(B). The UST Project Managers review submittals including data quality review, and preparation of determination letters.

The QAM is independent of the Executive Leadership Team who are the policy making group for ADEQ. With this separation of groups, Leadership Team, Value Stream QA Specialists, and the QAM, autonomy is preserved in fact and appearance. The ultimate responsibility for Quality Assurance for ADEQ lies with the agency Director. Details regarding the roles and responsibilities of the QAM and QA Specialists can be found in A.6 of this QAPP and Section 1.4.2 of ADEQ's Quality Management Plan, 2022.

Waste Programs Division

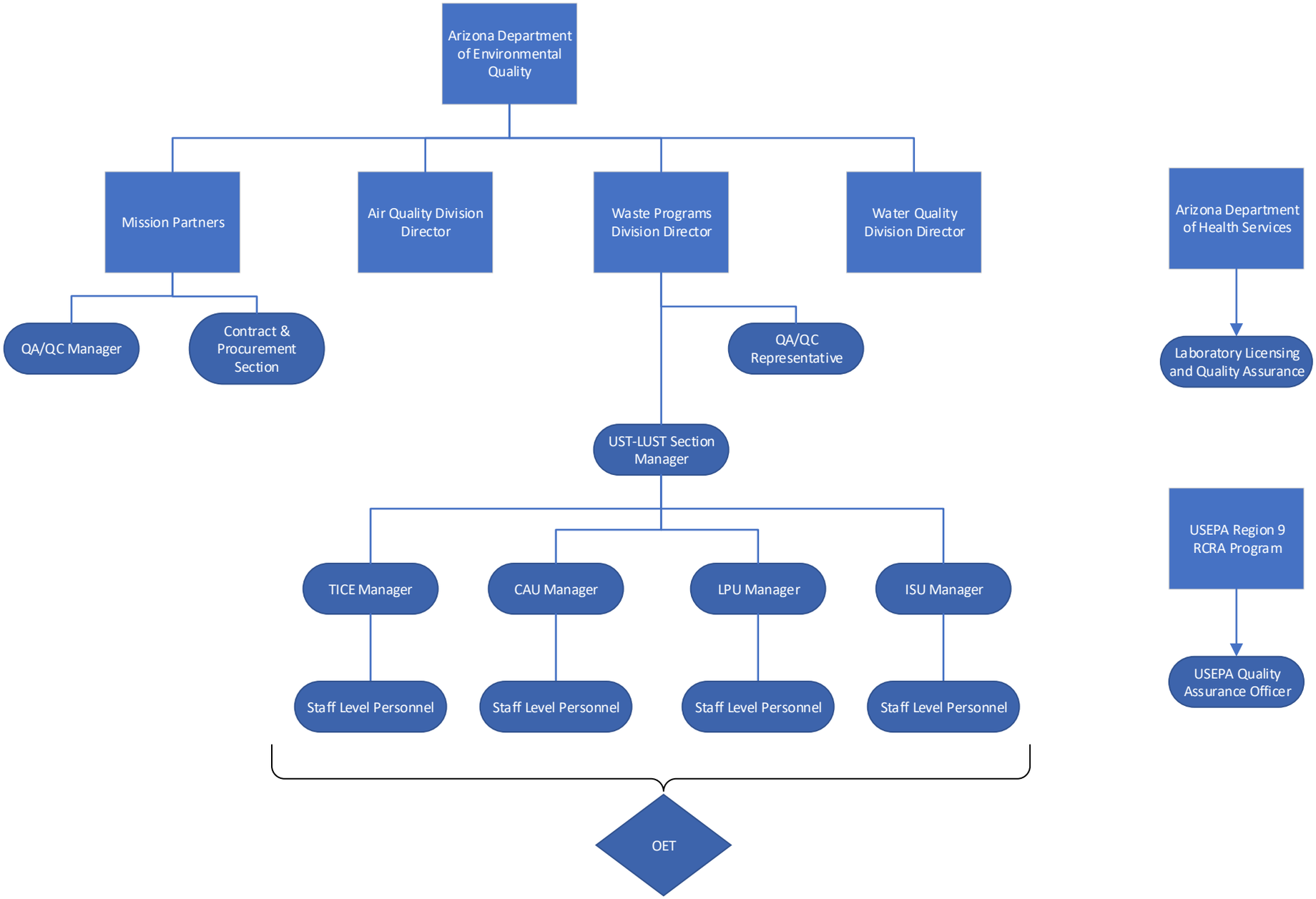
Press for Legend



The operation of the 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 the 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 A2: Components of the Quality System for ADEQ's UST Program. Figure A2 identifies entities based on their applicable data roles: data quality management, data generators or data users. 1) Section Manager; 2) Unit Supervisors; and 3) staff level personnel. Figure A2 incorporates other state and Federal entities. The prospective data users include the UST facility owner/operators, property owners, and local and state government.

Components of the Quality System for the ADEQ's UST Program
Data Quality Management



Data Generation

Environmental Laboratory Services | ADEQ Staff | UST Facility Owner/Operator | Existing Site Data

Data Users

Public Records Users | Governments | UST Facility Owner/Operator

A.5 ORGANIZATIONAL ROLES AND RESPONSIBILITIES

Environmental Protection Agency (EPA)

The EPA works closely with ADEQ in implementing the UST Program by providing grant funding, and conducting program oversight. EPA and ADEQ developed activities such as cooperative enforcement, corrective actions, closures, and inspection agreements for ADEQ's UST Program.

Prior to the implementation of this QAPP, this document will be reviewed and approved by the EPA Region 9 QA Office. Revisions will be made in accordance with EPA-provided comments until the QAPP is finalized. Once the document is finalized, any proposed revisions to the QAPP will be considered by the EPA Region 9 QA Office prior to inclusion in a revised document.

Any substantial deviations from the prescribed performance of QA elements as outlined in the approved QAPP will be documented and submitted as part of a Technical System Audit (TSA) prepared by the ADEQ QAM.

Arizona Department of Environmental Quality (ADEQ)

In administering RCRA Subtitle I, ADEQ's UST Program also conducts compliance inspections to ensure that UST systems are installed, operated, and permanently closed in a safe and proper manner; as well as tracks UST system registrations and registration fees. A.R.S. Title 49 https://www.azleg.gov/arsDetail/?title=49 authorizes ADEQ to conduct UST enforcement, compliance, inspection, corrective action, closures and permitting. The ADEQ has authority to require owners and operators to conduct corrective/remedial actions at the site of a release. A remedial/ corrective action is defined in A.R.S. § 49-281, 49-1001, and 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. ADEQ is responsible for the operation of the UST Program. All programmatic activities reside in the WPD of ADEQ. This section has one designated Section Manager and five Unit Supervisors. Three of the units are involved with collection of environmental data, as previously discussed.

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 A.A.C. applicable to ADHS laboratories (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 ADEQ and shall be consistent with Title 49 (Section 49-101 et seq.). Unless exempted by A.R.S. § 36-495.02, no person may operate or maintain an environmental laboratory without a license issued by the ADHS pursuant to A.R.S. §§ 36-495.03 through 36-495.14.

ADEQ 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). ADHS maintains oversight of analytical laboratory QC procedures regarding all environmental samples submitted for meeting requirements of a federal or state regulatory program. QA plans,

as required by A.A.C. R9-14-615.B, describe licensed laboratory QA responsibilities. ADHS maintains a list of licensed laboratories and periodically inspects them to ensure compliance.

The UST Program also has the option of having audits performed by ADEQ's QAM or QA Specialists on laboratories licensed by ADHS. All ADEQ laboratory audits must be performed in accordance with Section 2.3.2 of ADEQ's April 2022 Quality Management Plan.

Consultants for UST owner/operators or UST Program

As primary data generators, they are responsible for the implementation and documentation of specific QC elements, such as the collection and analysis of field blanks, field duplicates and rinsate samples, to satisfy the requirements of the QAPP.

Consultants hired by either the UST owner/operator or by UST Project Managers using the Tanks Contract, have overall responsibility for assigning appropriate personnel to complete any applicable tasks included in this QAPP. He/she will ensure that the project budget is adhered to, and will communicate with the UST Project Manager on all phases of work. Each consulting firm maintains their own corporate QAPP, independent of this document. Each consultant is expected to review this QAPP and adhere to its contents in responding to our project task order offers. SOPs relevant to each project are subject to review by UST Project Managers, or OET, for the duration of the project.

Also, reports requiring a certified Arizona Board of Technical Registration registrant's seal must meet all of the Arizona Board of Technical Registration requirements under A.R.S. Title 32, Chapter 1 and the rules made under that Chapter.

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.

Development of Standard Operating Procedures (SOPs) for data collection should follow EPA's Guidance for Preparation of Standard Operating Procedures for Quality-Related Operations (EPA, 2007a). SOPs should be included as an appendix of all the Planning Documents and Reports referenced in submitted to ADEQ's UST Program. Any QA or QC 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.

Regulatory Reports Associated with Suspected Releases:

a. *24-Hour Suspected Release Notification Form* [A.A.C. R18-12-251(B)] – initial notification to the department of the discovery of site conditions (equipment-related or environmental) indicating that regulated substance(s) may have been released to the environment. Primary review responsibility resides with LPU.
b. *14-Day Suspected Release Report* [A.A.C. R18-12-251(E)] – documents the source and nature of the suspected release, including the regulated substance(s) that may have been released to the environment; as well as any initial actions taken. Primary review responsibility resides with LPU.
c. *90-Day Suspected Release Report* [A.A.C. R18-12-251(F)] – documents the full findings of the suspected release investigation, including: the source and nature of the suspected release, environmental sampling conducted to investigate the potential release point(s) and analyses undertaken detailing that no regulated substance(s) was detected above the relevant Release Confirmation Level within a native environmental medium, and the response(s) and any repairs/replacements/modifications to the UST system equipment associated with the suspected release. Primary review responsibility resides with LPU.

Regulatory Reports Associated with Confirmed Releases:

a. *24-Hour Confirmed Release Notification Form* [A.A.C. R18-260(B)] – initial notification to the department of either the confirmation of a regulated chemical exceeding the Release Confirmation Level or the discovery of free product within a native environmental medium. Additional information includes the identification of the subject facility and any initial response actions taken. Primary review responsibility resides with LPU.
b. *14-Day Confirmed Release Report* [A.A.C. R18-12-261(C)] – documents the actions taken and planned during the initial investigation phase of the confirmed release, including the nature of the release, regulated chemical(s) released, and an estimation of elapsed time since the release occurred. Primary review responsibility resides with LPU.
c. *90-Day Confirmed Release Report* [A.A.C. R18-12-261(D)] – documents all activities undertaken as part of the required initial investigation phase and the initial site characterization for the confirmed release. Required information addresses the: nature, type, quantity, and duration of the release; initial response, abatement activities, and corrective actions initiated; and initial elements of the evolving conceptual site model including, known extent of contamination and media impacted, site lithologic characteristics from initial subsurface investigations, and an assessment of local potential receptors. 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 review responsibility resides with LPU.
d. *LUST Site Classification Form* [A.A.C. R18-12-261.01(E)] – documents a summary of currently known site conditions assessing the impacts and/or threats to receptors across all potential exposure pathways; as well as, the status of the delineation and remediation of contamination by impacted native environmental medium. Primary review

responsibility resides with CAU.

e. *Free Product Report* [A.A.C. R18-12-261.02(C)] – details to the department the party(s) responsible for undertaking free product removal measures; estimated quantity, type, and extent of free product; and information on the free product removal activities undertaken, including the treatment/disposal of generated wastes. Primary review responsibility resides with CAU.
f. *LUST Site Characterization Report (SCR)* [A.A.C. R18-12-262(D)] - provides a characterization of the full extent and distribution of all chemicals of concern within each contaminated medium resulting from a UST release. All information necessary to establish site-specific corrective action standards for each regulated chemical within each native medium must be included. 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 resides with the CAU.
g. *Periodic Site Status Report (PSSR)* [A.A.C. R18-12-263(G)] – details all further investigative and remedial activities conducted addressing the confirmed release after the approval of the LUST Site Characterization Report and the most recent PSSR. Information specifically required includes the initiation/cessation of any remedial alternatives, remediation performance, and an assessment of current estimated time to achieve case closure. Primary responsibility for review resides with the CAU.
h. *Risk-based Corrective Action (RBCA) Standards Tier Evaluation* [A.A.C. R18-12-263.01] – identifies the specific RBCA evaluation tier being proposed for the corrective action goals for the confirmed release. The corrective action standard for each chemical of concern within each native medium is established along with all required supporting documentation on calculations, modeling, and literature relevant to the calculation of these values for this specific site and local conditions.
i. *Corrective Action Plan (CAP)* [A.A.C. R18-12-263.02(B)] – defines the plan of action to remediate the currently known contamination to specific corrective action standards within the proposed timeframe. The CAP establishes site-specific RBCA standards for each regulated chemical within each medium, the specific remedial objectives, evaluation and selection of the appropriate remedial methods to achieve these objectives, and the proposed time to achieve the corrective action goals with accompanying performance monitoring/evaluation criteria. The CAP serves as the primary controlling plan governing the corrective actions and case progression for a confirmed release and establishes a framework for compliance and enforcement. Primary responsibility for review resides with the CAU.
j. *Corrective Action Completion Report (CACR)* [A.A.C. R18-12-263.03] – documents the full investigative and any remediation activities conducted demonstrating that the appropriate RBCA standard for each chemical of concern has been achieved for all impacted native media, and that the confirmed release case is eligible for closure. The CACR demonstrates that all corrective action goals have been achieved and contamination has been reduced to levels that are protective of human health and the environment under current and reasonably foreseeable future uses of the site. Primary responsibility for review resides with the CAU.

Regulatory Reports Not Associated with Releases:

a. *Baseline Assessment Report* [A.R.S. §49-1052 and associated guidance document] - details laboratory analytical results derived from sampling efforts at the most likely release areas from a UST system. The media sampled include 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 suspected or confirmed release to the environment. Primary responsibility for review resides with the LPU.

b. *UST Closure Report* [A.A.C. R18-12-272] - provides information on the decommissioning activities undertaken to permanently close an UST system, disposition of the decommissioned equipment and environmental medium encountered during decommissioning, collection and analysis of environmental samples to investigate for the previously unknown presence of regulated chemical(s) that may have been released from the decommissioned UST system. Primary responsibility for review of the 90-day report resides with the LPU.

A.6 INDIVIDUAL ROLES AND RESPONSIBILITIES

In addition to those general responsibilities maintained by the above organizations, individuals involved in UST Program activities have specific QA responsibilities. These individuals are referred to herein by 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 the UST Program's QA system.

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 of data generated in-house and externally. The Director has delegated this responsibility to the QAM.

Director, Waste Programs Division (WPD) 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 Director of the Waste Programs Division (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 plays an important function in determining data quality and sufficiency for the WPD which includes the UST Program.

The regulations governing investigations and cleanups (A.R.S. Title 49 – The Environment) in Arizona determine, on a general level, the type and amount of data necessary to make decisions regarding issuance of permits, Notice of Violations (NOVs), compliance orders, and the issuance of determination letters (e.g. "No Further Action" letters). The Division Director is responsible for ensuring a consistent application of these regulations across all WPD 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 WPD operations.

Section Manager, UST-Leaking UST Section, Waste Programs Division

The Manager of the UST Program (Section Manager) is responsible for staff level participation in all the administrative and technical areas of the four units within the section. The Section Manager is responsible for ensuring that the four units perform 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 decision or comment letter. The Value Stream Managers are also responsible for ensuring that any amended versions of the QA program plan are provided to the EPA for approval and then distributed to the appropriate individuals and organizations. The Section Manager ensures that all staff meet program goals.

Unit Supervisors, UST-Leaking UST Section

The Unit Supervisors of the UST Program are responsible for staff level participation in all the administrative and technical areas of the program. The Unit Supervisor's level of supervision routinely consists of ensuring staff members perform inspections and review, comment on, and draft an appropriate response to submitted planning documents and reports. The Unit Supervisor will also edit, if necessary, decision/response letters. The Unit Supervisor is responsible for final approval of submitted planning documents and reports.

Staff Level Personnel

Staff level personnel consist of Environmental Hydrogeologists, Engineers, Scientists, and Inspectors. Their responsibilities with QC may involve: inspecting regulated facilities for regulatory compliance, reviewing planning documents and reports submitted by the UST owner/operators or ADEQ-hired consultants, to investigate and remediate soil and groundwater contamination. On rare occasions, soil, groundwater and/or soil gas samples may be collected directly by ADEQ staff during site characterization activities or during facility inspections. ADEQ's UST Inspectors can conduct announced or unannounced inspections to ensure a UST facility maintains compliance with regulatory requirements.

Some UST Project Managers oversee UST closure and site investigation/remediation projects conducted by ADEQ within the State Lead financial assistance program. Their duties include hiring and oversight of a consultant from the Tanks Contract, review submittals including data quality review, and preparation of determination letters. A few UST Project Managers oversee consultants hired to perform corrective actions at orphaned sites under the Leaking UST Grant provided by the EPA.

Some UST Project Mangers oversee projects where the UST owner/operators are responsible for data collection and report submittal. The UST owner/operators hire consultants to generate environmental data, which includes a registrant of the Arizona Board of Technical Registration of an appropriate discipline to seal all documents requiring professional judgment, as required under A.R.S. §32-101 and A.A.C. R18-12-264(B). The UST Project Managers review submittals including data quality review, and preparation of determination letters.

Provisions in A.A.C. R18-12 (https://apps.azsos.gov/public_services/Title_18/18-12.pdf) define the requirements to address the following UST activities that are covered in this QAPP:

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 establish and document the extent and degree of contamination; or
f. To determine when a contaminated area meets closure requirements.

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 OET or QA Specialist 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 QAPP requirements, sampling goals and data quality objectives (DQO's).

OET- Technical Support

Staff in the OET (Operational Excellence Team which is imbedded in the Operational and Tech Support Unit, Leak Prevention Unit and the Corrective Action Unit) 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. Described below are three major activities for Technical Support:

1 Review of Planning Documents - 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 - 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.

Quality Assurance Manager (QAM)

ADEQ's Director has delegated authority for the QMS to the QAM. The QAM resides in the Office of Environmental Excellence, outside of the Divisions, and reports to the Director. The QAM, together with assistance of QA/QC specialists from each Value Stream implements the QMP for each Division within ADEQ. The responsibilities of the QAM include: dispute resolution, managing the implementation of QMS through periodic leadership communications and trainings, updates to the ADEQ QMP, designation of QA Specialists throughout the Agency; reviewing and approving QAPPs, determining internal and external audit schedules and if audit corrective actions have been completed, and conducting management service reviews. Dispute resolution typically will be conducted through utilization of the Arizona Management System, which, depending on the nature of the dispute, can involve escalation to the appropriate Executive Leadership Team member (Division Directors, Director, Deputy Director, and Chief Officers). Quality disputes will be discussed during the bi-weekly QMS meetings to determine if there are impacts that may affect other Divisions and or ADEQ as a whole, however, the QAM retains the authority to make the final decision.

The QAM is responsible for reviewing all internal QA/QC documentation, including QAPPs, Quality Assurance Project Plans (QAPjPs), and audit findings. The QA Specialist that oversaw generation of the QAPP may choose to address those comments, or delegate that responsibility to subject matter experts and others within the Value Stream or Unit. Draft review by the QAM will precede all EPA document deliverables.

The QAM may provide assessment of UST Program activities through the activities listed below:

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

The QAM reviews and can revise the QAPP. The QAPP will be updated to accommodate new developments in QA/QC as necessary, or every 5 years. Revisions to the QAPP may

become necessary through several different routes, and the QAM or the QA Specialists will be responsible for responding and making these revisions when appropriate. During regular contact with the EPA, the EPA QA Officer may make suggestions for improving quality performance that could be incorporated into the QAPP. During a TSA, the QAM will examine the QAPP and the performance of the UST Program and may make suggestions for improved performance that can result in revisions to the QAPP. A facility owner/operator, permittee, or, environmental consultant may request revisions to the QAPP in response to changes in industry-wide field methodology or for the addition of new or innovative technologies. Development and acceptance of new and more sophisticated analytical methods that provide lower detection limits, or other improvements can also be acceptable basis(es) for revisions to the QAPP.

The QAM is not be routinely involved with the day-to-day activities of the UST Program, and does not routinely participate in any of the planning phases of a project. The QAM, though, can be requested to assist in the review of data when necessary.

QA Specialist

The QA Specialist provides the bridge between the QAM, the VS, and unit programs. The QA Specialist is part of the OET. The QA Specialist provides assessment of UST Program activities through the processes listed below:

- Oversight of QAPP generation, and amendment;
- Oversight of uniform presentation of SOPs;
- Implementation of QMS Training;
- Planning, scheduling and implementation of the QMS audit program; and
- Generation of standard work for all the QMS processes listed above.

QA Specialists take on the role of auditors for VSs other than their own enabling them to avoid potential conflicts of interest and continue with their routine working responsibilities. QA Specialists are required to have at least one performance goal related to the work they are performing for ADEQ's QMS. Although the QA Specialists will continue to report directly to their Value Stream or Unit Managers, the QAM may be given the opportunity to provide the relevant manager with feedback related to their performance as a QA Specialist.

A.7 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.

There are two sets of program activities that are environmental data related, namely sample collection and review of laboratory analytical data. Typically, samples used for generating data on which program decisions are made are collected by facility owners and/or operators'

consultants, UST State Lead consultants, or on rare occasion UST staff. The samples are then analyzed by a laboratory licensed by the ADHS.

Analytical data are used by the UST Program to make various decisions to determine whether a release to the environment has or has not occurred. To assess compliance with the regulations applicable to this task, the UST Program must evaluate laboratory data. The UST Program compares laboratory data with regulatory standards such Soil Remediation Standards (SRLs), Aquifer Water Quality Standards (AWQS) and Maximum Contaminant Levels (MCLs) to determine whether a release has occurred to the environment. Evaluation of laboratory data also provides information as to the extent above which a standard is exceeded allowing program staff to gauge the severity of the threat posed by the release to the environment. Table A.1 shows contaminants commonly found at UST facilities.

Table A.1

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	Soil (mg/Kg) Residential 2007 SRLs	Soil (mg/Kg) 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*

A7.1 Establishment of Media-Specific Regulatory Levels

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

Remediation Standards for Soils

A.A.C. 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 B contains the weblinks for Arizona's Soil Remediation Standards rule which details how each standard is established. The weblink for Soil Remediation Standards is https://apps.azsos.gov/public_services/Title_18/18-07.pdf. Appendix B also contains this link.

Water Quality Standards for Groundwater and Surface Water

A.A.C. 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. The weblink for Water Quality Standards is https://www.epa.gov/sites/default/files/2014-12/documents/az-chapter11.pdf . Appendix B contains the weblinks for Arizona's Water Quality Standards rule. For those chemicals that do not have an established Aquifer Water Quality Standard, the Narrative Aquifer Water Quality Standards (A.A.C. R18-11-405) apply.

The UST program also has a substantive policy for UST Release Confirmation found at https://static.azdeq.gov/ust/ust_release_conf_levels.pdf. (Appendix B)

A7.2 Measurement Quality Objectives and Data Quality Indicators

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.

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 RPS objectives and meet the data quality goals associated with those objectives. MQOs are the project or program QC criteria defined for various 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.

Identifying DQIs and establishing QC samples and Measurement Performance Criteria (MPC) to assess each DQI 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.

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 being generated for use by the UST Program. The following documents can be found in their entirety in Appendix C.

- ADEQ Temperature and 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.

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.

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. A.A.C. R9-14-615 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 will provide project or site-specific requirements.

ADEQ Project Managers may consult with the ADEQ QAM, or research a variety of published or written materials, to aid them in selecting or developing measurement technologies. ADEQ staff professional knowledge is used to identify appropriate analytical procedures. General DQIs are provided in Table A3 below.

Table A.3 Example of Soil and Water Samples Analyzed Using EPA Method 8260.

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

PCE = tetrachloroethylene
TCE = trichloroethylene
ND = Not detected at laboratory reporting limits
ug/l = micrograms per liter
% = percent

A.7.3 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT OF DATA

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 Measurement Quality Objectives (MQOs) and Data Quality Indicators (DQIs) under the UST Program.

The Data Quality Objective (DQO) process is used to systematically plan for generating environmental data of a known quality to support decisions. This is done through focused, documented sampling, testing, and data evaluation activities. It entails using a systematic planning approach that includes hypothesis testing to differentiate between two or more clearly defined alternatives.

UST Project Managers may consult with the QAM or the designated QA Specialist and/or OET to aid them in developing measurement tools like DQO's and use professional knowledge to identify appropriate analytical procedures on a site-specific basis. The main UST project DQO is to verify if a release to the environment has occurred. This is documented by laboratory analytical results

exceeding an applicable Release Confirmation Level https://static.azdeq.gov/ust/ust_release_conf_levels.pdf. Once a release from a UST system is confirmed, the corrective action process (i.e. notification to conduct site characterization, and possibly remediation to obtain Leaking UST case closure) commences.

Each scenario for which data is to be generated is unique because of the various variables that must be considered, including regulatory requirements, waste characteristics, facility-specific characteristics, and others. Therefore, the DQO process is intended to yield qualitative and quantitative statements that answer four basic questions:

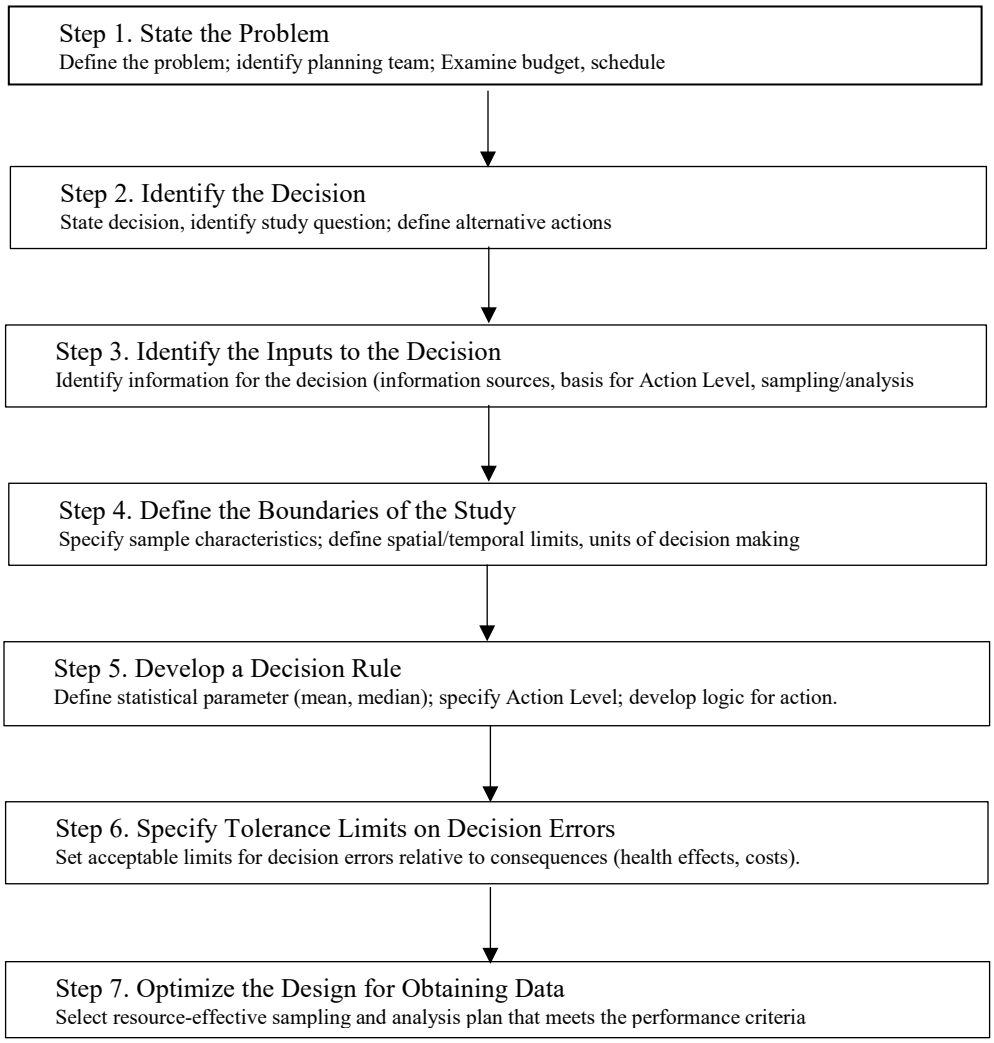
- What data is needed?
- Why is it needed?
- How will the data be used?
- What tolerance is allowed for decision errors?

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. Two 2006 EPA guidance documents on DQA are available from EPA at: https://www.epa.gov/quality/agency-wide-quality-system-documents.

DQA is the scientific and statistical evaluation of environmental data to determine if they meet the planning objectives of the project, and thus are of the right type, quality, and quantity to support their intended use. The document Data Quality Assessment - A Reviewers Guide (EPA, 2006b) broadly describes the statistical aspects of DQA in evaluating environmental data sets. Data Quality Assessment - Statistical Methods for Practitioners (EPA, 2006c), the companion guidance document on statistical methods for practitioners, provides a more detailed discussion on implementation of graphical and statistical tools. These EPA guidance documents discuss the use of DQA to support environmental decision-making (e.g., compliance determinations).

The DQO Process consists of seven planning steps as shown in Figure A.3.

Figure A.3 Data Quality Objective Process



The outputs of the DQO process are used to define the quality control requirements for sampling, analysis, and data assessment. These requirements are then incorporated into a site-specific planning document like a workplan (UST Facility owner/operator consultants) or task order offer (State Lead program consultants).

Failure to establish DQOs prior to implementing field and laboratory activities can result in undesirable outcomes such as inefficiencies, increased or unnecessary costs, or the generation of unusable data.

Data quality indicators (DQIs) are pre-determined limits on the acceptability of the data in regards to accuracy, precision and bias, completeness, and sensitivity. Utilization of DQIs is part of the data evaluation process. Each DQI helps interpret and assess specific data quality needs for each sample medium/matrix and for each associated analytical operation.

Precision

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 Control Samples/Control Sample Duplicate (LSC/LSCD) and the Matrix Spike/Matrix Spike Duplicate (MS/MSD) analyses are the basis for laboratory precision. The LSC/LSCD samples evaluate the precision of the analytical method while the MS/MSD samples evaluate for potential matrix effects (increasing or decreasing) on the documented precision of the specific analytical method.

Accuracy

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 sampling method blanks (e.g. trip blanks, field blanks, equipment blanks) for contamination is an assessment of sampling accuracy. Pervasive contamination found in sampling 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) relative to 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 80% 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.

Sensitivity

Sensitivity is the ability of a method or instrument to discretely detect an analyte from background signal at a specific measured level of interest. For example, the sensitivity measurements of the field instruments that measure temperature, pH, conductivity, turbidity, etc. 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 may require dilution prior to laboratory analysis if sufficient concentrations of other analytes assayed in the method or matrix interference cause an increased signal response that raises the detection limits beyond the accepted method calibration range. Dilution is a leading cause of reporting limits exceeding applicable criteria. However, 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 event is not an issue.

QC acceptance criteria exist for each analytical method. A.A.C. 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 QAPP provides general requirements, but individual documents will provide any project-or site-specific requirements.

A.8 SPECIAL TRAINING/CERTIFICATION

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.
The Section Manager shall appoint an appropriate staff member to be the QA Specialist for the program. This duty will remain effective until a new staff member is appointed.
The QA Specialist will attend trainings indicated and scheduled by the QAM, along with attending bi-weekly team meetings and perform other duties as stated in the ADEQ QMP.

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 Quality Management System training programs defines QA/QC training needs and is being transitioned to computer-based training. All staff are required to take basic QMS training as a part of their onboarding requirements.

Core quality management training will be coordinated through the QAM in conjunction with various Division supervisory personnel. Intermediate and advanced skill training will be arranged when the appropriate Agency staff identify the need. The QAM or QA Specialist, 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.

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
- Preparing Quality Assurance Project Plans
- How to Perform an Audit of Data Quality and Data Quality Assessment

Staff 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. QA training records are maintained by the Office of Environmental Excellence and will be transitioned to TraCorp, the Arizona state training software as the QMS training is transitioned to a computer-based format.

A.9 DOCUMENTS AND REPORTS

Throughout the life of the 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 QAPP is a dynamic document that is subject to revision, as needed. UST Program personnel, OET and/or the QA Specialist will review this QAPP on an as needed basis, or at a minimum annually.

A9.1 Environmental Data Documentation

This QAPP 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, including data from split sampling and inspections and from consultants working for UST owner/operators, must be of sufficient quality to withstand challenges to their validity, accuracy and legibility. To meet this objective, utilization of standardized formats and prescribed procedures occurs to record data. 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 QAPP and referenced in SOPs.

A9.2 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.

A9.3 Project Files

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 A5 of this QAPP. Additionally, 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.

All reports submitted to the UST Program are filed electronically in the J drive:\UST to LUST VS drive under the UST facility number, in the applicable folder. Paper versions are maintained in either the UST facility or Leaking UST file associated with that UST facility number. These files are located in the central agency Records Center.

A9.4 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 will 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.

Data collected in the UST program is entered into the internal electronic database to track project related documents. This database, **A**ri**z**ona **U**nified **R**epository for **I**nformational **T**racking of the **E**nvironment or AZURITE, maintains lists of project related documents. Electronic back-up of this database occurs on a nightly basis.

Data collected in the UST program is entered into the electronic groundwater quality database to track groundwater sampling data. Electronic back-up of this database occurs on a nightly basis.

ADEQ data that is cloud based or stored in the State Data Center is considered secure. Data loss mitigation efforts include Uninterruptible Power Supplies (UPS) and backup generators. Source data is obtained from laboratory data sheets and reports or data submitted by contractors. Staff

takes appropriate measures to prevent and address data loss at the source by electronic storage/scan of paper documents.

The current electronic mail (e-mail) tool, Google Mail, is a cloud-based storage system that is considered secure. Employee's inbox storage space is unlimited. E-mail messages that are considered critical artifacts to a program should be saved as a PDF and stored in the appropriate program folder/file location. Electronic mail messages that are moved to "trash" are archived after 30 days, but can be retrieved via an Information Technology Service Desk Request. Microsoft Outlook e-mail files have been saved to the J:/Drive and also can be retrieved as needed with a Service Desk Request.

A9.5 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 how enforcement activities are defined. Therefore, this QAPP is recognized as a dynamic document that is subject to revision, as needed. Re-submittal of this plan to the EPA Region 9 QA Manager for review will occur minimally once every five years and as otherwise needed based on any QAPP revisions made by ADEQ. The QAPP will be kept on-file at ADEQ and saved in the Quality Management Program folder located in the COMMON folder in the ADEQ drive (J:). The document is also available on the ADEQ webpage under the UST program at https://azdeq.gov/node/5815. Dissemination of approved revisions includes personnel on the Distribution List (page 2) via email.

SECTION B DATA GENERATION AND ACQUISITION

B.1 SAMPLING PROCESS (NETWORK) DESIGN

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 A.A.C. Title 18. Specifically, the regulations for release notification and reporting for ADEQ's UST Program are located in A.A.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 .R.S. 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 protective of state water resources and 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 the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 U.S. Code Ch. 103 §9601 et seq.) and (2) reportable quantities of petroleum product described in the Resource Conservation & Recovery Act (RCRA) Subchapter IX (42 U.S. Code Ch. 82 §6901 et seq.).

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 Clean Water Act (CWA), Safe Drinking Water Act (SDWA), RCRA, Clean Air Act (CAA), 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, and finally, Chapter 14 of the Arizona Administrative Code details ADHS approved methods with corresponding analytes.

This QAPP 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 sampling and analysis requirements. Site-specific information required in project-specific 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 UST Program personnel is required for all project-specific planning documents.

B.1.1 Sampling Design

ADEQ's UST Program oversees UST facility owner/operators and project management under the State Lead program the initial site investigations to determine if environmental media have

been contaminated. If evidence of impact to a native environmental medium is identified, further investigation follows to characterize the full environmental setting and scope of the contamination impacts and threats. Characterization includes evaluating the threat(s) to human health and the environment posed by the contamination and determining potential solutions for remediation to protective levels. This QAPP 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.

A sampling design specifies the number and location of samples collected at a site. Sampling design strategies should factor in the conditions unique to the site, including data gaps in the Conceptual Site Model (CSM), exposure potential, projected site reuse, and available resources. As noted above, identification of sampling design strategies occurs during the systematic planning process and is described in the applicable project-specific planning document like a work plan, task order, or SAP. 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. 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. The use of biased sampling based upon judgement of professionals in the field allows for data collection at the specific locations of the greatest concern or benefit to site characterization which often cannot be known *apriori*. 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.

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, multievent 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 UST Program guidance found at https://azdeq.gov/node/5815 or in ADEQ's Site Investigation Guidance Manual (ADEQ, 2014) or ADEQ's Soil Vapor Sampling Guidance found at https://static.azdeq.gov/legal/subs_policy_svsg.pdf.

B1.2 Sample Types and Matrices

Sample types typically include surface soil, subsurface soil, groundwater and surface water. Some sites require sampling of sediment, pore water, and air (soil gas or vapors). Samples collected can be discrete (grab) or composite samples (for evaluation of stock-piled soil for disposal). 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 in the work order, task order or SAP.

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.

B1.3 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 planning 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 cleanup standards, additional sampling would be required during remedial activities and/or post remedial activities.

B1.4 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. Listed are considerations when planning a sampling event:

1. Sample Handling and Custody Procedures - Field personnel arrange 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 appropriate SOPs (Appendix D).

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.

8. Site Access – Site access will be obtained by either the UST Facility owner/operator's consultant or by UST Project Managers for State Lead program sites. The UST program has standard work for site access, which includes the process for escalation to management for assistance. J:\UST to LUST VS\Standard Work\02. CAU\7. State Lead - CA\Access and Easement.

B.2 SAMPLING METHODS

The following sections describe the sampling and analysis requirements under the UST Program. Site-specific information including 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 are provided in the program required reports that were previously discussed. Arizona Administrative Code requires UST 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. A.A.C. R18-12-262(D)(7) and R18-12-263(G)(3)).

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, and air.

General guidelines for field sampling are included in the EPA Standard Operating Procedure (SOP) on General Field Sampling Guidelines (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-regulated sites may include surface and subsurface samples. Sample types may be discrete or, when sampling stockpiled soil, composite samples. There are a variety of acceptable methods for collection of soil samples and selection of an appropriate method will be determined by the consultant depending upon 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 Preparation of Soil Sampling Protocols: Sampling Techniques and Strategies (EPA, 1992b) and in the referenced EPA SOP for soil sampling located in Appendix D.

B2.2 Groundwater Samples

Groundwater sample collection is typical during site investigations and cleanups regulated by ADEQ's UST Program. 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). When collecting samples from a water system to represent aquifer conditions in the area of production, 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 of the aquifer conditions as possible. Remove any faucet aerators and reduce water flow before collecting samples to minimize sample bias due to volatilization.

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. In addition, groundwater sample collection from permanently installed monitoring wells is also commonly conducted over the course of site investigation and remediation activities. Proper installation according to state regulations (see A.R.S. 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. SOPs describing groundwater monitoring well sampling, monitoring well installation and monitoring well development are included in Appendix D.

B2.3 Surface Water Samples

Surface water sample collection may be part of 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 SOP for surface water sampling included in Appendix D.

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. The hyporheic zone is an area of mixing of groundwater and surface water within the sediments of flowing surface water bodies (e.g. rivers, streams) and is of particular importance in the evaluation of potential contaminant discharge from groundwater to a surface water body. 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. The SOP for sediment sampling provides additional information on the collection of sediment samples is included in Appendix D.

B2.6 Air/Soil Vapor Samples

Collection of air sampling 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.

B.3 SAMPLE HANDLING AND CUSTODY

Analytical laboratories are selected by either the consultant for the UST Facility owners/operators, or on rare occasions, by UST Program staff. Per A.A.C. R18-12-280 (A) (1) (2) (3), sample analyses, and the specified time period required for that test method requires using a laboratory certified by the Arizona Department of Health Services (ADHS) under A.A.C. R9-14-601 through 617. ADHS maintains a listing of certified laboratories at https://app.azdhs.gov/BFS/LABS/ELBIS/ArizonaCertifiedLabs/LabSearchContentPage.aspx.

Each laboratory has their own set of SOPs for sample receipt, analysis, data generation, data distribution, sample hold times, archiving and disposal. 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 arrange 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 QAPP references SOPs and forms for sample handling, custody (chain-of-custody forms), and transport.

Environmental consultants conducting work on behalf of UST owner/operators and/or the UST program follow their own corporate standard operating procedures (SOPs) regarding sample collection, sample identification/labelling, packaging and shipment must meet the requirements of A.A.C. R18-12-280 et seq., and this QAPP. Consultants document this information in field notes and on the laboratory chain of custody forms.

B.4 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/RPS-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. ADHS weekly provides an update of the licensed laboratories, methods and analytes that is captured in the database. This allow for checks on any data captured in the database.

Attachment B Analytical Methods Table to the UST Permanent Closure and Change-in-Service Guidance document presents the typical compounds that are of greatest interest to UST site investigations (https://static.azdeq.gov/ust/ust_perm_closure.pdf).

Releases of regulated substances regulated by the UST Program, as defined in A.R.S. §49-1001, are based upon analytical data confirming concentration(s) of regulated substances within a native environmental medium exceeding the defined "Release Confirmation Levels". UST Program substantive policy establishes the specific Release Confirmation Level for each listed regulated substance as the minimum concentration threshold for the confirmation of a release and can be found at https://static.azdeq.gov/ust/ust_release_conf_levels.pdf.

Required laboratory analytical methods for each environmental medium are identified in the UST Analytical Data Information Sheet https://static.azdeq.gov/ust/analytical_data.pdf based on the contents of the USTs over the lifespan of the system. The UST program also requires the laboratories to report results to the method detection limit (MDL) instead of the laboratory reporting limit (LRL), due to some regulated chemicals having extremely low release confirmation and/or remediation levels.

Alternative methods may be available and appropriate and can be found in Exhibit 1 of Title 9, Chapter 14, Article 6 of the Arizona Administrative Code. (**http://apps.azsos.gov/public_services/Title_09/9-14.pdf**.

B.5 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 QAPP describes and defines the general quality objectives of the 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, nondefinitive 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 Guidance for Preparation of Standard Operating Procedures for Quality Related Operations (EPA, 2007a) is typical for developing SOPs. Environmental consultants are responsible for preparing or obtaining SOPs and they should be included as an appendix of all planning documents and reports generated for and submitted to ADEQ's UST Program. Any deviations from an SOP require documentation in all planning documents and reports generated. On the rare occasion UST Program staff collect environmental samples, existing EPA or ADEQ SOPs are used. The Arizona Department of Health Services (ADHS) is responsible for reviewing the standard operating procedures developed by and used for environmental laboratories. ADHS is also responsible for licensing of environmental laboratories under Title 9, Chapter 14, Article 6 – Licensing of Environmental Laboratories. Corrective actions required under the laboratory licensure program are monitored by ADHS. If corrective actions affect the usability of ADEQ, ADHS will contact the QAM to ensure that those data are not used for making compliance-related decisions.

B5.1 Quality Control in the Field

Description of QC parameters in detail 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 trip blanks, rinsate blanks, field duplicates, and extra volume for matrix spikes and matrix spike duplicates. Subsequent paragraphs contained in this section of this QAPP 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.

B5.2 Field Documentation

The field team should record field activities in indelible ink, in a permanently bound notebook with prenumbered 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 QAPP and any project specific planning document. UST Program personnel will use permanently bound field logbooks with sequentially numbered pages to record and document field activities, or applicable field forms. 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. The environmental consultants that perform field work have developed field forms to record field activities. 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 environmental consultants performing field work are expected to develop field forms to record field activities. Labeling individual samples should occur 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.

Consultants hired by the UST Program are also instructed to collect locational data besides analytical data from monitoring wells sampled, for inclusion into the Arizona Groundwater Quality Database. The instructions for submittal of monitor well information and analytical data to ADEQ's UST Program is found at http://www.azdeq.gov/node/1196.

ADEQ has a legacy locational data policy http://intranet/policy/download/0034.001%20Locational%20Data%20Policy.pdf. The 2021 methodology for locational data is as follows:

Preferred
For Water Level purposes and latitude/longitude and legal description/location, property boundaries, etc. (for legal purposes)
Methodology: Line Survey
Elevation accuracy 0.01 ft
Latitude and longitude: 1.00 ft

Acceptable/Adequate (no water level measurements planned)
Water Level not required and latitude/longitude (specific location needed)
Methodology: GIS Receivers, RTK GPS, High Accuracy GPS
Elevation less than 1.00 ft
Latitude and longitude less than 3.00 ft

B5.3 Trip Blanks

Trip blank samples help evaluate whether the shipping and handling procedures are introducing contaminants into the samples or if cross-contamination in the form of migration of VOCs between the collected samples. One trip blank submitted to the laboratory for analysis is necessary each day that samples are collected. Trip blanks for soil and water samples are volatile organic analysis (VOA) vials filled with purged deionized water that remain closed while transported to the field and then returned to the laboratory without being opened.

B5.4 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 nondisposable 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. Affected results will be qualified as estimates or as non-detects at an elevated PRQL as appropriate.

B5.5 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 ten field samples collected (and at least one per sampling day if less than twenty are collected) for water, soil, and air. Field duplicate precision will be evaluated as described below.

B5.6 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).

B5.7 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 Facility owner/operator consultants may collect these samples as a way to check on laboratory performance. These samples are collected when a concentration of chemical contamination in a media needs to be verified, since the data appears to be anomalous or inconsistent data.

B5.8 Quality Control in the Laboratory

Compliance monitoring on ADHS licensed laboratories is conducted by the ADHS as described in Title 9, Chapter 14, Article 6 of the Arizona Administrative Code (A.A.C. 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 QAM 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 QAM or QA Specialists.

B.6 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. Each instrument will be calibrated 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.

Owners and/or operators and their contractors may use field equipment such as pH meters, dissolved oxygen meters, PIDs, and others to take environmental measurements. Such equipment must be properly maintained, calibrated, and tested prior to use according to written SOPs, and follow the equipment manufacturer's recommendations. Testing, maintenance, inspection, and calibration, schedule should be included in their corporate QAPP as applicable.

B6.1 Field-Based Instruments

Field equipment, if used, will be calibrated 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, and general guidelines are included in SOPs. All calibration information will be recorded in a field logbook or on field forms. A label that specifies the scheduled date of the next calibration will be attached to the field equipment. If this type of identification is not feasible, equipment calibration records will be readily available for reference. Field-based analytical instruments, such as turbidimeters and pH electrodes must be calibrated following manufacturers' instructions and frequency recommendations (or following appropriate SOPs) before they may be used for collecting data.

Sampling and analysis generally require 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.

For field-testing, 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.

All field instruments should be tested, inspected, and maintained according to the manufacturer's guidelines and recommendations. Data collected from improperly functioning equipment will not be used. ADEQ contractors, Owner/Operator contractors, and property owner 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. 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.

UST Project Managers may request any and all records during the life of the project for review.

B6.2 Laboratory Instruments

Calibration and maintenance of analytical instruments will be conducted in accordance with the QC requirements identified in each laboratory SOP and in QA manuals, along with the manufacturers' instructions. General requirements are discussed below.

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, all initial and continuing calibration procedures will be implemented by trained personnel following the manufacturer's instructions and in accordance with applicable EPA protocols to ensure 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 will be made from reagent-grade chemicals or as specified in the analytical method. Stock standards will also be used to make intermediate standards that will be used to prepare calibration standards. Special attention will be paid to expiration dating, proper labeling, proper refrigeration and freedom from contamination. Documentation on receipt, mixing and use of standards will be recorded in the appropriate laboratory logbook. Logbooks must be permanently bound. Additional specific handling and documentation requirements for the use of standards may be provided in subcontractor laboratory QA plans.

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

Analytical balances will be calibrated annually according to manufacturer's instructions and have a calibration check before each use by laboratory personnel. Balance calibration shall be documented in hardbound logbooks with pre-numbered pages.

All refrigerators and incubators will be monitored for proper temperature by measuring and recording internal temperatures on a daily basis. At a minimum, thermometers used for these measurements will be calibrated annually, according to manufacturer's instructions.

The subcontract laboratories will maintain an appropriate water supply system that is capable of furnishing ASTM Type II polished water to the various analytical areas.

B.7 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

The laboratory shall inspect supplies and consumables prior to their use in analysis. The description of materials provided in the method shall be used as a guideline for establishing the acceptance criteria for these materials. Purity of reagents shall be monitored 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 Specifications and Guidance for Obtaining Contaminant-Free Sampling Containers (EPA, 1992c).

Procedures for receiving supplies and consumables in the field are similar. When supplies are received, the project manager or field team leader will log the supplies into a supply logbook and then inspect all items against the acceptance criteria. The laboratory will provide sample containers, labels, chain-of-custody forms, and coolers, as requested by the program. Properly cleaned sample containers must be provided so that no target compound contamination occurs from contact with the sample container. Equally important is that where applicable, the laboratory must provide preservative reagents that are free of target analytes or other contaminants. Any deficiencies or problems will be noted in the field logbook, and deficient items will be returned for immediate replacement.

B.8 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. 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 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

B.9 DATA MANAGEMENT

Field staff record field data generated, such as sample ID and latitude/longitude coordinates, groundwater monitor well data on field data sheets or hand-held computers. Field data are reported to the UST Project Manager through submission of field notebooks or field sampling data sheets by UST Program field staff or consultants (UST owner/operator or State Lead program) field staff.

Laboratory analytical reports will include QC results and any other necessary analytical information, enabling reviewers to determine data quality. Laboratory data should be submitted

to the ADEQ Project Manager in both printed and electronic form. Rapid turnaround data from the laboratory are reported to the Project Manager, if requested, but rapid turnaround is generally not required. This will be captured on the data review checklist. Copies of field logs, a copy of chain-of-custody forms, original preliminary and final lab reports and electronic media reports must be kept by contractors for review by ADEQ. The field crew must retain original field logs. The contract laboratory shall retain chain-of-custody forms. Logs and lab reports are maintained in facility files as hard copies, and are also maintained on ADEQ's common J:\ drive in facility-specific folders. The contract laboratory will retain copies of the preliminary and final data reports.

The ADEQ Records Management Process defines the ADEQ system/processes for handling public records. This plan outlines the roles and responsibilities for management and staff concerning chain of custody procedures and records management. UST Program personnel are responsible for the maintenance of the project file. UST Program personnel will collect and include in the project file any relevant project documentation (e.g. reports, correspondence and raw data files). The project file will also include all information not related to data generation, including documentation of all public involvement or community notification efforts.

Project files follow the ADEQ's retention schedule outlined in State policies. The retention policy provides essential information, guidance and tools necessary for ADEQ to manage and operate an effective records management system and disposition program. Individual project files are located in the Record Center, on the first floor of ADEQ's Phoenix office. ADEQ's Record Retention Schedule is attached as Appendix C.

ADEQ data that is cloud-based or stored in the State Data Center is considered secure. Data loss mitigation efforts include Uninterruptible Power Supplies (UPS) and backup generators.

SECTION C ASSESSMENT AND OVERSIGHT

C.1 ASSESSMENT 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 generated for and submitted to RPS.

During the planning process, many options for 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.

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 Specialists current conduct Audits of Data Quality and Technical Systems Audits of programs that collect data used for compliance, assessment and prevention purposes. These audit types are discussed in greater detail in subsequent subsections. Data Quality Assessments will be conducted on a project-by-project basis. QA audit frequency and scheduling will vary with the type of review conducted. Assessment activities are scheduled and conducted at the direction of the QAM in accordance with the internal audit standard work requirements (ADEQ, 2019). The internal audit standard work is maintained at J:\Common\ADEQ Quality Management Program\Projects. All audit findings are shared with the Value Stream Managers and are tracked by the audit team until the VS implements successful countermeasures.

C1.1 Management Systems Review (MSR)

An MSR is an independent assessment of a Program's QA management practices and data collection procedures. As described in the ADEQ QMS, all ADEQ programs, including the UST program will have an MSR conducted by an external party (typically the QAM) once every four years. This review will focus on the Program's adherence to and implementation of this QAPP. The QAM's MSR will focus on the overall structure and procedures for accomplishing the QA program and will be conducted in accordance with the Guidance on Assessing Quality Systems, March, 2003, EPA QA/G-3 https://www.epa.gov/sites/default/files/2015-06/documents/g3-final.pdf.

The MSR will qualitatively assess a program to determine if the ADEQ QMS 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 items:

- 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 and Quality Assurance Project Plans (QAPjPs);
- Effectiveness of existing QAPP guidance and QAPjPs;
- 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 QAM utilizes EPA's Guidance on Assessing Quality Systems (Management Systems Review Process, 2003) 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 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.

TSA's occur if specifically requested by a UST Project Manager, as deemed necessary based upon the findings of an audit or review, or if the UST QA Specialist plans one. Written comments by the UST Project Manager must be supplied to the UST QA Specialist, and QAM 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 with the QAM or QA Specialist. Distribution of additional copies occurs as appropriate as determined by the QAM.

Laboratory TSAs

TSAs occur on entities that submit analytical data to ADEQ. 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 QAM and QA Specialists 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 QAM Manager or QA Specialists will conduct QA audits of field sampling activities conducted by ADEQ staff. Eventually, consultants that collect samples for the UST Program may be audited. The QAM 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, the QAM and the QA Specialists 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.

The UST Program may schedule 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 by the QAM or QA Specialists. For external projects requiring PEs, the Task 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 used 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 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 DQO for the project occurs. For most circumstances involving source area decision units, sample results involve 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. In some cases, 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, not collecting samples over a long enough time period, 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, the QAM or QA Specialists can review data generated by contract laboratories. These data review activities should use checklists, standard operating procedures, and standardized qualification codes to indicate data quality.

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 Investigations

Once every four years every major Agency Program attempts an MSR. TSA's occur if specifically requested by ADEQ's Project Manager, the findings of another audit or review necessitate another, or if the QAM. MSRs and TSAs are generally conducted by the QAM and focuses on adherence to the approved Agency QMP and the UST Program's QAPP. 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 Manager must be supplied to the QAM and the QA Specialist 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 in the J:\COMMON\ADEQ QUALITY MANAGEMENT PROGRAM folder for the QAPP that was audited. Distribution of additional copies occurs as appropriate.

C.2 REPORTS TO MANAGEMENT

Effective management of environmental data collection requires (1) timely assessment 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 UST owner/operator led projects. 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, project managers, and the QA Specialist 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.

C2.1 Frequency, Content and Distribution of Reports

Field, technical, laboratory or QA personnel generate QA/QC reports and send them to the UST Project Manager within the applicable regulatory submittal, as required throughout the duration of the project. 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 consultant's 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 QAPP or project-specific planning document, and explanations for the deviations. The field team leader prepares the daily log book and submits it to ADEQ, 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 Report, if appropriate.

C2.2 Identify Responsible Organizations and Individuals

The UST facility owner/operator, property owner, or ADEQ– either directly or through its consultant - is responsible for preparing planning documents and reports and incorporating any comments received from 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.

SECTION D DATA VALIDATION AND USABILITY

D.1 DATA VERIFICATION AND VALIDATION REQUIREMENTS

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. 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.

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.

EPA's Guidance on Environmental Data Verification and Data Validation (EPA, 2002c) 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.

D.1.1 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.

Project team personnel, whether they are ADEQ consultants, ADEQ staff, or UST owner/operators' consultants, 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.

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 is used 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, reanalysis of the sample occurs when possible. Only the results of the reanalysis will be submitted, provided these results are acceptable.

D.1.2 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 QAPP and in project-specific work plans or task orders. Data validation is an analyte- and sample-specific process that extends the evaluation of data beyond data verification and is performed to determine the analytical quality of a specific data set.

Unlike data verification, a qualified person not affiliated with the laboratory performs data validation. UST Project Managers, or, upon request, OET or the UST QA Specialist performs data validation of analytical data generated for and submitted to UST Program. This partial validation involves an examination of the data package to determine whether MQOs for precision, accuracy and sensitivity have been met. Partial validation is based on discrepancies noted during the verification step. 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 is centered on surrogate recoveries. The intent of the partial validation is to qualify data so that the user is alerted that s/he should understand the limitations when making decisions based on the data.

The level of data validation depends on the size and complexity of the project and the project-specific decisions. Basically, data validation is the process of evaluating the available data against the project MQOs. The UST Project Manager notifies the UST QA Specialist if there

is a need for full data validation, although full data validation is a rare occurrence in the UST Program.

ADEQ-contracted consultants, and UST owner/operators' consultants are expected to perform partial data validation on laboratory analytical reports. A second person, other than the project manager performs that partial data validation. Depending on the outcome of the partial data validation, qualitative or quantitative use of the data occurs. Field data and laboratory data are reviewed. Arizona Data Qualifiers are used by the laboratories 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.

Data generated for and submitted to the UST Program have DQA's performed on them on an on-going basis by the consultants conducting the work. When ADEQ staff collects environmental data, the UST Project Manager, OET and/or the QA Specialist will review the data generated by the contract laboratories. These data review activities can be documented by using this checklist.

UST Program
Quality Assurance Data Review Checklist

Site/Project

Name:	
Data Reviewed by:	
Name of Report:	

Laboratory Name: Is this an ADHS Certified Lab?			Yes		No
If No? Please Explain					
What QAAP were samples collected under?					
Was the data validated with a third-party validation packet? Was it necessary?					
Are the SOPs documented? Did the procedures match the approved SOP/QAPP/Work Plan?					

(Place X before field)

Sample Matrix:		Soil		Water		Other:	

Analyses: (1 checklist per method or as applicable)		VOCs 8260B/C		BTEX only 8260B		SVOCs 8270C/D/E		TPH AZ8015R1
		Metals 6000/700		PAHs 8270C		VOCs TO-15		EDB 8011 or

		0		SIM				504.1
		TEL 8270 SIM or HML method						
		Other:		Other:		Other:		Other

Samples								
Chain of Custody #:			NA	Acceptable?		Yes		No
Sample Integrity:	No damage or missing labels		NA	Acceptable?		Yes		No
Sample Headspace:	No headspace		NA	Acceptable?		Yes		No
Cooler Temp (° C):	$>0^{O}$ but $<6^{O}$		NA	Acceptable?		Yes		No
Preservation Type:			NA	Acceptable?		Yes		No
Sampling Date:								
Lab Receipt Date:			NA	Acceptable?		Yes		No
Preparation Date:			NA	Acceptable?		Yes		No
Analysis Date:			NA	Acceptable?		Yes		No
Reporting Limits:	</= action levels		NA	Acceptable?		Yes		No
Lab QA/QC:								
Method Blank:	Non-detect		NA	Acceptable?		Yes		No
TB/EB/AB:	Non-detect		NA	Acceptable?		Yes		No
Replicate RPD	W/in 20 for H_2O/100 for soil		NA	Acceptable?		Yes		No
Field Dup RPD:	W/in 20 for H_2O/100 for soil		NA	Acceptable?		Yes		No
Surrogate Recovery:	W/in lab criteria		NA	Acceptable?		Yes		No
MS %R:	W/in lab criteria		NA	Acceptable?		Yes		No
MSD %R:	W/in lab criteria		NA	Acceptable?		Yes		No
MS/MSD RPD	W/in lab criteria		NA	Acceptable?		Yes		No
LCS %R:	W/in lab criteria		NA	Acceptable?		Yes		No
LCSD %R:	If applicable, w/in lab criteria		NA	Acceptable?		Yes		No
LCS/LCSD RPD:	If applicable, w/in lab criteria		NA	Acceptable?		Yes		No

Holding Times: (days)	BTEX:	14	VOCs:	14	SVOCs:	7^{*}	TPH:	14
	GRO:	14	DRO:	14	Metals:	28	PAHs:	7^{*}
	O&G:	14	Pest:	7^{*}	PCBs:	7^{*}	TCLP:	7^{*}
Preservation: (for water only) (also 4° C for all)	BTEX:	HCl	VOCs:	HCl	SVOCs:	4° C	TPH:	4° C
	GRO:	HCl	DRO:	HCl	Metals:	HNO_3	PAHs:	$NA_2S_2O_3$
	O&G:	H_2SO_4	Pest:	4° C	PCBs:	4° C	TCLP:	4° C
Notes: 7^{*} = 7 days to extract; 40 days for analysis. Holding times for BTEX and VOCs is 7 days without HCl preservation.								

D.1.3 Data Quality Assessment

A Data Quality Assessment (DQA) refers to the process used to determine whether the quality of a given data set is adequate for its intended use. DQAs can be performed on all, or 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 at one of two points in the data generation process. First, as data are generated, 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, can be used to arrive at an assessment of whether the data are valid and acceptable. Rejected or questionable data cannot be used by ADEQ in its decision making, except in limited circumstances, such as a rough site screening.

Once data have been examined and assessed, and they are found to be of known and acceptable quality, then the results can be evaluated in the context of the DQO's for the project. In some, but not all, cases this may involve a statistical evaluation such as null hypotheses testing. In others, it may involve a comparison to regulatory action levels. An assessment must also be made as to whether there is a sufficient quantity of data to support program or project decisions, and whether the original sampling design was appropriate. In some cases, the data may suggest that additional data are required to achieve a higher statistical confidence level. This could be because too many data points were invalidated, that samples were not collected over a long enough time period, or that a vital sampling area not previously considered important, was missed. 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. Thus, both types of assessments are vital to the successful completion of a project.

These data review activities use checklists, SOPs, and standardized qualification codes to indicate data quality. The use of checklists and SOPs help standardize the data review process. The extent and level of verification for individual data sets should clearly be defined in the project's work plan or task order, or other planning document.

D.2 APPROACHES TO VERIFICATION, VALIDATION AND ASSESSMENT

The integrity of the data generated over the life of the project is confirmed by data verification and validation. The process for determining if the data satisfy program-defined requirements involves evaluating and interpreting the data, in addition to verifying that QC requirements were met. Projects planned using EPA's DQO process should produce data that provide answers to critical study questions.

The process for verifying and validating data is presented in EPA Guidance on Environmental Data Verification and Data Validation (EPA, 2002c). Section 5 of this EPA guidance provides tools and techniques for data verification and validation: https://www.epa.gov/quality/guidance-environmental-data-verification-and-data-validation.

D2.1 Approaches to Data Verification

Project team personnel 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. All field personnel will be responsible for following the sampling and documentation procedures described in the project specific submittal so that defensible and justifiable data are obtained.

Laboratory personnel will verify analytical data at the time of analysis and reporting and through subsequent reviews of the raw data for any non-compliance with 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 that are found to be the result of errors will be identified and corrected; outliers that cannot be attributed to errors in analysis, transcription, or calculation will be clearly identified in the case narrative section of the analytical data package. All analytical data generated for and submitted to ADEQ are to be verified by the laboratory.

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 should be dated and signed.

The laboratory QA manual must be used to accept, reject or qualify 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. Only data that have acceptable deviations explained, should be submitted by the laboratory. When QA requirements have not been met, the samples should be reanalyzed when possible, and only the results of the reanalysis will be submitted, provided these results are acceptable.

D.2.2 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, which may be done by the laboratory, data validation is typically performed by a qualified person who is not affiliated with

the laboratory. Validation of analytical data generated for and submitted to ADEQ's UST VS is performed by the QA Specialist, staff level personnel or, upon request, Technical Support.

The level of data validation depends on the size and complexity of the project and the decisions to be made. Basically, data validation is the process of evaluating the available data against the project MQOs to make sure that the objectives are met. Cursory validation is performed on data generated for and submitted to ADEQ's UST VS. If full data validation is ever needed on an UST project, the QAM will be notified. Criteria for data validation are summarized in Table D-1. The personnel validating the data should be familiar with the project-specific MQOs. So, the validator should have access to the QAPP, submitted document like a work plan or task order, 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 to be validated. 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.

Any field or laboratory data that did not meet the quality goals established in the planning documents are summarized in a comment letter to the party responsible for performing the Site Assessment.

D.2.3 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 QAPP or else in project-specific planning documents. Aspects of the sampling program evaluated during the data assessment include sampling design, sample collection procedures and sample handling. Analytical procedures (both field and laboratory) and QC procedures are also reviewed during the process. Field and laboratory instrument calibration logbooks are maintained by the environmental consultant and laboratories, respectively, and are reviewed by the appropriate personnel (Unit Manager, staff level personnel, Technical Support and/or QAM) on an as needed basis. Criteria for evaluating all aspects are provided in the following paragraphs.

D2.3.1 Sampling Design

Samples should conform to the type and location specified in the project-specific SAP or other planning document. Any deviations should be noted, along with the likely effect on the usability of the data for its intended purpose. EPA also provides guidance in its Guidance on Choosing a Sampling Design for Environmental Data Collection (EPA, 2002b).

D2.3.2 Sample Collection Procedures

The data reviewer (i.e. typically the field team leader from the contracted environmental consultant) should verify that the appropriate specified methods were used 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 should evaluate field records and notebooks for consistency with field methods and procedures described in the SAP to ensure that these procedures were followed properly or that deviations from the procedures will 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 from SAP 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 work plan, task order, or limited sampling analysis plan (when ADEQ staff collects samples). The different parts of the data verification summary are typically incorporated into the final deliverable to the RPS personnel for review. The 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 certified laboratories develop SOPs and analytical methods as part of their overall QA program. SOPs should be developed following EPA 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.

D2.3.3 Sample Handling

QA personnel should confirm that samples were handled in accordance with protocols required in the QAPP, SAP, or other planning documents. Sample containers and preservation methods should be confirmed as appropriate for the nature of the sample and type of data generated from the sample. Chain-of-custody records and storage conditions should be checked to ensure the representativeness and integrity of the samples.

D2.3.4 Analytical Procedures

Section B4 of this QAPP identified the requirements of analytical methods used to generate the data. Each sample should be verified to ensure that the procedures used to generate the data were implemented as specified. 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 QAPP specifies the QC checks that should be performed during sample collection, handling and analysis. Here, the QA reviewer should confirm that results for QC samples were evaluated against acceptance criteria (i.e., MQOs) specified in Section B.

D2.3.6 Calibrations

Section B7 of this QAPP 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, 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 or 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 collected for and submitted to ADEQ. All equipment and instrument calibrations shall be recorded in an appropriate log book and be made available to the 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. Steps in data reduction should be clearly documented so that the validity of the analysis can be properly assessed.

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 how the data will ultimately be interpreted to influence conclusions and recommendations.

D3 RECONCILIATION WITH DATA QUALITY OBJECTIVES

After the data have been verified and validated, the data are evaluated against project DQOs. Implementation of the DQA process completes the data life cycle by providing the assessment needed to determine if project objectives were achieved.

Two 2006 EPA guidance documents on DQA are available from EPA at http://www.epa.gov/quality/qa_docs.html. DQA is the scientific and statistical evaluation of environmental data to determine if they meet the planning objectives of the project, and thus are of the right type, quality and quantity to support their intended use. Data Quality Assessment - A Reviewers Guide broadly describes the statistical aspects of DQA in evaluating environmental data sets. A more detailed discussion on implementation of graphical and statistical tools is found in the companion guidance document on statistical methods for practitioners Data Quality Assessment - Statistical Methods for Practitioners (EPA, 2006c), *see* https://nepis.epa.gov/Exe/ZyPDF.cgi/900B0D00.PDF?Dockey=900B0D00.PDF.
These EPA guidance documents discuss the use of DQA to support environmental decision-making (e.g., compliance determinations).

The DQA process is built on 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 in what context a data set is to be used, 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 a decision (or estimate) be made with the desired level of certainty, given the quality of the data?
2. How well did the sampling design perform?
3. If the same sampling design strategy is used again for a similar study, would the data be expected to support the same intended use with the desired level of certainty?
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. Scientific and statistical evaluations of the data are used to 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 statistical evaluations of data generated for and submitted to the UST Program are rarely employed. This is because judgmental sampling is most always the appropriate method for collecting samples for situations encountered. The goal of judgmental sampling is to use process or site knowledge to choose one or more sampling locations to represent the average concentration or typical property. In the rare occurrence when UST Program staff collect samples, judgmental sampling is done and is done under circumstances such as the following:

- Preliminary information is needed about a waste stream or site to facilitate planning;
- Site assessment to identify a potential or actual release;
- Determining the chemical makeup of a spilled material;
- Screening samples in the field to identify "hot" samples for subsequent analysis in a laboratory;
- Support development of an enforcement case.

Generally, based on knowledge of the facility processes, and discussions with the UST owner/operator, the UST Program compliance staff would identify sample locations and determine the number and type, i.e., grab, or composite, samples to collect to the DQOs.

For the rare occasion when a project needs a statistical evaluation, 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 statistical evaluation other than confidence intervals is needed, a contractor may be selected to perform independent statistical evaluations in accordance with the DQA process outlined in this QAPP.

D3.2 Reconciling Results with Program Objectives or DQOs

EPA guidance documents for data evaluation (EPA 2006) describe an iterative five-step process called the "Five Steps of Statistical DQA":

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 anomalies in the data that may not have been noticed during data verification and validation. Are there outliers or other anomalies that should be further investigated before 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. In some cases, the conclusion may be that more data are needed to answer the primary study questions.

If DQOs have not been adequately developed, UST Program staff may need to review the planning documents and sampling design, and then define the statistical hypotheses to be tested and establish tolerable limits on decision errors.

When the DQOs are qualitative, judgmental sampling is utilized and statistical tools are not appropriate, the ADEQ will still systematically assess data quality and data usability. This DQA assessment – Four Steps of DQA for Qualitative DQOs - will 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 the decisions to be made 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.

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.

The objectives of the study should be reviewed in order to provide a context for analyzing the data. If a systematic planning process has been implemented before the data are collected, then this step reviews the study objectives to evaluate whether project goals have been met and whether the study questions have been adequately answered. If no clear planning process was used, the reviewer should:

- Develop a concise definition of the problem (DQO 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.
- Identify the target population and determine if any essential information is missing (DQO Step 3). If so, either collect the missing information before proceeding, or select a different approach to resolving the problem.
- Specify the scale of determination (any subpopulations of interest) and any boundaries on the study (DQO Step 4) based on the sampling design. The scale of determination is the smallest area or time period to which the conclusions of the study will apply. The apparent sampling design and implementation may restrict how small or how large the scale of determination can be.
- Evaluate whether the data support the conclusions offered (DQO Step 5). The overall type of sampling design and the manner in which data were collected will likely place

constraints on how the data can be used and interpreted. 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)?

The design and sampling strategy should be discussed in clear detail in the work plan, task order or SAP. The overall type of sampling design and the manner in which samples were collected or measurements were taken will place conditions and constraints on how the data can be used and interpreted.

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 some advantages and is appropriate in some cases. This type of sampling should be considered when the objectives of the investigation are not of a statistical nature (for example, when the objective of a study is to identify specific locations of leaks/hot spots or when the study is focused solely on the sampling locations themselves). Generally, conclusions drawn from judgmental samples apply only to those individual samples.

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 an effluent stream over time, then composite samples may be an appropriate sampling design. If the goal of the study is to find hot spots of contamination or sources of contamination, compositing should be used with caution, to avoid "averaging away" hot spots.

The reviewer should also look for potential problems in the implementation of the sampling design. For example, if simple random sampling was used to collect the data, can the reviewer be confident that the sampling locations or data points were truly random? Small deviations from a sampling plan probably have minimal effect on the conclusions drawn from the data set, but the effects of significant or substantial deviations should be carefully assessed. Finally, the reviewer should verify that the data are consistent with the project-specific work plan, task order or SAP and the overall objectives of the study.

D3.2.2 Conduct Preliminary Data Review

For judgmental sampling there is no probability-based theory for reliably estimating the magnitude of sampling errors. Any inference is confined to the sample locations judgmentally selected in the field.

Nevertheless, it is still possible to commit decision errors. Measurement errors can occur during sample analysis. Sampling errors can be caused by variability of contaminant concentrations in visibly stained soil areas. In the case of judgmental sampling, the magnitude of sampling errors

cannot be reliably estimated, however, measurement error can be quantified. Assessments for judgment sampling data are done initially by the UST Program staff, and a final review is performed by the program's OET.

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 statistical method will be selected based on the sampling plan used to collect the data, the type of data distribution and the assumptions made in setting the DQOs, noting any deviations from these assumptions. Conclusions about other aspects of the data set or the stated null hypothesis are made based on the results of this evaluation. EPA DQA guidance provides a discussion (with mathematical formulas and examples for conducting statistical tests) of the process for statistically evaluating environmental data. Detailed technical information that reviewers can use to select appropriate procedures may be found in Chapter 3 of EPA's 2006 Data Quality Assessment: Statistical Methods for Practitioners (EPA, 2006c).

For the rare occasion when a 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 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 a particular statistical procedure was specified in the project work plan, task order or SAP, 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 deemed inappropriate, and then select a different method. The EPA's Quality Assessment guidance document (EPA 2006) provides alternatives for several statistical procedures. If a particular procedure has not been 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 that are insensitive to small or moderate departures from the assumptions are called "robust." 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 one or more of the assumptions are called into question, this could require a re-evaluation of which test may be most appropriate for the data. It is true that some deviations do not invalidate the results of a statistical test, but this should be confirmed here 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 that were taken.

D3.2.5 Draw Conclusions from Data

Step 5 of the DQA process represents the culmination of the planning, implementation and assessment 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.

In Step 1, the project objectives are reviewed (or developed retrospectively) and the sampling design is evaluated. In Step 2, the implementation of the sampling scheme is reviewed and a preliminary picture of the data set is developed. In Step 3, the appropriate statistical tests are selected. Finally, the underlying assumptions of the statistical test are verified in Step 4.

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. The confidence and power of the tests are stated, along with the study conclusions in plain English. Finally, the data analyst provides an assessment of the overall performance of the sampling design and identifies additional data that may be needed (that is, data gaps are identified).

If data were collected using a judgmental sampling design or if few samples were collected, professional judgment rather than formal statistical testing may be applied to draw conclusions. Or, statistical tests may be applied, recognizing 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 cleanup standard or action level, and test results show that concentrations do not exceed the action level, then a conclusion can be drawn. If test results show that concentrations do exceed the action level, then, in formulating conclusions, the reviewer should balance the test results against the knowledge that the data were biased toward the sampling of "hot spots."

Table D.1 – 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 SDG data	• Holding times • Gas Chromatography/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 SDG data
Inorganic Analyses	• Holding times • Calibration • Blanks • Matrix spike recovery • Matrix duplicate sample analysis • Laboratory control sample or blank • Field duplicate sample analysis • Temperature • ICP serial dilution • Overall assessment of SDG data	• Holding time • 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 SDG data

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

REFERENCES

ADEQ, 2022. Quality Management Plan

ADEQ, 2014. Site Investigation Guidance Manual

ADEQ, 2019. Internal; Standard Work Requirements

EPA, 1992a. Guidance for Performing Site Inspections Under CERCLA (EPA/540-R-92-021), September

EPA, 1992b. Preparation of Soil Sampling Protocols: Sampling Techniques and Strategies

EPA, 1992c. Specifications and Guidance for Obtaining Contaminant-Free Sampling Containers

EPA, 2001. Requirement for Quality Assurance Project Plan for Environmental Data Operations (QA/R-5), March

EPA, 2002a. Guidance for Quality Assurance Project Plans (QA/G-5), December

EPA, 2002b. Guidance on Choosing a Sampling Design for Environmental Data Collection

EPA,2002c. Guidance on Environmental Data Verification and Data Validation

EPA, 2003. Guidance on Assessing Quality Systems (Management Systems Review Process)

EPA, 2006a. Guidance on Systematic Planning using the Data Quality Objectives Planning Process

EPA, 2006b. Data Quality Assessment- A Reviewer's Guide

EPA, 2006c. Data Quality Assessment – Statistical Methods for Practitioners

EPA, 2007a. Guidance for Preparation of Standard Operating Procedures for Quality Related Operations (EPA/600/B-07/0001), April

EPA, 2007b. Guidance for Developing Standard Operating Procedures

APPENDICES

Appendix A	Arizona Administrative Code Applicable to ADHS Laboratories
Appendix B	Arizona Administrative Code for Soil Remediation Standards and Water Quality Standards, and Substantive Policy for UST Release Confirmation Levels
Appendix C	ADEQ Specific Quality Assurance Guidance and Policies
Appendix D	Standard Operating Procedures

Appendix A Arizona Administrative Code Applicable to ADHS 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, Petroleum Chemicals of Concern, Substantive Policy for UST Release Confirmation and UST Program Analytical Data Information

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

Below is the hyperlink for the Petroleum Chemicals of Concern: https://static.azdeq.gov/ust/tier1_petroleum_standards.pdf

Below is the hyperlink to the substantive policy for UST Release Confirmation Levels https://static.azdeq.gov/ust/ust_release_conf_levels.pdf.

Below is the hyperlink to the UST Program Analytical Data Information Sheet: https://static.azdeq.gov/ust/analytical_data.pdf

Appendix C ADEQ Specific Quality Assurance Guidance and Policies

ADEQ's Waste Programs Division Site Investigation Guidance is available at the following link: http://legacy.azdeq.gov/environ/waste/download/SI_Guidance_Manual_Final.pdf

ADEQ's Soil Vapor Sampling Guidance dated May 2011 is available at the following link:http://static.azdeq.gov/legal/subs_policy_svsg.pdf

The Arizona Department of Health Services (ADHS) issued information Update #119 (VOCs in 8260B) on May 15, 2014 and is available at the following link: http://www.azdhs.gov/documents/preparedness/state-laboratory/lab-licensure-certification/technicalresources/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/technicalresources/information-updates/2011.pdf

ADEQ Matrix interference policy is located at the following hyperlink: Substantive Policy 0154 - Addressing Spike And Surrogate Recovery As They Relate To Matrix Effects In Water, Air, Sludge And Soil Matrices Policy; and

ADEQ Soil sample preservation policy is located at the following hyperlink: Substantive Policy 0170 - Implementation of EPA Method 5035 - Soil Preparation for EPA Method 8015B, 8021B and 8260B.

ADEQ Temperature/Preservation Guidance Policy:

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.

ADEQ Retention Schedule

Retention Work Instruction

General Records Series	General Ret Total	General Ret Remarks
Duplicates / Copies	------	Not longer than official record is kept
Working Papers/Feeder Documents	------	After final document has been created or administrative or reference value has been served, whichever is longer
Publications	1 year	After superseded or obsolete (Obtain publication number from ADEQ Communications Office)
Email/Correspondence:		
Non-Case or Project	------	After administrative or reference value has been served
Program:		
Official Record	------	Retain with, and for same period as required for, Program record series
Copies	------	Not longer than official record is kept
Databases:		
Field/Data Collection Sheets	------	After entered data is verified or after administrative or reference value has been served, whichever is later
Electronic Data	------	After superseded or obsolete or after administrative or reference value has been served, whichever is later
Legislation Records:		
Case Files for legislation proposed by agency	Permanent	Preserve pursuant to ARS §39-101
Legislation Tracking Files	1 year	After either calendar year or fiscal year passed into law or defeated
Litigation	------	No record shall be destroyed that is part of an ongoing litigation
Personnel:		
Hiring Selection Records	Not longer than 2 years 6 months	After either calendar year or fiscal year created or received
Section/Supervisor Personnel Files	between 6 months and 5 years	After either calendar year or fiscal year employee terminated or transferred
Employee Leave and Time Records	Between 1 and 3 years	After fiscal year created or received
Travel Claims	Between 1 and 3 years	After fiscal year created or received
Budget Records	Not longer than 3 years	After fiscal year covered by budget
Purchase Orders	Between 1 and 3 years	After fiscal year created or received
Contracts, ISAs, and IGAs etc.	Not Longer than 6 Years	After either calendar year or fiscal year fulfilled, cancelled or revoked

Audits	Not Longer than 7 Years	After fiscal year report completed or after reference value has been served, whichever is later
ADEQ Annual Reports	Not longer than 10 years	After either calendar year or fiscal year reported or after reference value has been served, whichever is later.
ADEQ Strategic Plans and Goal Records (including 5-year, 10-year and long range planning records)	Not longer than 5 years	After either calendar year or fiscal year created or received or after administrative value has been served, whichever is later
Transitory Materials:		
Lists, Logs, and Reading/Reference Files	------	After administrative or reference value has been served
Appointment Calendars/Planners	1 Year	After calendar year of last entry or after administrative or reference value has been served, whichever is later
Grants:		
Historically Significant	Permanent	Preserve pursuant to ARS §39-101
All Other Program Records	3 years	After fiscal year quarterly, annual or final expenditure report submitted and approved or after funding agency requirements are met, whichever is longer
Unsuccessful Grant Application Records	1 year	After rejected or withdrawn or after administrative or reference value has been served, whichever is later
Committee, Board, Commission, Council, or Task Force Records (Decision Making):		
Meeting minutes (including information needed to clarify minutes)	Permanent	Preserve pursuant to ARS §39-101
Reports/Studies resulting in no action	5 years	After either calendar year or fiscal year submitted or after administrative value has ended, whichever is later
Reports/Studies resulting in a project	------	File with project records
Everything other than meeting minutes and reports/studies	3 years	After either calendar year or fiscal year created or received
Committee or Task Force Records (Non-Decision Making):	------	After administrative or reference value has been served
Progress/ Activity/Statistical Reports (including weekly or monthly reports to supervisors and managers and status reports but not including official agency annual report)	------	After administrative or reference value has been served
Rule Making Records	1 year	After either calendar year or fiscal year rule is rejected, superseded or no longer in effect, or after administrative or reference value has been served, whichever is later
Customer Service Records (including customer surveys)	------	After administrative or reference value has been served
Maps		
With Publication Number	1 year	After superseded or obsolete (Obtain publication number from ADEQ Communications Office)
Without Publication Number	------	After administrative or reference value has been served
Federal Mandates	------	Retain for time period required by Federal Agency

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. EPA's April 2007 Guidance for Preparation of Standard Operating Procedures for Quality-Related Operations (EPA/600/B-07/0001) is a guide for developing SOPs. 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

ASTM SOPs:

ASTM D 5088-20 Standards Practice for Decontamination of Field Equipment Used at Waste Sites https://www.astm.org/d5088-20.html

ASTM D 5679-95a. (2006). Standard Practice for Sampling Consolidated Solids in Drums or Similar Containers https://www.astm.org/d5679-95ar06.html

ASTM D 5680-14. Standard Practice for Sampling Unconsolidated Solids in Drums or Similar Containershttps://www.astm.org/d5680-14.html
.

ASTM D 5743-21. Standard Practice for Sampling Single or Multilayered Liquids, With or Without Solids, in Drums or Similar Containers https://www.astm.org/d5743-21.html

ASTM D 6063-11. (2018). Standard Guide for Sampling of Drums and Similar Containers by Field Personnel https://www.astm.org/d6063-11r18.html

ASTM D6232-21. Standard Guide for Selection of Sampling Equipment for Waste and Contaminated Media Data Collection Activities https://www.astm.org/d6232-21.html

Appendix E ADEQ Field Forms

The RBCA Tier 3 Submittal Checklist for Soil Vapor Survey can be found at this hyperlink: https://static.azdeq.gov/forms/tier_3_sv_checklist.pdf

Example of a Monitoring Well sampling log:

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: 855 Navajo Boulevard, Holbrook, Arizona	
Contact Information:	Project No: 2334000008	Phase No: 01
Well ID: MW-1L	Contractor: None	
	Weather: Clear	Temperature: 30

Purging & Sampling Instrumentation & Method

Water Level Meter (Model(s)):	Interface Probe (Model(s)): Keck
Water Quality Meter (Model(s)): YSI / Oakton / Hanna	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) (gal/vol): 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	18.3	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	5.05	7.19	69	
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 (DTW) (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:

ADEQ QA/QC checklist for Soil Vapor Sampling example:

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 inch³ (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° ☐ F° ☐

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 inch³ (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:** _____