

	<p>Investigation of Underground Storage Tank Releases</p> <p><i>Office of Land Quality Underground Storage Tank Branch</i></p> <p>Quality Assurance Program Plan</p> <p>B-001-OLQ-UST-LST-16-Q-R2</p>
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Office: Office of Land Quality (OLQ)

Branch: Underground Storage Tank Branch

Sections: Underground Storage Tank Section, Leaking Underground Storage Tank Section, Excess Liability Program Technical Section

Effective date: Upon United States Environmental Protection Agency (U.S. EPA) Approval

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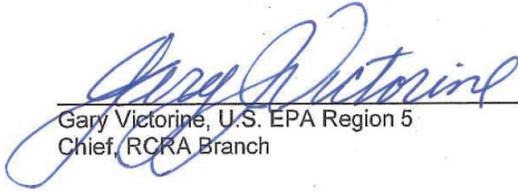
QAPP Summary:

This Quality Assurance Program Plan (QAPP) outlines the requirements for administering the leaking underground storage tank (UST) program through the OLQ Underground Storage Tank Branch. Specifically, this QAPP provides guidance for the collection of data used to support investigation, monitoring, and corrective action activities associated with the release of petroleum and hazardous substances from regulated USTs. The program activities are supported by U.S. Environmental Protection Agency (U.S. EPA) Region 5 through a Cooperative Agreement with the Indiana Department of Environmental Management (IDEM).

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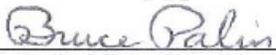
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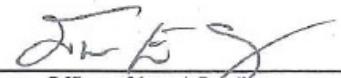
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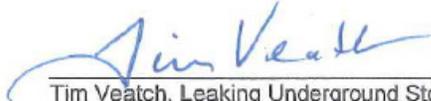
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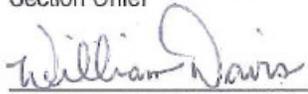
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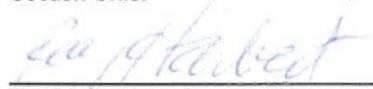
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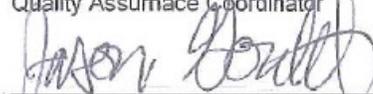
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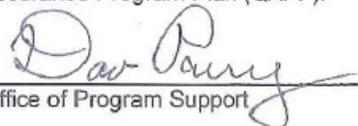
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The Office of Program Support Quality Assurance Program reviewed and approves this Quality Assurance Program Plan (QAPP).



Office of Program Support

6/23/16
Date

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- Appendix D – Remediation Closure Guide

Introduction

The following Quality Assurance Program Plan (QAPP) was prepared by the Office of Land Quality (OLQ) in an effort to facilitate the Underground Storage Tank (UST) Program conducted by OLQ, based on the Indiana Department of Environmental Management (IDEM) and U.S. Environmental Protection Agency (U.S. EPA) Region 5 requirements.

This document provides instruction for the preparation, review, approval, and implementation of technical and quality aspects of leaking UST environmental investigations and conceptual site model (CSM) data prepared for IDEM by external contractors and IDEM staff. It does so primarily by referencing existing program documentation.

The U.S. EPA, through Chief Information Officer 2106.0 October 21, 2008 (e.g., Appendix A, #3) reaffirms and establishes requirements for the agency's mandatory quality system. Because UST Program activities include environmentally-related measurements or data generation, IDEM is required by U.S. EPA regulations (40 CFR Part 31.45) to develop and implement a quality assurance system. This resulting QAPP for the IDEM's UST Program has been developed pursuant to:

- *U.S. EPA Requirements for Quality Assurance Project Plans (QAPPs) (QA/R-5)*, U.S. EPA/240/B-01/003, March 2001 (Reissued May 2006);
- *Guidance for QAPPs, (G-5)*, U.S. EPA/240/R-02/009, December 2002;
- *IDEM Agency Wide Quality Management Plan*, IDEM, 2012;
- *OLQ Quality Management Plan*, IDEM 2012; and,
- *QAPP Development and Approval SOP*, A-006-OEA-06-S-R0, IDEM, June 2006.

A. Project Management

A.1. Title and Approval Sheet

See cover page and page iii.

A.2. Table of Contents

See table of contents, pages v and vi.

A.3. Distribution List

Each role listed below will either receive a copy of the approved QAPP, or be notified of how to obtain an electronic copy. The approved document will be made available via IDEM's UST Branch SharePoint site, and also be available via a link on IDEM's Leaking Underground Storage Tank web site.

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UST Owners and Operators, Environmental Consultants and Contractors, and other External Stakeholders

The approved document will be posted on IDEM's OLQ web site.

A.4. Project/Task Organization

A.4.1. UST Program Structure

IDEM is the State agency authorized to manage environmental issues and conditions in the State of Indiana. The State of Indiana applied for approval of the underground storage tank (UST) program under Subtitle I of the Resource Conservation and Recovery Act (RCRA) (Appendix A, #10); this approval was granted by the U.S. EPA, effective July 12, 2006, authorizing IDEM to operate the State UST Program in lieu of the Federal UST program.

Within IDEM's Office of Land Quality (OLQ) Underground Storage Tank Branch, there are five groups that are involved with the implementation of the UST programs. These sections are:

- Underground Storage Tank (UST) Registration Program
- UST Section
- Leaking Underground Storage Tank (LUST) Section
- Excess Liability Trust Fund (ELTF) Technical Section
- ELTF Claims Section

The responsibilities associated with each group are as follows:

- UST Section – UST registration, fee assessment, inspection, and UST closure
- LUST Section – Release documentation, corrective action oversight
- ELTF Technical Section – Corrective action oversight and ELTF eligibility determination
- ELTF Claims Section – Review and approval of claims for corrective action costs and third party damage claims.

This *Investigation of UST Releases QAPP* covers activities involving the collection and analysis of environmental data for the UST Branch in support of suspected and confirmed releases of petroleum and hazardous substances from regulated USTs. It also covers conducting investigations, performing corrective actions and making decisions regarding completion of site cleanup. Every section, except for the ELTF Claims Section, performs one or more of these responsibilities. The LUST Program is also supported by technical staff in the Science Services Branch (SSB) of OLQ, including:

- Geological Services
- Chemistry Services
- Risk Services
- Engineering and GIS Services

In Indiana, environmental data collection in support of the investigation of UST releases is usually documented by and submitted to IDEM by consulting firms hired by the owner/operators of the site. Data collection requirements are laid out in the applicable UST/LUST program guidance (Appendix A, #2 and #3) and in this *Investigation of UST Releases QAPP*. The principal data users are the LUST and ELTF Section Chiefs (SC); Project Managers (PM); site consultants; technical evaluation staff (chemist, geologist, risk assessor, data manager, and/or engineer); and the U.S. EPA.

An organizational chart for the UST Programs is provided in Figure 1, and the roles and responsibilities as they pertain to this QAPP and releases from USTs are described in the narrative below.

A.4.2. UST Program Roles and Responsibilities

IDEM OLQ UST Branch Roles and Responsibilities

- **OLQ UST Branch Chief (BC):**
 - Assigns staff to develop, review, and implement the *Investigation of UST Releases QAPP*;
 - Ensures staff compliance with this QAPP and applicable laws, SOPs, and policies;
 - Approves the *Investigation of UST Releases QAPP*.
- **Environmental Specialists:**
 - Draft and update the *Investigation of UST Releases QAPP*;
 - Provide compliance and technical support to the Branch Chiefs, Section Chiefs, and program staff.
- **UST Section Chief (SC):**
 - Responsible for approving and implementing the *Investigation of UST Releases QAPP*;
 - Assigns UST Program inspector caseload;
 - Coordinates UST Program requirements with LUST and ELTF SCs, and U.S. EPA.
- **UST Closure Coordinator:**
 - Inspect UST closure activities;
 - Evaluate and approve *UST Closure Reports*;
 - Notify the LUST Section when confirmed UST releases have been noted during inspection duties and UST Closure Report review;
- **UST Inspectors:**
 - Evaluate owner/operator compliance with UST Program rules and regulations.
 - Investigates UST system operation and maintenance records regarding suspected release investigation and confirmations steps.

- **LUST and ELTF Technical Section Chiefs (SCs):**
 - Are responsible for approving, maintaining, and implementing the *Investigation of UST Releases QAPP*;
 - Serve as the primary interface with the U.S. EPA for program reporting (LUST SC);
 - Assign project manager (PM) caseload (ELTF Technical Section);
 - Approve site closure documentation, typically in the form of 'No Further Action' letters.
 - **Senior Environmental Managers**
 - Assigns PM caseload (LUST Section).
 - Evaluates ELTF Eligibility (ELTF Technical Section)
 - Project Manager Tasks:
 - Are responsible for compliance with the *Investigation of UST Releases QAPP*;
 - Evaluate owner/operator compliance with UST Program rules and regulations;
 - Coordinate the OLQ technical evaluation team (see the end of section A.4.1);
 - Approve UST Program site documentation;
 - Write IDEM site correspondence;
 - Conduct or arrange for field work oversight;
 - Concurrently collect and/or split samples with owner/operator consultants;
 - Manage contracts at sites where the owner/operator is unable or unwilling to comply with regulations;
 - Receive notification of suspected and confirmed releases;
 - Along with administrative assistants, maintain site-specific records and update IDEM's UST/LUST/ELTF databases.
 - **Project Managers (PM):**
 - Are responsible for compliance with the *Investigation of UST Releases QAPP*;
 - Evaluate owner/operator compliance with UST Program rules and regulations;
 - Coordinate the OLQ technical evaluation team (see the end of section A.4.1);
 - Approve UST Program site documentation;
 - Write IDEM site correspondence;
 - Conduct or arrange for field work oversight;
 - Concurrently collect and/or split samples with owner/operator consultants;
 - Manage contracts at sites where the owner/operator is unable or unwilling to comply with regulations;
 - Along with administrative assistants, maintain site-specific records and update IDEM's UST/LUST/ELTF databases.
 - **Administrative Staff**
 - Receive notification of suspected and confirmed releases (LUST Section);
 - Documents release reporting and initial correspondence (LUST Section);
 - Assigns PM Caseloads;
 - Tracks incoming and outgoing documents in IDEM databases;
 - Index documents in IDEM electronic filing system
 - Manages Leaking UST electronic mail inbox (LeakingUST@idem.in.gov);
 - Coordinates program complain tracking.

IDEM OLQ Science Services Branch Roles and Responsibilities

The following roles provide independent technical evaluation services for the UST Program:

- **OLQ Science Services Branch (SSB) Chief:**
 - Assigns staff to review the *Investigation of UST Releases QAPP*;
 - Ensures SSB and UST staff compliance with QAPPs, SOPs, Guidance, and policies.

- **Chemistry Services, Geological Services, Engineering and GIS Services, and Risk Services SCs:**
 - Assign technical reviewer caseload;
 - Approve technical reviewer memoranda and reports.
- **Chemists:**
 - Provide an independent review, verification, and validation of data generated for the UST Program;
 - Evaluate project goals, analytical methods, data reviews and data acceptability on the basis of analytical data results, laboratory Quality Assurance/Quality Control (QA/QC), sampling reports, audits, and procedures;
 - Review Quality Assurance Project/Program Plans (QAPPs);
 - Provide support as required for sampling plan development and oversight of field sample collection;
 - Peer review of Quality Assurance.
- **Geologists:**
 - Provide technical services as required, including: report review, evaluation of proposed remedy options, evaluation of plume behavior, and appropriateness of engineering and institutional controls;
 - Provide services as required for sampling plan development and oversight of field sample collection.
- **Engineers:**
 - Provide technical services as required, including: report review, evaluation of proposed remedy options, evaluation of plume behavior, and appropriateness of engineering and institutional controls.
- **Risk Evaluators:**
 - Provide technical support and expertise for LUST sites seeking risk-based closure.
- **Geographic Information System (GIS)/Data Services Personnel:**
 - Provide technical support as required, including: geographic positioning system (GPS) data, GIS mapping, and electronic data submission and storage.

IDEM Quality Assurance Roles and Responsibilities

- **IDEM Agency Quality Assurance (QA) Manager(s);**
 - Review and evaluate the *Investigation of UST Releases QAPP* for conformance with the *QAPP Development and Approval SOP*, U.S. EPA and IDEM QAPP Checklists, and other quality management system requirements;
 - Are responsible for the implementation and maintenance of the IDEM quality management system, as described in the U.S. EPA-approved *IDEM Agency Wide Quality Management Plan, 2012-2017*.
- **SSB Quality Assurance (QA) Coordinator:**
 - Provides the independent reviewer role for program and project QAPPs, including the *Investigation of UST Releases QAPP*;
 - Performs contract laboratory performance and system audits;
 - Participates in QA efforts at the agency, program office, and branch levels.
- **UST Branch Quality Assurance (QA) Coordinator:**

- Facilitates the *Investigation of UST Releases QAPP* development process;
- Participates in QA efforts at the agency, program office, and branch levels.

Consultant Roles and Responsibilities

- **Owner/Operator Consultant:**
 - Prepares release notifications and reports, and implements corrective action as needed;
 - Supervises and schedules consultant or subcontractor field staff for sample collection and site characterization activities, in accordance with IDEM and UST Program guidance documents;
 - Ensures staff are qualified and trained, including in knowledge of IDEM and UST Program requirements;
 - Develops environmental standard operating procedures for use by consultant staff;
 - Reviews, approves, and submits consultant generated reports;
 - Complies with UST Program laws and guidance, including but not limited to, the UST Rule (329 IAC 9), *Remediation Closure Guide (RCG)*, and *Remediation Program Guide (RPG)* – primarily Section 3.
 - Implements IDEM-approved remedy options at sites.
- **Consultant Laboratory:**
 - Performs requested test methods on samples submitted by the consultant;
 - Provides QA/QC documentation (see *Remediation Closure Guide*, section 3.9.1);
 - Ensures that appropriate analytical methods, QA/QC procedures, and equipment calibrations are performed;
 - Ensures that laboratory staff is adequately trained;
 - Prepares laboratory analytical data packages.

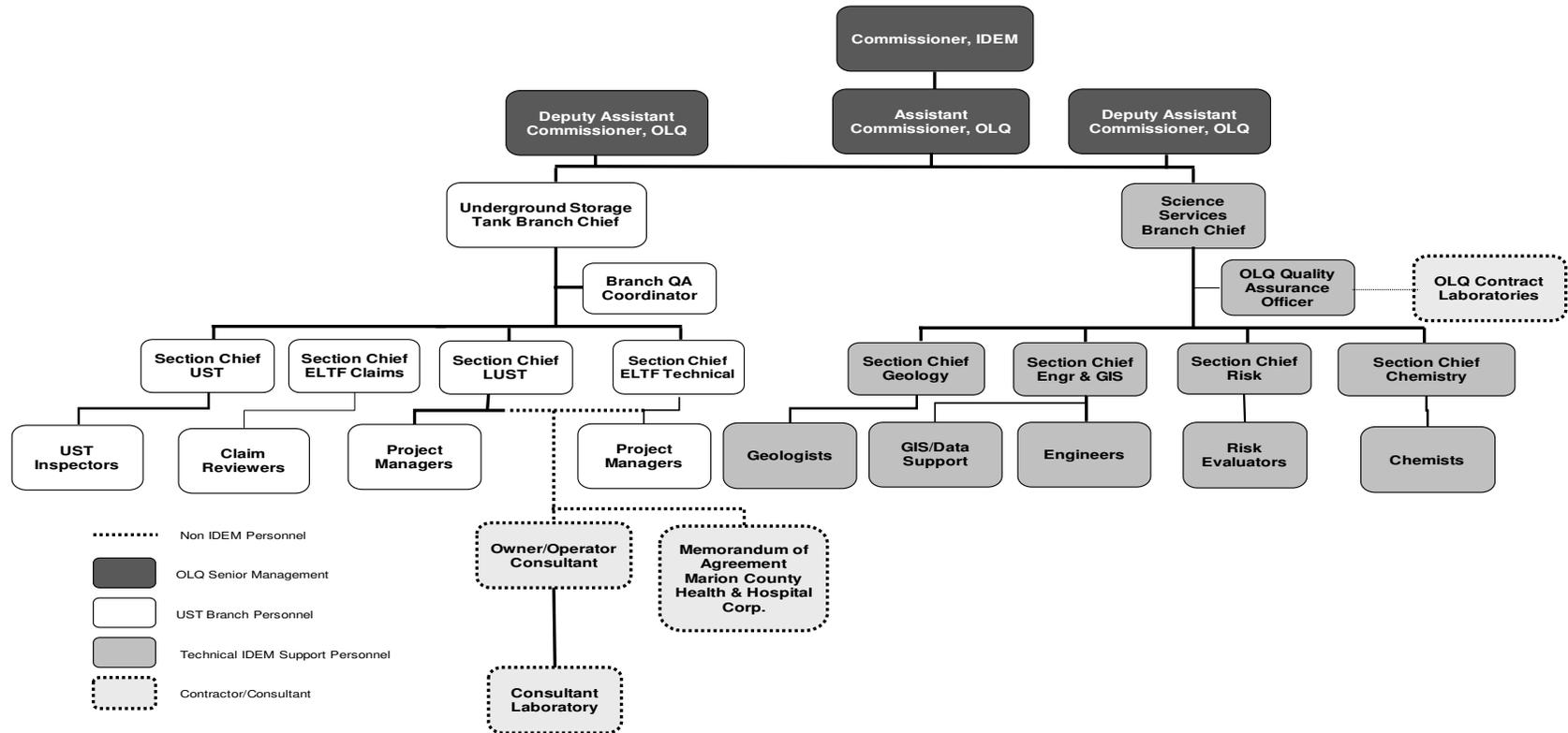
U.S. EPA Roles and Responsibilities (not shown on organizational chart)

- **U.S. EPA Region 5 UST Section, Enforcement Officer:**
 - Responsible for directing and overseeing UST Program activities;
 - Serves as the final approval authority of IDEM *Investigation of UST Releases QAPP*;
 - Conducts annual and semi-annual programmatic reviews.
- **U.S. EPA QA Reviewer:**
 - Reviews *Investigation of UST Releases QAPP* and other quality documentation as assigned.
 - Approves IDEM *Investigation of UST Releases QAPP*.

Other Organizations - Roles and Responsibilities

- **OLQ Contract Laboratory Staff:**
 - Perform requested test methods on samples submitted by IDEM staff;
 - Ensure that appropriate analytical methods, QA/QC procedures, documentation, and equipment calibration are performed;
 - Ensure that laboratory staff is adequately trained;
 - Prepare laboratory analytical data packages per section 3.9 of the *Remediation Closure Guide* as required by the OLQ Laboratory Contract 13-83.

Figure 1 UST Releases QA Organizational Chart



A.5. Problem Definition/Background

The [U.S. EPA](#) estimates that there are approximately 578,000 USTs nationwide that store petroleum and other hazardous substances. Releases from USTs impact soil, groundwater, and surface water; and can cause harm to human health and the environment. In 1984, Congress added Subtitle I of the Resource Conservation and Recovery Act (RCRA) requiring the U.S. EPA to develop a regulatory program for USTs. The federal Leaking Underground Storage Tank Program was supplemented in 1986 with creation of the Leaking Underground Storage Tank Trust Fund, financed by a 0.1 cent tax on each gallon of motor fuel sold nationwide. These funds are allocated through the states, including Indiana and IDEM's UST Program, to oversee cleanups of sites where releases from UST have occurred and to pay for cleanups at sites where owner/operators cannot be identified or are not responsive.

IDEM received UST state program approval from the U.S. EPA on August 11, 2006. (Appendix A, #11) In addition to federal funds, the UST Program is also financed by State dedicated funds including the Underground Petroleum Storage Tank Trust Fund (UPSTTF) and the Underground Petroleum Storage Tank Excess Liability Trust Fund (ELTF). The UST Rule, 329 IAC 9, (Appendix A, #13) contains the technical and financial responsibility requirements for UST owners and operators. The ELTF Rule in 328 IAC 1 (Appendix A, #12) contains mechanisms for using ELTF to fulfill UST owner and operator financial responsibility requirements as well as for reimbursement of corrective action costs and payment of third party claims.

IDEM's UST Program utilizes a risk-based approach to assess and remediate UST releases. The *Remediation Closure Guide* and *Section 3 of the Remediation Program Guide* describe how to achieve consistent closure of contaminated soil and groundwater by documenting:

- How to assess contamination present at a site;
- How to evaluate potential exposure pathways to contamination;
- What the options are for determining risk-based site closure levels;
- What options are available for achieving a closure (No Further Action) status;
- How to use exposure prevention of residual contamination as a closure option (to prevent people from coming in contact with contaminants), and;
- What to do if contamination threatens exposure pathways, such as drinking water or indoor air.

The *Remediation Closure Guide* (RCG) describes selected approaches to investigation and risk-based closure of contaminated or potentially contaminated sites. A companion manual, the *Remediation Program Guide* (RPG), provides guidance related to specific regulatory programs. Together, the RPG and the RCG provide a framework for investigating sites and moving them toward closure. Section 3 of the RPG provides details on processes and the applicability of the RCG to the UST Program.

A.6. Project/Task Description

Within the UST Program, the number and type of tasks required may vary based upon site characteristics. Each completed task may lead to a request for additional investigation, corrective action, or a consideration of a 'No Further Action' (NFA) status from IDEM. In general, the project tasks for the UST Program may be broken into 3 major categories: 1) Notification and response tasks for suspected or confirmed releases, 2) Investigation tasks for potential or confirmed releases, and 3) Remediation, risk assessment, and closure tasks.

Tasks within these groups are summarized in Table I, and include references to sources where additional information may be found as well as project schedule dates.

Table 1. UST Program - Releases Project Task Summary

Task	Description/Report Contents	Category	Schedule	References for More Detail
Suspected Release/Confirmed Release	Documentation to include owner/operator details; UST system description; description of suspected release.	Notification and Response	RPs notify IDEM within 24 hours; 7 days for RP to confirm release or no release	<i>Remediation Program Guide, Section 3.4; 329 IAC 9-4, 329 IAC 9-5-2</i>
Mitigation and Free Product (FP) Abatement	Documentation of vacuum events; vapor mitigation; occupant evacuation; alternate water supply provision; interceptor trench; booms in surface water; product recovery efforts; etc.	Notification and Response	Reports due 20-days (mitigation) OR 45 days (FP Recovery) from date of notification to IDEM	<i>Remediation Program Guide, Section 3.5; 329 IAC 9-4-1; 329 IAC 9-5-3.2</i>
UST Closure Report	Report provides the details of UST closure, including sampling results that may or may not indicate a release from the UST system. Required for removal, closure in-place, and change of service.	Investigation	Within 30 days of UST decommissioning or closure	<i>Remediation Program Guide, Section 3, Table 3.1; 329 IAC 9-6</i>
Initial Site Characterization (ISC)	Initiate investigation to define nature and extent of contamination and evaluate exposure pathways and receptors, evaluate remediation alternatives.	Investigation	Within 60 days of release confirmation	<i>Remediation Program Guide, Section 3.7; 329 IAC 9-5-5.1</i>
Further Site Investigation (FSI)	Further investigation if ISC fails to define nature and extent of contamination; evaluation of remedial alternatives.	Investigation	Generally within one year of release confirmation upon request from IDEM request for FSI; extensions possible upon request	<i>Remediation Program Guide, Section 3.7; 329 IAC 9-5-6</i>
Corrective Action Plan (CAP)	Plan describing remedial strategy for site.	Remediation, risk assessment, and closure	Due as directed by IDEM 60-90 days from request for CAP; must include progress milestone timetable.	<i>Remediation Program Guide, Section 3.8; 329 IAC 9-5-7.</i>
Corrective Action Implementation Report	Documents remedial system installation, construction activities, etc.	Remediation, risk assessment, and closure	Generally 60 days from CAP implementation completion; extensions possible upon request	<i>Remediation Program Guide, Section 3.9; 329 IAC 9.5.7</i>
Corrective Action Plan Progress Report	Required for: 1) When requested by IDEM prior to corrective action; 2) Corrective action monitoring; 3) Monitored natural attenuation or other closure monitoring such as plume stability demonstration.	Remediation, risk assessment, and closure	Quarterly, or as documented in approved CAP	<i>Remediation Program Guide, Section 3.9; 329 IAC 9.5.7</i>

Task	Description/Report Contents	Category	Schedule	References for More Detail
Request for No Further Action	Documents justification for closure decision, including risk assessment.	Remediation, risk assessment, and closure	After successful implementation of CAP and cleanup objectives achieved	<i>Remediation Program Guide, Section 3.10</i>

A.7. Quality Objectives and Criteria

A.7.1. Data Quality Objectives (DQOs)

DQOs are qualitative and quantitative statements that clarify the study objective and define the appropriate type of data to collect. The DQO process results in the full set of specifications needed to support the qualitative and quantitative design of a data collection effort. DQOs are also used to assess the adequacy of data in relation to their intended use.

The seven steps to the DQO Process and the approach to each step for IDEM's UST Program are described below.

State the Problem

A release or suspected release from a regulated UST has been identified.

Identify the Decision

There are five main decision statements to consider:

- Decision Statement I - *A release of petroleum or hazardous substance potential contaminants from an UST system has been confirmed.*
- Decision Statement II – *The release presents an immediate threat to human health or the environment (e.g., fire, explosion, chemical burns, and vapor hazards) and requires accelerated response activities. Sites that present an immediate health or environmental threat will undergo additional accelerated response requirements.*
- Decision Statement III – *The areal extent of the release above the screening levels has been delineated and lists of potential exposure pathways and potential exposure scenarios are identified.*
- Decision Statement IV – *The site contamination requires active remediation and/or the use of engineering or institutional controls.*
- Decision Statement V – *The remedial actions were performed, meet remedial objectives, and eliminate or limit exposure to potential contaminants.*

Identify the Inputs to the Decision

Groundwater and soil samples will be collected and analyzed to assess and document releases to the site media. In addition, potential exposure pathways are evaluated, and sensitive areas (e.g., surface water and well head protection areas) are identified and may be sampled. Concentrations of detected contamination in soil and groundwater will be compared to the screening levels (Sections 1.3.1, 1.3.2, and Appendix A of the [Remediation Closure Guide](#)). The screening levels are risk-based numerical values for each contaminant based on chemical characteristics, media concentration, toxicity, and exposure pathway.

If site conditions warrant, evaluation of soil gas or indoor air samples may be necessary to evaluate the risk due to vapor intrusion. Soil gas and/or indoor air samples are compared to criteria in Table A-6 of the *Remediation Closure Guide*.

Define the Study Boundaries

The spatial and temporal boundaries of each site may vary. Samples may be collected on-site or off-site as necessary to determine the nature and extent of contamination.

IDEM follows U.S. EPA in recommending eight to ten or more samples for determining a background threshold value (Appendix A, #14). In some cases, more than ten samples may be necessary to support a background demonstration,

depending on methodology and site characteristics. Investigators should document that the number of samples is adequate to support the selected method. Because the data evaluation process sometimes reduces the size of the set of background samples, it may be prudent to collect extra samples during the initial sampling effort.

Representative background samples should come from equivalent stratigraphic positions in background reference areas comparable to the site. Suitable areas are (1) free of the influence of nearby sources of the contaminants under investigation and (2) underlain by the same soil layers as the source area.

Develop a Decision Rule (Develop the Analytic Approach)

Decision Rules are "if/then" statements that determine how a project will proceed by evaluating the data. Once data have been verified and validated according to Section 3.9 of the Remediation Closure Guide (Appendix A, #2), all useable data are evaluated to ensure that they meet the investigative criteria. Examples of decision rules are:

- Decision Rule I (Section 3.4 of the Remediation Program Guide, Appendix A, #3) – If a suspected or confirmed release of one or more potential contaminants has occurred, then an incident number is generated and additional assessment is necessary. A release of regulated substance from the UST system is confirmed when the UST owner/operator or an IDEM representative as part of 329 IAC 9-3-4 *Release investigations and confirmations steps*, or during 329 IAC 9-6-2.5 *UST Closure procedures*, observes detections of contaminants in lab analytical, or determines via olfactory confirmation, visual staining, field screening, or observes unusual operating conditions that may include the sudden loss of product, or failed line or tightness testing. If the release is confirmed, the owner/operator must conduct an *Initial Site Investigation* per 329 IAC 9-5-5.1.

If information submitted by the owner/operator supports the conclusion that no release of a regulated substances has occurred from the UST system, the details of the suspected, but not confirmed, release will be documented in the ULCERS or other relevant database and IDEM's Virtual File Cabinet. If the incident is determined to not have been a release, the incident number will be deactivated.

- Decision Rule II (Section 3.5 of the Remediation Program Guide, Appendix A, #3) – If the release causes an immediate threat to human health or the environment, then the appropriate response(s) to mitigate the threat must be initiated. Depending on the situation, the appropriate responses may include vapor mitigation, free product abatement/removal, control of emergency conditions (e.g., explosion hazards). Emergency abatement requirements are outlined in 329 IAC 9-5-3.2 *Initial abatement and site check*.

If there is no immediate threat to human health or the environment, then the determination of nature and extent of contamination should proceed per 329 IAC 9-5-5.1.

- Decision Rule III (Section 3.7 of the Remediation Program Guide, Appendix A, #3) – If the areal extent of the released regulated substance has not been delineated to the media specific IDEM screening levels outlined in table A-6 of the RCG (Appendix A, #2), then conduct additional investigations as necessary to delineate the site and to assess pathways and receptor effects. If the extent of contamination has been determined and the conceptual site model (see the Remediation Closure Guide (Appendix A, #2)) has been developed, then the appropriate remedial action may be selected.

- Decision Rule IV (Section 3.8 of the Remediation Program Guide, Appendix A, #3) – If corrective action is necessary based on the conceptual site model, the owner/operator must submit a Corrective Action Plan to IDEM. If corrective action is not necessary, the site would proceed to Decision Rule V. The owner/operator should use published resources when evaluating remediation alternatives (Appendix A, #29 & #30).
- Decision Rule V (Section 3.10 of the Remediation Program Guide, Appendix A, #3) – If the conceptual site model can be satisfactorily addressed with an appropriate closure strategy, the site will be eligible for No Further Action. The closure strategy must adequately demonstrate that the remedy (when required, which may include institutional controls) and site conditions adequately control current and future risk to human health and the environment due to a release of contamination.

Optimize the Design for Obtaining Data

Expected spatial, sampling, and analytical variations are key inputs to designing sampling schemes for judgmental sampling.

Spatial and sampling variations have been considered in the UST Program sampling design, with the result that soil sample evaluation is conducted by calculating exposure point concentrations (EPCs). For more details, refer to Section 8.4 of the Remediation Closure Guide.

A.7.2. Measurement Quality Objectives (MQOs)

Measurement quality objectives (MQOs) are "acceptance criteria" for the quality attributes measured by project data quality indicators (DQIs). (Please see section B.5) The principal DQIs are precision, accuracy (as bias), representativeness, comparability, completeness, and sensitivity (PARCCS). Data Quality Indicator (DQI) criteria apply not only to the laboratory, but also to the field sampling measurements.

The overall QA objective for the UST Program is to develop and implement procedures for sampling, contaminant selection, laboratory analysis, and reporting. The following sections provide a brief description of each performance indicator selected for the sampling measurement systems. Tables 2 and 3 provide MQO and DQI elements for project field and analytical control standards.

Precision

Precision, usually expressed as a relative percent difference (RPD), is the degree of agreement among repeated measurements of the same characteristic (analyte, parameter, etc.) under the same or similar conditions. Precision data indicate how consistent and reproducible the field sampling or analytical procedures have been. Comparing field and laboratory precision will help to identify sources of imprecision if a problem exists. Poor precision may result from field instrument variation, analytical measurement variation, poor or inappropriate sampling technique, sample transport problems, and/or heterogeneous matrices.

Accuracy (as Bias)

Accuracy usually expressed as a percent recovery (% R), is the extent of agreement between an observed value (sample results) and the accepted, or true, value of the parameter being measured. Analyte accuracy can be evaluated using different types of QC samples, such as a Standard Reference Material (SRM) or Laboratory Control Sample (LCS). Because environmental samples contain interferences (i.e., other compounds that may interfere with the analysis of specific analytes), the accuracy for a specific analyte should be evaluated in relation to the sample matrix. This is done

by analyzing matrix spike/matrix spike duplicate (MS/MSD) samples and computing the percent recovery.

Accuracy can be impacted by field sample collection and transport contamination, or by contamination introduced at the time of sample preparation and/or analysis. Sample contamination may result in either negative or positive bias. For example, metals may adsorb on plastic sampling materials. This would result in lower metal concentrations being reported than are actually present in the collected sample (i.e., negative bias).

Representativeness

Representativeness is a qualitative term that describes the extent to which a sampling design adequately reflects the environmental conditions of the site. Representativeness 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 reflects the conditions at the site. If field duplicate or co-located precision checks indicate potential spatial variability, then this may trigger additional coordination with IDEM and subsequent resampling in order to collect data that is more representative of a non-homogeneous site.

Completeness

Completeness is a measure of the amount of valid data collected using a measurement system. The percent of completeness is the total number of samples for which acceptable analytical data are generated divided by the total number of samples analyzed and multiplied by one hundred (100). A lack of data completeness may require additional sampling.

Sensitivity

Sensitivity is the capability of a method or instrument to discriminate between measurement responses representing different levels of a variable of interest. Sensitivity is determined from the value of the standard deviation at the concentration level (method detection level) of interest. It represents the minimum difference in concentration that can be distinguished between two samples with a high degree of confidence.

Comparability

Comparability is an expression of the confidence with which one set of data can be compared to another as a qualitative measurement. It is a careful identification that two data sets may be equivalent in the measurement of a parameter or set of parameters. It is dependent upon proper sampling design and may be satisfied by ensuring that the field sampling plan is followed, that proper sampling techniques are utilized, that proper analytical methods are established, and proper quality assurance objectives are used and documented.

For long term monitoring projects such as plume stability assessments, data comparability is extremely important. Project data will be compared to previously generated data to determine the possibility of misidentification, poor recoveries, matrix interferences, comparative data abnormalities, or irregularities.

The following tables provide a general program list of MQO and DQI elements for project field and analytical control standards. Site-specific criteria may be modified.

Table 2. Quality Assurance/Quality Control – Soil (SW 846)

QC Sample	Frequency/ Number	Data Quality Indicator (DQI)	Measurement Quality Objective (MQO)	Conclusion
Equipment Blank	1 per sample location when non-disposable sampling equipment used	Effectiveness of field decontamination procedures	All analytes < Reporting Limit	All affected data considered biased (High or Unknown) due to possible cross-contamination. Field decontamination procedures should be reviewed.
Field Duplicate	1 per 20 samples	Effectiveness of field sampling procedures	< 40% Relative Percent Difference (RPD)	All affected data considered biased (High, Low, or Unknown) due to sampling error. Sample collection procedures should be reviewed.
Laboratory Control Sample (LCS)	Per Method and/or Laboratory SOP	Evaluation of laboratory and instrument capability	% Recovery and % RPD as per Method or Laboratory SOP	All affected data considered biased (High, Low, or Unknown) due to laboratory or instrument error.
Internal Std (IS)	Per Method and/or Laboratory SOP	Evaluation of laboratory analysis procedures	% Recovery and Method or Laboratory SOP	All affected data considered estimated (High, Low, or Unknown) due to cross-contamination during transport or storage
Matrix Spike/ Matrix Spike Duplicate (MS/MSD)	1 per 20 samples	Evaluation of matrix interferences	< 40% RPD, % Recovery as per Method or Laboratory SOP	All affected data considered biased (High, Low, or Unknown) due to Matrix Interference.
Method Blank(MB)	Per Method and/or Laboratory SOP	Evaluation of laboratory and instrument conditions	All analytes < Reporting Limit	All affected data considered biased (High or Unknown) due to laboratory or instrument cross-contamination.
Surrogate Spike(SS)	Per Method and/or Laboratory SOP	Evaluation of instrument capability	% Recovery and % RPD as per Method or Laboratory SOP	All affected data considered biased (High, Low, or Unknown) due to laboratory or instrument error.

Table 3 Quality Assurance/Quality Control – Groundwater (SW 846)

QC Sample	Frequency/ Number	Data Quality Indicator (DQI)	Measurement Quality Objective (MQO)	Corrective Action if Out of Control
Equipment Blank	1 per sample location when non-disposable sampling equipment used	Effectiveness of field decontamination procedures	All analytes < Reporting Limit	All affected data considered biased (High or Unknown) due to possible cross-contamination. Field decontamination procedures should be reviewed.
Field Duplicate	1 per 20 samples	Effectiveness of field sampling procedures	< 20% RPD	All affected data considered biased (High, Low, or Unknown) due to sampling error. Sample collection procedures should be reviewed.
Laboratory Control Sample (LCS)	Per Method and/or Laboratory SOP	Evaluation of laboratory and instrument capability	% Recovery and % RPD as per Method or Laboratory SOP	All affected data considered biased (High, Low, or Unknown) due to laboratory or instrument error.
Internal Std(IS)	Per Method and/or Laboratory SOP	Evaluation of laboratory analysis procedures	% Recovery and Method or Laboratory SOP	All affected data considered estimated (High, Low, or Unknown) due to cross-contamination during transport or storage
Matrix Spike/ Matrix Spike Duplicate (MS/MSD)	1 per 20 samples	Evaluation of matrix interferences	< 20% RPD, % Recovery as per Method or Laboratory SOP	All affected data considered biased (High, Low, or Unknown) due to Matrix Interference.
Method Blank(MB)	Per Method and/or Laboratory SOP	Evaluation of laboratory and instrument conditions	All analytes < Reporting Limit	All affected data considered biased (High or Unknown) due to laboratory or instrument cross-contamination.
Surrogate Spike(SS)	Per Method and/or Laboratory SOP	Evaluation of instrument capability	% Recovery and % RPD as per Method or Laboratory SOP	All affected data considered estimated (High, Low, or Unknown) due to laboratory or instrument error.
Trip Blank	1 per 20 samples	Evaluation of sample integrity during transport and storage	All analytes < Reporting Limit	All affected data considered estimated (High, Low, or Unknown) due to cross-contamination during transport or storage.

A.8. Special Training/Certification

A.8.1. Owner/Operator Consultant Training/Certification

Consultants are responsible for ensuring that their staff are adequately educated and trained in safety, sampling protocols, LUST QAPP, and other IDEM program guidance. In addition, the following training/certifications are mandatory:

- UST closure contractors must be certified by the Division of Fire and Building Safety of the Indiana Department of Homeland Security to perform UST upgrades, repairs, removals, change-in-service, and closures;
- Health and safety plans for field work should be prepared, and should include a list of personnel training, qualifications, and certifications;
- All reports of release investigations must be signed by one of the following environmental professionals.
 - 1) Registered Professional Engineer licensed by the State of Indiana;
 - 2) Indiana Licensed Professional Geologist;
 - 3) Certified Hazardous Materials Manager;
 - 4) Indiana Registered Soil Scientist.

A.8.2. IDEM Staff Training/Certification

The Section Chiefs provide new staff with in-house training on UST issues, federal regulations, state regulations, technical guidance, and records management. UST program staff receive intensive office and field training through document review as well as office and field mentoring on program specific practices, procedures, policies and laws. All IDEM staff that conduct field work must have successfully completed:

- Initial 24 or 40-Hour OSHA Safety Training
- Annual 8-Hour OSHA Safety Training Updates

Technical staff must have completed specific educational and experience requirements in the pertinent field (e.g., environmental chemistry, geology/hydrogeology, engineering), to qualify for hiring.

A.9. Documents and Records

A.9.1. IDEM *Investigation of UST Releases QAPP*

The most current, approved version of this QAPP will be available in two places to accommodate both IDEM staff and owner/operators and their consultants: 1) The IDEM Quality Management System Library, available to staff on the IDEM SharePoint Site for the UST Branch; and 2) The [Leaking UST Program Website](#).

A.9.2. UST Program Deliverables - Information Submitted by Owner/Operator Consultants

UST Releases Reporting Requirements

A list of the tasks requiring reports is included in Table 1. These reports include:

- Abatement/Free Product Recovery Reports
- Underground Storage Tank Closure Report

- Release Investigation and Confirmation
- Initial Site Characterization
- Further Site Investigation
- Corrective Action Plan
- Corrective Action Plan Implementation Report
- Corrective Action Plan Progress Report
- LUST Quarterly Monitoring
- No Further Action Request

UST Releases QA/QC Documentation

329 IAC 9 requires the owner/operator of a UST submit required documentation in a technically adequate manner. The rule discusses sampling information, laboratory procedures, and documentation requirements. (*Remediation Closure Guide*, Section 3.9.1)

UST Releases Reporting Formats

Electronic Report and Data Submittal Guidelines are available at the IDEM website at <http://www.in.gov/idem/landquality/2369.htm>

A.9.3. UST Program Deliverables – IDEM Sampling Events

In the event IDEM project manager staff are engaged in sampling activities and/or utilize IDEM Contract Laboratories, the following types of records may be generated, depending on the goal of the sampling. These records will become part of the site project file.

Field Collection Records. These records document sampling protocol in the field.

The records may include:

- *Field Log Book/Sheets.* The field log book or field sheets will document personnel present, time spent, weather conditions, other information collected during a site investigation. The field log book should include information recorded on the sample containers, a description of the sample, when the sample was sealed and preserved, equipment used, field measurements, calibration and maintenance checks for instruments used, decontamination procedures, and deviations from the standard UST release sampling design.
- *Chain of custody records.* For IDEM OLQ contract lab sampling, refer to the IDEM SOP *Chemistry Services Section Field Documentation Requirements* (Appendix A, #16) for more details.
- *Site Map.* The site map will document sampling locations and sample numbers, locations of access, surface features, buildings and other points of interest.
- *Geographic Positioning System (GPS) coordinate data.* IDEM guidance encourages that all data gathering activities conducted by the agency be undertaken utilizing GPS techniques found on the Spatial Data Collection Standards [website](http://www.in.gov/idem/6839.htm) (<http://www.in.gov/idem/6839.htm>).

Sample Management Records and Raw Data. IDEM may request additional laboratory documents when anomalies are identified, or if they are necessary to complete the case narrative, e.g., enforcement cases. OLQ contract laboratories shall keep all raw data for at least five (5) years. The laboratory will discard the samples in accordance with applicable State contract requirements.

QC Sample Records. These records document the generation of QC samples, such as field, trip, and equipment rinsate blanks and duplicate samples. They also include

documentation of sample integrity and preservation; and documentation of calibration. Quality control sample records should contain information on the frequency, conditions, level of standards, and instrument calibration history.

Chemistry Verification and Validation Memorandum. This memorandum is prepared in accordance with the IDEM SOP *Chemistry Services Data Verification and Validation*. (Appendix A, #18)

A.9.4. Data Reporting Package Archiving and Retrieval

IDEM utilizes an in-house electronic filing system, the Virtual File Cabinet, (VFC) for archive of program records. The public interface for this system can be found at [IDEM Virtual File Cabinet](#).

B. Data Generation and Acquisition

B.1. Sampling Process Design

B.1.1. Rationale for the Design and Design Assumptions

In the UST Program, samples are typically collected from subsurface soil and groundwater media. Depending on the site-specific characteristics, they may also be collected from surface soil (spills or overfills) and surface water. In addition, soil gas and/or indoor air samples may be collected to assess the vapor intrusion exposure pathway.

IDEM's risk based sampling design is based upon the goal of locating sample points at areas most likely to be impacted by a release from a UST system. Therefore, the design initially includes sampling at the UST pit area, piping runs, and dispenser islands. IDEM does allow flexibility in the selection of sampling points if appropriate justification is provided to the agency from the consultant performing the work (for instance, if the sampling point location is inaccessible).

The contaminants of concern (COCs) to be included in the analytical suite for petroleum USTs are in four main groups: gasoline, diesel, hydrocarbon oils, and waste oil. Additional information is available on Table 3.1 of the *Remediation Program Guide*.

B.1.2. Procedures for Locating and Selecting Environmental Samples

The *Remediation Closure Guide* and section 3 of the *Remediation Program Guide* describe the sample location procedures for this program. A judgmental sampling approach, entitled the 'Step-Out' procedure is utilized.

Field screening instrumentation such as photoionization detectors (PIDs) or flame-ionization detectors (FIDs) should be used (as applicable for the relevant contaminants) to assist in the selection of soil samples to be submitted for laboratory analysis.

For IDEM staff directly involved with the collection of samples, field screening equipment standard operating procedures (SOPs) (Appendix A, #19 and #20) are available and should be utilized for select equipment. In addition, equipment user's guides are available for staff to review prior to utilization of equipment. In addition, sample collection SOPs should be followed.

B.1.3. Validation of Nonstandard Sampling/Measurement Methods

IDEM Project Management staff must approve all nonstandard sampling or measurement methods in advance. IDEM may request additional data be collected if nonstandard sampling or measurement methods are utilized without prior approval.

B.2. Sampling Methods

B.2.1. Owner/Operator Consultant Sampling Events

Sampling for UST release sites shall be conducted in accordance with IDEM program guidelines, the LUST QAPP, and state laws 329 IAC 9 (Appendix A, #13). IDEM strongly encourages all consultant firms to utilize their own SOPs, including sample collection procedures; use, maintenance, and calibration of field equipment; decontamination of equipment; and disposal of investigative derived waste.

UST Program reports shall include a description of the sample and data collection procedures followed. IDEM recognizes that deviations to procedures may occur from time to time due to site-specific conditions or due to problems that may occur such as equipment failure. The owner/operator consultant should have backup plans in the event that problems such as equipment failure or a need for additional supplies might arise. All deviations and corrective actions will be thoroughly documented.

B.2.2. IDEM Sampling Events

If IDEM staff conduct sampling events, sample/data collection procedures will be in accordance with IDEM sample collection SOPs (Appendix A, #19 and #20). IDEM staff may utilize field equipment available for check-out through the OLQ Supply Manager. IDEM staff conducting sampling are required to work under a site-specific Health and Safety Plan approved by the OLQ Site Safety Officer.

B.3. Sample Handling and Custody

Proper sample handling and custody procedures found in Section 3.1 of the Remediation Closure Guide (Appendix A, #2) are crucial to ensuring the quality and validity of data obtained through field and laboratory analysis. The admissibility of environmental data as evidence in a court of law is dependent on the custody of the data. The possession and handling of samples should be documented from the time of collection to delivery to the laboratory. A sample is considered in custody if it is:

- In a person's possession;
- In view of the person after being in their possession;
- Sealed in a manner such that it cannot be tampered with after having been in physical possession; or
- In a secure area restricted to authorized personnel.

B.3.1. Owner/Operator Consultant Sampling Events

All site reports submitted by owner/operator consultants will be reviewed and the following elements assessed for appropriate sample handling (Appendix A, #27):

- Preservatives;
- Cooler temperature (must be 4 ± 2 °C);
- Holding times;
- Designation of persons responsible for maintaining field notebooks, sample custody, and sample receipt by the laboratory;
- Project sample tracking system including a unique project numbering system;
- Chain of custody information that includes at a minimum: date and time of collection; number of each type of sample; matrix type; method of preservation; type of analysis; turnaround time; sampler name; and sampler's signature.

All sample containers should be labeled in waterproof ink at the time of sample collection but prior to being filled. Each label will indicate at a minimum:

- Sample identification;
- Date/time of sample collection;
- Sampler's initials;
- Required analyses;
- Type of preservative.

The owner/operator consultant is responsible for ensuring that samples are packaged and transported in a manner that maintains the integrity of the sample and permits the analysis to be performed within the prescribed holding time. Samples may be shipped by courier or overnight mail to the laboratory. IDEM recommends the use of bubble-wrap packing materials and ice stored in resealable plastic bags. The cooler should be taped closed using custody seals.

B.3.2. IDEM Sampling Events

Occasionally, IDEM personnel conduct sampling and utilize analytical services by IDEM OLQ contract labs. IDEM staff who conduct field sampling must follow the IDEM *Chemistry Services Contract Laboratory Sample Set-up* work summary (Appendix 1, #15, completing the sample request sheet and submitting it to the OLQ chemistry section.

IDEM staff shall perform field sampling record collection in accordance with the IDEM SOP *Chemistry Services Section Field Documentation Requirements (Appendix A, #16)*. This SOP includes site information sheets, sample field sheets, and chain of custody forms to be completed by the IDEM project manager or lead sampler.

- The sampler will provide each sample with a unique OLQ number;
- The PM will retain one copy of the chain of custody documentation and the laboratory will retain a second copy;
- The laboratory will return the original chain of custody to IDEM along with the laboratory deliverables (data package).

B.3.3. Laboratory Custody

For both owner/operator consultant and IDEM sampling events, the laboratory utilized must sign the chain of custody when the samples are received. The laboratory verifies that all samples are accounted for and are not broken. The laboratory must store the samples in a secure refrigerated area that maintains the temperature at 4 ± 2 °C and is responsible for disposal of samples. The laboratory must submit a cooler inspection report (or equivalent) along with the laboratory report.

B.4. Analytical Methods

B.4.1. Description of Analytical Methods to be Used

The selection of potential contaminants to be evaluated depends on the type of petroleum or, in rare instances, hazardous substances stored in the UST system. The typical petroleum categories, the standard target contaminants, and analytical methods for each group are listed in Section 3 (Table 3.1) of the Remediation Program Guide. In addition, the *Supplemental Guidance for Sampling Soil and Waste Samples for VOCs* technical guidance document (Appendix A, #21) should be consulted for all sites with VOC analysis requirements.

Potential Petroleum Contaminants¹

Petroleum Product or Waste	Soil	Ground Water	Air/ Soil Gas	Typical Products/Wastes
Gasoline Range Product	VOCs ² Naphthalenes ³ Lead and Lead Scavengers ⁴	VOCs ² Naphthalenes ³ Lead and Lead Scavengers ⁴	VOCs ⁵	Automotive Gas Aviation Gas Racing Fuel Mineral Spirits Stoddard Solvent Naphtha Jet Fuel - JP-4 Ethanol fuels
Diesel Range Product	VOCs ² PAHs ⁶	VOCs ² PAHs ⁶	VOCs ⁵	Diesel #1 & 2 Kerosene Jet Fuel-JP #5, 7 & 8 Light Oil Home Heating Oil Biodiesel <100%
Hydrocarbon Oils Range Product	PAHs ⁶	PAHs ⁶	None	#4, 5, & 6 Fuel Oil Bunker C Mineral Oil Virgin Motor Oil Hydraulic Oil
Waste/Used Oil and Unknown Products and Wastes	VOCs ² PAHs ⁶ Lead and Lead Scavengers ⁴	VOCs ² PAHs ⁶ Lead and Lead Scavengers ⁴	VOCs ⁵	Waste/Used Oil Unknown refined petroleum product or waste

¹ Scope and general guidance – This table is intended for use when investigating refined petroleum releases at regulated UST sites. Consult the IDEM Project manager regarding: 1) laboratory methods based on site-specific needs and cost effectiveness; 2) modification of contaminant reporting once the site characterization is completed; 3) potential petroleum contaminants for products not listed in this table; and 4) additional reporting based on site-specific information.

² VOC Methods - During site characterization use SW846 Method 8260B and report all VOCs and naphthalenes. SW846 Method 8021 may be more cost effective during Corrective Action Plan (CAP) Implementation and closure monitoring and should be considered when seeking reimbursement from the Excess Liability Trust Fund (ETLF). Identify which methods are proposed in the CAP.

³ Naphthalenes – Report naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene.

⁴ Lead and Lead Scavenger Methods – Report total lead and lead scavengers when investigating aviation gas and racing fuel, and when automotive gas was used or stored before January 1, 1996. Lead scavengers include EDB (ethylene dibromide or 1,2-dibromoethane) and 1,2-DCA (1,2-dichloroethane). Use EPA Methods with appropriate detection limits. Ground water samples for lead analysis should be unfiltered.

⁵ Air VOC Method – Report all VOCs. Use Method TO-15 for VOC.

⁶ PAHs Methods – Report all PAHs. Use SW846 Method 8270 SIM, 8310 or other appropriate method for PAHs.

Potential Petroleum Contaminants

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Owner/operator consultants should familiarize themselves with *Remediation Closure Guide* screening levels (Sections 1.3.1, 1.3.2, and Appendix A of the Remediation Closure Guide) in order to select the analytical method with an appropriate detection or quantitation limit. Owner/operator consultants must obtain approval from the IDEM

PM for any deviations or modifications to analytical methods prior to sample collection. For any nonstandard methods, the owner/operator consultant will provide method validation information such as determination of detection limits, quantitation limits, typical recoveries, analytical precision, bias, and other applicable criteria.

B.4.2. Laboratory Turnaround Times

Owner/operator consultants are responsible for ensuring samples are analyzed within their recommended holding time.

For IDEM contract laboratories, laboratory turnaround times are set out in the Technical Specifications for Analytical Services (Appendix A, #21). IDEM staff may request project-specific laboratory turnaround times when the sampling request is submitted on the "Sample Request Sheet". A copy of this form is included as an appendix to the IDEM work summary, *Chemistry Services Section Contract Services Sample Set-Up*. (Appendix A, #15)

B.5. Quality Control

B.5.1. Quality Control (QC) Activities for Sampling, Analytical or Measurement Techniques

Refer to Section 3.9 of the Remediation Closure Guide for details regarding required QC. IDEM requires the collection of QA/QC data throughout different stages of the site characterization, corrective action, and closure process.

B.5.2. Control Limits and Corrective Actions

The difference between the reported and actual concentrations of a sample is a function of both sampling or field error and analytical error. Sampling or field error is assessed with field QC samples. The magnitude of analytical error may be assessed by evaluating the laboratory quality control samples.

The IDEM PM, with input from OLQ chemists, will determine the usability of data. In some cases, data of poor quality may necessitate the collection of new or additional samples.

IDEM OLQ contract lab control criteria are identified in the IDEM OLQ lab contract (Appendix A, #21). The laboratory QC measures and their results must be documented and should be submitted as supporting documentation along with the analytical report of sample results.

Accuracy

Accuracy is used to determine systematic or random error of results. The accuracy objectives for quantitative analyses are expressed in part in terms of recovery of surrogate compounds (organic compounds) or recovery of spike analyses (inorganic analyses). For all analytes, the accuracy should be within the recovery ranges listed in the referenced DQO analytical method. Recovery outside these criteria will be flagged by OLQ Chemistry Section personnel in their technical review memoranda submitted to the PM.

Precision

Field precision will be assessed through the collection and analysis of field duplicate samples. Groundwater matrix samples can be readily duplicated due to their homogenous nature; conversely, the duplication of soil samples is much more difficult due to their non-homogenous nature. Due to this discrepancy by media type, maximum RPDs of 20% for groundwater samples and 40% for soil sample field

duplicates will be used as advisory limits for analytes detected at concentrations greater than or equal to five times the quantitation limit.

Laboratory precision will be based upon laboratory matrix spike/matrix spike duplicate (MS/MSD) analyses. The criteria for precision are specific to the parameter being measured.

Completeness

For this program the desired goal is at least 90% of samples should yield valid data. If completeness falls below 90%, it shall be noted by chemists in their review memoranda submitted to the PM.

B.6. Instrument/Equipment Testing, Inspection, and Maintenance

B.6.1. Owner/Operator Consultant

The Owner/Operator Consultant is responsible for ensuring that equipment is tested, inspected, calibrated, and maintained. IDEM expects that owner/operator consultants have documented standard operating procedures (SOPs) for maintenance and calibration of field and laboratory equipment, although copies of SOPs are not routinely requested as submittals. In the event that questions arise during data evaluation, IDEM reserves the right to request full QA/QC documentation from the sampling event and the laboratory utilized. Faulty sampling protocols or findings of inappropriate use of field equipment may result in requests for corrective action, including the possibility of resampling.

B.6.2. IDEM Sampling Event/OLQ Contract Laboratories

In the event that IDEM conducts field sampling support or utilizes OLQ contract laboratory services, the following testing, inspection, and maintenance requirements apply:

- IDEM measuring and testing equipment will be maintained in accordance with manufacturers' specifications
- The Project Manager or other assigned field staff are responsible for ensuring applicable materials and equipment needed for the sampling event are available through coordination with the Office of Land Quality Supply Manager.
- For IDEM Contract Laboratory equipment, the laboratory QA manager will be responsible for ensuring that the laboratory's data precision and accuracy are maintained in accordance with specifications (Appendix A, #27). Laboratory equipment will be as specified in the laboratory contract.

B.7. Instrument/Equipment Calibration and Frequency

Instruments used to gather, generate, or measure environmental data will be calibrated in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. Trained personnel will operate and calibrate field measurement equipment in accordance with manufacturer's specifications.

Field Equipment

Field personnel are responsible for the calibration of field equipment, such as PIDs and FIDs. The following UST Program Reports require calibration data:

- *UST Closure Report*
- *ISC Report*
- *Further Site Investigation*

When equipment that is owned and maintained by IDEM is to be used in the field, the IDEM PM will ensure that it is properly calibrated.

Laboratory Equipment, Including Mobile Laboratories

Equipment will be calibrated using reference standards having known relationships to nationally recognized standards or accepted values of physical constants. Laboratory calibration records will be maintained by the laboratory QA officer.

B.8. Inspection/Acceptance of Supplies and Consumables

The Owner/Operator consultant is responsible for the inspection and acceptance of supplies utilized for investigative purposes.

When field activities are performed by IDEM personnel, the PM is responsible for ensuring that proper supplies are available. The laboratory QA Officer will be responsible for ensuring that proper supplies are on hand for laboratory activities.

B.9. Non-direct Measurements

Data from secondary sources, such as: computer modeling, DNR Well logs, topographic map, and sewer maps, must be reviewed and approved by IDEM Science Services Branch technical evaluation staff. Consultants are encouraged to contact the IDEM PM for approval prior to utilizing non-direct measurement methods.

B.10. Data Management

B.10.1. Data Recording

Laboratory Data

When environmental sampling is part of a required report, the report shall present all sample results, including all QA/QC samples. Laboratory data is to be recorded and submitted in accordance with Table 3-A of the *Remediation Closure Guide*. IDEM OLQ contract lab data will be maintained and submitted in compliance with the IDEM OLQ lab contract (Appendix A, #27).

Field Data

Owner/operator consultant field staff will record data such as groundwater elevation data, calibration data, field screening readings, and pilot test results on field forms or in field logbooks. All field records should be signed by the person who performed the analysis or collected the data.

As appropriate, the owner/operator consultant may need to transfer raw data to computer databases or spreadsheets (e.g., field screening equipment with data download capabilities).

When IDEM staff collect field data, IDEM staff will use field logbooks and the "Site Information and Sample Field Sheet" provided in the IDEM SOP *Chemistry Services Section Field Documentation* to record data requirements (Appendix A, #16).

B.10.2. Data Transformation/Data Reduction

Data transformation is conversion of individual data point values into related values or possible symbols using conversion formulas. Data resulting from the analyses of samples should be reduced according to protocols described in the laboratory procedures. This information may include: weight or volume of sample used, percent dry weight for solids, extract volume, dilution factor used, and background-correction protocols followed. For soil samples, IDEM requests that results be reported on a dry weight basis. Please see IDEM Office of Land Quality Chemistry Services [Website](http://www.in.gov/idem/landquality/2333.htm) (<http://www.in.gov/idem/landquality/2333.htm>).

B.10.3. Data Transmittal/Transfer

Data transmittal occurs when data are transferred from one person or location to another or when data are copied from one form to another. The current guidance for program documentation submittals may be found on IDEM's [Office of Land Quality Document Submittal Guidelines website](http://www.in.gov/idem/landquality/2368.htm) (<http://www.in.gov/idem/landquality/2368.htm>).

B.10.4. Data Assessment

The QA review consists of internal and external assessments to ensure that QA/QC procedures are in use and to ensure that laboratory staff conform to these procedures. As documented in the IDEM SOP *Chemistry Services Section Data Verification and Validation (Appendix A, #18)*, the chemist also reviews field records for compliance with IDEM and/or U.S. EPA guidance. (EPA Data Quality Assessment: A Reviewer's Guide (QA/G9R) (Appendix A, #28)

B.10.5. Data Storage and Retrieval

Records provide the direct evidence and support for the necessary technical interpretations, judgments, and discussions concerning project activities. These records, particularly those that are anticipated to be used as evidentiary data, must directly support technical studies and activities, and provide the historical evidence needed for later reviews and analyses. Records should be legible, identifiable and retrievable, and protected against damage, deterioration, unauthorized modification or loss.

Project related documents (release reports, investigation reports, corrective action plans, quarterly monitoring reports, etc.) that are submitted to or generated by IDEM will be indexed and imported or scanned into IDEM's electronic image storage system, entitled the Virtual File Cabinet (VFC). Documents will be archived in accordance with the applicable retention schedule.

B.10.6. Data Security

All data and analytical reports, including QA/QC results, will become part of the project file record and will be retained in the VFC in accordance with the applicable retention schedule (See page 43 of the IDEM QMP, Appendix A, #4).

C. Assessment and Oversight

C.1. Assessments and Response Actions

Assessment of the Program

External Assessments:

- *Semiannual Performance Measures Report*. The UST and LUST Section responsibilities are documented in a cooperative agreement with the U.S. EPA, which provides partial funding for the program through federal funds. The UST and LUST Sections develop an annual work plan, and progress is traced by reporting to the U.S. EPA via the web based "LUST4" database (<https://SSoprod.epa.gov/sso/jsp/oblogin.jsp>). Data is later summarized by U.S. EPA and documented in the Semiannual Performance Measures Report (<http://www.epa.gov/OUST/cat/camarchv.htm>)
- *U.S. EPA Management System Reviews (MSRs)*. On an agency level, IDEM plans on inputs from U.S. EPA-lead MSRs to be a key quality system assessment tool.

Internal Assessments:

- *IDEM Quality System Audits.* The IDEM Quality Managers will perform agencywide quality system audits of each IDEM branch at least once every five years. These audits focus on both agency-wide and branch level quality system components. Details on IDEM quality system audits may be referenced in paragraph 9.1.1 in the *IDEM Agency Wide Quality Management Plan (Appendix A, #4)*. Personnel involved in assessment of the UST Branch quality system include the IDEM quality managers, UST Branch management, members of the OLQ quality team, the Science Service Branch QA Coordinator, and technical personnel (e.g., chemists, geologists, risk assessors). Assessments by non-UST Branch staff such as the IDEM quality managers and by Science Services Branch personnel ensure independence.
- *Periodic Internal Reviews.* From time to time, staff or managers identify strengths or shortcomings of the quality system. Recommendations should be sent to QA staff or supervisors for potential revision. The need for updates to program planning documents, technical guidance and SOPs may be dictated by periodic QA document (QAPP or SOP) review as well as rule changes, technology changes, extramural agreements, or changes in internal practices.
- *Performance Evaluations.* Technical knowledge of all personnel is evaluated annually as a component of individual performance appraisals, and may be addressed at any time if problems arise. Further information about the types of training available for staff may be referenced in the *IDEM Agencywide Quality Management Plan*.

Assessments of Contractors/Grantees:

- *IDEM Contract Laboratory Audits.* During the contract procurement phase, responding laboratory quality system assessments are conducted. The Science Services Branch QA Coordinator reviews Quality Management Plans (QMP), SOPs, internal QA and QC requirements, control charts, performance evaluation samples, and other technical documents. A lab management system review is then conducted at qualifying laboratories. Mid-contract audits may also be performed for various reasons; for example, if a contract laboratory moves or undergoes a merger or reorganization.

Assessment of Individual Project Activities

Surveillance. The PM is responsible for monitoring the status of a project and reviewing records and reports, ensuring that they meet the requirements of the project. The deficiency and any corrective action shall be noted in writing and a follow-up audit may be completed if deemed necessary by the PM.

Peer Review – Project Managers. Project manager work products (e.g., reports, memoranda, and correspondence) are subject to review by other PMs, senior environmental managers, or section chiefs. Depending on the nature of the document, the branch chief, assistant commissioner or commissioner may also review it.

Peer Review – Technical Review Staff. At the PM's request, technical staff in the Science Services Branch will perform data quality assessments to confirm that data meets the requested criteria in accordance with the project standards. There is a peer review function within each technical review staff specialty area. Peer reviewers have technical expertise in the subject area, and are not in the management chain of

the UST Branch, maintaining independence. A Chemist will perform peer reviews of data QA reviews that are performed by the site chemist.

Field Evaluations. IDEM staff periodically perform field oversight activities to obtain qualitative assessments of environmental data collection activities. The following documents should be considered in the evaluation:

[Volatile Organic Compounds in Soil, SW-846 5035A, Appendix A](#) (Appendix A, #22)

[Sampling Soil and Waste for Volatile Organic Compounds Technical Guidance Document](#) (Appendix A, #21)

[Conceptual Site Model Technical Guidance Document](#) (Appendix A, #23)

[Drilling Procedures and Monitoring Well Construction Guidelines Non-rule policy](#) (Appendix A, #24)

[The Micro-Purge \(Low Flow\) Sampling Option Technical Guidance Document](#)
Appendix A, #25

[The Non-Purge Sampling Option Technical Guidance Document](#) (Appendix A, #26)

C.2. Reports to Management

- *Reports to U.S. EPA.* IDEM reports periodically to the U.S. EPA on LUST program performance, typically referred to as semiannual performance measures. Currently this reporting includes the number of confirmed releases; number of cleanups initiated; number of cleanups completed; and number of emergency responses. Data for this report is currently pulled from the Underground Leaking, Community Right-to-Know, and Emergency Response System (ULCERS) database. In addition, IDEM provides the U.S. EPA with a Financial Status Report.
- *IDEM Quality System Audits.* Audit planning and reporting will involve the participation of the appropriate levels of IDEM management (assistant commissioners and deputy assistant commissioners, branch chiefs, and section chiefs). Those involved in assessment of the UST Branch quality system include: the IDEM quality managers, UST Branch management, members of the OLQ quality team, the Science Service Branch QA Coordinator, and technical personnel. Assessments by non-UST Branch staff, such as the IDEM quality managers and SSB personnel, ensure independence.
- *IDEM OLQ Contract Laboratories.* Whenever IDEM OLQ contract laboratories are involved in a discrepancy, the SSB QA Coordinator and management will be included in the decision making hierarchy and will review any decisions as to corrective action. In any event, the SSB QA Coordinator will provide guidance regarding these issues to the PM.
- *Project Documentation.* At a project level, the SSB Staff reports unacceptable data quality assessment findings to the PM. The PM is responsible to ensure that any necessary corrective actions are identified, documented for the public file, and implemented. If necessary, the PM will document corrective actions to be taken in correspondence to the Owner/Operator. The following are examples of topics that may be included:
 - Non-Conformance of program guidance/procedures.
 - Unauthorized deviations from the program guidance or approved corrective action steps.
 - Results of data validation activities.

- Sufficiency of usable data generated.
- Required corrective actions and effectiveness of corrective action implementation.
- Data quality assessments in terms of precision, accuracy, representativeness, completeness, comparability, and sensitivity.

Section chiefs review, and must approve, any documentation regarding the data and any corrective action, such as memoranda, reports, or correspondence. When staff or managers identify program quality issues, they may elevate those issues to the section chiefs; if adequate resolution cannot be achieved at that level, they may subsequently escalate the issue to the branch chiefs and then to the senior management.

D. Data Validation and Usability

D.1. Data Review, Verification, and Validation

Data review is the examination to ensure that the data have been recorded, transmitted and processed correctly. This includes checking for data entry, transcription, calculation reduction, and transformation errors. It also includes ensuring there is a complete list of sample information, such as field documentation, sample matrices, blanks, duplicates, shipping date, preservatives, and holding times.

Data verification evaluates performance against the pre-determined set of specifications; e.g., the sampling design, the analytical method, the appropriate contaminant selection, or other project criteria.

Data validation identifies the quality or the appropriateness of the data set beyond procedural, lab method, or contract compliance criteria to be used to meet the project objective. For example, in the case of a laboratory analysis, the data verification process might identify that spike recoveries fell below project specifications; the validation process would then determine the root cause of the deficiency. Data validation procedures will be performed for both field and laboratory operations. The criteria that will be evaluated are discussed further in D.1.1 through D.1.7.

D.1.1. Sampling Design

The UST Program utilizes a judgmental 'step out' sampling design, as described in section 3.7 of the *Remediation Closure Guide*. Any subsequent changes in the sampling design are reviewed to ensure that adequate decision data is available.

The PM and technical reviewers should check for compliance to the sampling design, or for adequate documentation and justification when the sampling design has been modified.

D.1.2. Sample Collection Procedures

Review of the data submittals (e.g., *UST Closure Reports* and *Initial Site Investigation*) will include a review of whether the appropriate procedures were followed, or whether any necessary variation in the procedures affected the value of the data.

D.1.3. Sample Handling

Review of the data will include a review of sample handling. Deviations from approved handling practices, such as the length of the holding time or storage temperature) are typically noted by the assigned SSB chemist and noted in the technical review memorandum.

D.1.4. Analytical Procedures

Each sample will be verified to ensure that the procedures used to generate the data were implemented as specified and that the results met expected project parameters. Data validation activities will be used to evaluate the potential effects of any deficiencies. (See Section 3.9.1 of the RCG)

D.1.5. Quality Control

QC checks that are to be performed during sample collection, handling, and analysis are specified in Sections B4 and B5. During data validation, the corrective actions that were taken, which samples were affected, and the potential effect of the actions on the validity of the data will be documented.

D.1.6. Calibration

Field and laboratory instrument calibration information will be evaluated to ensure that calibrations were performed.

D.1.7. Data Reduction and Processing

SSB chemists will provide checks on data. These checks will include checks where duplicate rekeying of data may have resulted in data entry errors. In order to avoid IDEM review staff rekeying errors, chemistry staff have been advised to not re-tabulate sample results in technical review memoranda.

D.2. Verification/Validation Methods

SSB chemists provide data review, verification, and validation of analytical data packages and field documentation in accordance with the IDEM SOP *Chemistry Services Section Data Verification and Validation*. Verification and validation is provided both for owner/operator consultant laboratory data and IDEM OLQ contract laboratory data as shown in Figure 2. SSB personnel in the geology, engineering, or risk assessment discipline areas may also conduct technical reviews.

D.2.1. Verification

The PM and SSB chemist (if requested) will verify field data by reviewing field records (e.g., screening results, monitoring well diagrams, and soil boring logs), chain of custody records, and laboratory analytical results packages. Reports will be checked to ensure field work was documented and field equipment was calibrated. The laboratory data will be verified in respect to the contaminant, units of measure, and citation of analytical methods, including method and method criteria. The SSB chemist will review the laboratory case narrative for deviations or corrective actions taken, will verify the use of blanks and duplicates, and will document concerns within technical review memoranda.

For UST Release sites, IDEM will use minimum data documentation requirements (MDDRs) as specified in Table 3A of the RCG. In the event that data evaluation indicates questions or concerns, full QA/QC documentation may be requested from the laboratory.

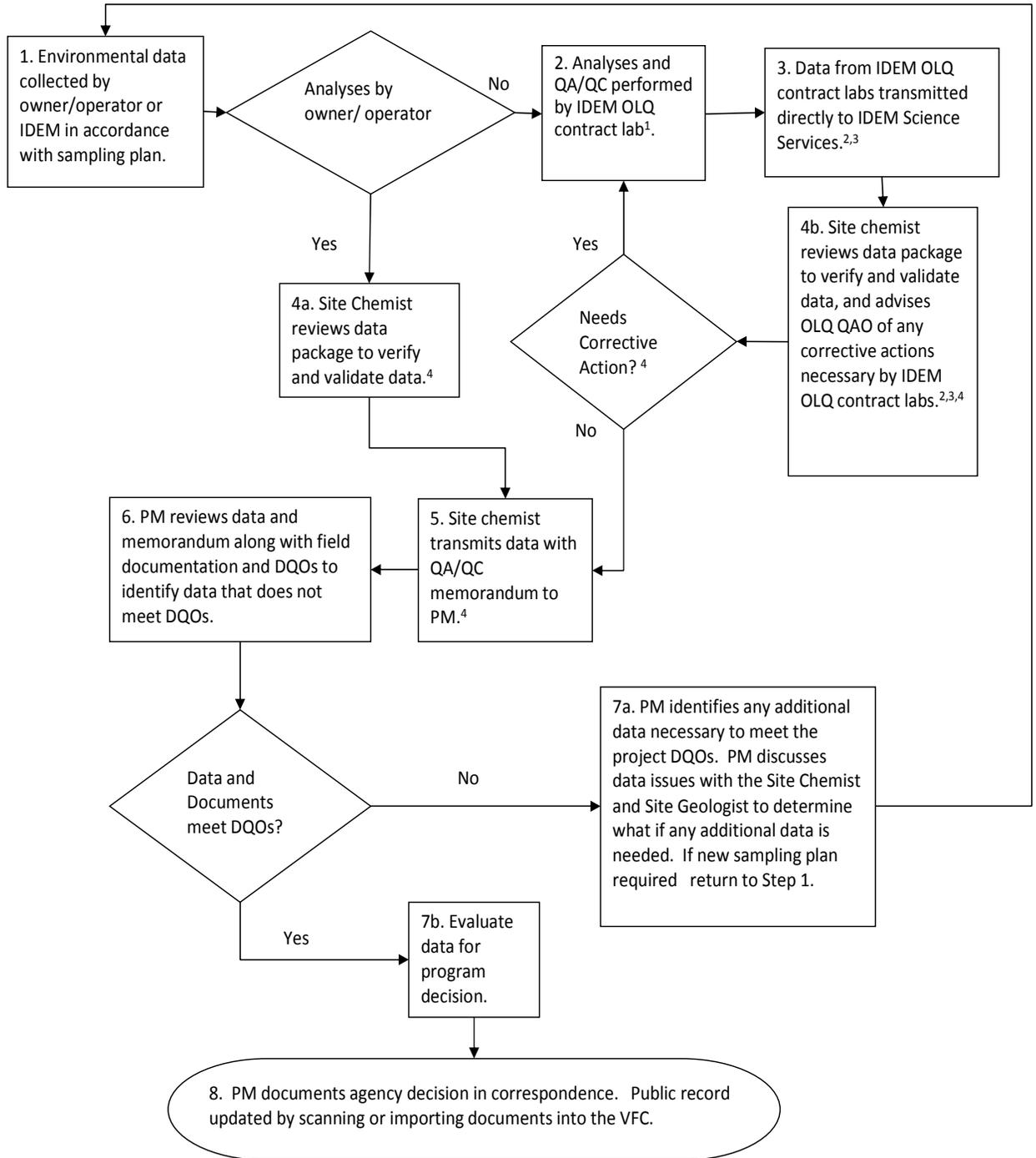
D.2.2. Validation

Data validation is an analyte-specific and sample-specific process that extends the evaluation of data beyond method, procedure, or contractual compliance (i.e., data verification) to determine the quality of a specific data set relative to the end use. It focuses on the project's specifications or needs, designed to meet the needs of the decision makers/data users and should note potentially unacceptable departures from the quality management system.

Owner/Operator Consultant Reports. For data submitted from Owner/Operator Consultants associated with any of the UST Branch reporting tasks (Table 1), SSB chemists review the data in accordance with the IDEM SOP *Chemistry Services Section Data Verification and Validation*.

OLQ Contract Lab Packages. When a laboratory data package from an OLQ contract lab is received by IDEM, the package is logged, collated with field documentation, and assigned for data validation in accordance with the *Chemistry Services Section Data Package/Field Documentation Receipt* IDEM work summary, *Chemistry Services Section Field Documentation Requirements* SOP, and *Chemistry Services Section Data Verification and Validation* SOP.

Figure 2. OLQ Data Verification and Validation Process



¹ Refer to IDEM Work Summary *Chemistry Services Section Contract Lab Sample Set-up*.

² Refer to IDEM SOP *Chemistry Services Section Field Documentation Requirements*.

³ Refer to IDEM Work Summary *Chemistry Services Section Data Package Field Documentation Receipt*.

⁴ Refer to IDEM SOP *Chemistry Services Section Data Verification and Validation*.

D.3. Reconciliation with User Requirements

The PM and chemistry staff will conduct a data quality assessment (DQA) to determine whether data are of the correct type, quality, and quantity to support environmental decision making for each project. When any of the project-required measurement performance criteria are not met, then the chemist will document the evaluation in a memorandum to the PM which will address:

1. The specific nature of the problem with the data;
2. The probable source of the error;
3. The potential impact of the error on the usability of the data.

The PM will meet with chemistry staff as needed to discuss the significance of the problem(s), and will write correspondence to the owner/operator that documents the agency's official decision including:

1. A summary of problems (if present);
2. The potential need for corrective action.
3. Recommendations for further actions based on program goals, which may include resampling if data is determined to be unusable.

PMs and chemistry staff should estimate the potential effect that each deviation or deficiency may have on the usability of the associated data item and its contribution to the quality of the reduced and analyzed data. All SSB technical review memoranda and program correspondence generated in the data review, verification, and validation process will be retained in the project file. The official agency decision record is publicly available via the public interface to the electronic filing system, the Virtual File Cabinet (VFC), discussed in section B.10.

The data from each investigative phase and site activities will change the CSM as understanding of the site improves. Each of these documents are submitted, reviewed and stored in the VFC to assist in the development of the CSM.

APPENDIX A

REFERENCES

1	IDEM Leaking Underground Storage Tank Section Web Site (Main Menu) http://www.in.gov/idem/4997.htm
2	IDEM 2012. <i>Remediation Closure Guide</i> http://www.in.gov/idem/files/remediation_closure_guide.pdf
3	IDEM 2012. <i>Remediation Program Guide Section 3; Leaking Underground Storage Tank Program and Excess Liability Trust Fund Program</i> http://www.in.gov/idem/files/remediation_program_guide_chap_3.pdf
4	IDEM 2012. <i>IDEM Agency-Wide Quality Management Plan</i> http://www.in.gov/idem/5158.htm
5	IDEM 2012. <i>IDEM Office of Land Quality Management Plan</i> https://extranet.idem.in.gov/standards/docs/quality_improvement/qmps/olq_qmp_2012.pdf
6	IDEM Office of Land Quality Document Submittal Guidelines http://www.in.gov/idem/6578.htm
7	U.S. EPA 2002. <i>EPA Guidance for Quality Assurance Plans</i> , U.S. EPA QA/G5, EPA/240/R-02/009. https://www.epa.gov/sites/production/files/2015-06/documents/g5m-final.pdf
8	U.S. EPA 2001. <i>EPA Requirements for Quality Assurance Plans</i> , U.S. EPA QA/R5, EPA/240/B-01/003. https://www.epa.gov/sites/production/files/2015-07/documents/r5-final.pdf
9	U.S. EPA 2008, Quality Policy, Chief Information Officer 2106.0 https://www.epa.gov/sites/production/files/2015-10/documents/21060.pdf
10	Resource Conservation and Recovery Act (RCRA); Subtitle I https://www.epa.gov/rcra
11	EPA Final Approval of IDEM Underground Storage Tank Program https://www.gpo.gov/fdsys/pkg/FR-2006-07-12/pdf/E6-10866.pdf
12	Indiana Administrative Code 328 Underground Storage Tank Financial Assurance Board http://www.in.gov/legislative/iac/T03280/A00010.PDF?
13	Indiana Administrative Code Underground Storage Tanks http://www.in.gov/legislative/iac/T03290/A00090.PDF?
14	EPA ProUCL Version 4.0 Technical Guide https://www.epa.gov/sites/production/files/2015-03/documents/proucl_v4.0_tech.pdf
15	IDEM Work Summary Chemistry Services Section Contract Lab Sample Set-up. (Please click on the title to open link or request the document from the IDEM OLQ Chemistry Services Section.)
16	IDEM SOP Chemistry Services Section Field Documentation Requirements. (Please click on the title to open link or request the document from the IDEM OLQ Chemistry Services Section.)

17	IDEM Work Summary Chemistry Services Section Data Package Field Documentation Receipt. (Please click on the title to open link or request the document from the IDEM OLQ Chemistry Services Section.)
18	IDEM SOP Chemistry Services Section Data Verification and Validation. (Please click on the title to open link or request the document from the IDEM OLQ Chemistry Services Section.)
19	IDEM Chemistry Services Section Soil Sampling for Non-Volatile Compounds SOP (Please click on the title to open link or request the document from the IDEM OLQ Chemistry Services Section.)
20	IDEM Chemistry Services Section Soil Sampling for Volatile Compounds SOP (Please click on the title to open link or request the document from the IDEM OLQ Chemistry Services Section.)
21	IDEM Sampling Soil and Waste for Volatile Organic Compounds (VOCs) Technical Guidance Document http://www.in.gov/idem/files/land_soil_sampling_and_waste_for_vocs.pdf
22	Volatile Organic Compounds in Soil, SW-846 5035A, Appendix A http://www.epa.gov/epawaste/hazard/testmethods/index.htm
23	Conceptual Site Model Technical Guidance Document http://www.in.gov/idem/files/remediation_tech_guidance_conceptual_site_model.pdf
24	Drilling Procedures and Monitoring Well Construction Guidelines Non-rule policy http://www.in.gov/idem/files/nrpd_waste-0053.pdf
25	The Micro-Purge (Low Flow) Sampling Option Technical Guidance Document http://www.in.gov/idem/files/remediation_tech_guidance_micro-purge.pdf
26	The Non-Purge Sampling Option Technical Guidance Document http://www.in.gov/idem/files/remediation_tech_guidance_non-purge.pdf
27	Technical Specifications for Analytical Services (Please request the document from the IDEM OLQ Chemistry Services Section.)
28	EPA Data Quality Assessment: A Reviewer's Guide (QA/G9R) https://www.epa.gov/sites/production/files/2015-08/documents/g9r-final.pdf
29	IDEM Remediation Technology & Other Guidance Website http://www.in.gov/idem/6514.htm
30	EPA Contaminated Site Clean-Up Information Website http://www.clu-in.org/

APPENDIX B LIST OF ACRONYMS

CA	Cooperative Agreement
CAP	Corrective Action Plan
COC	Contaminants of Concern
DQA	Data Quality Assessment
DQI	Date Quality Indicator
DQO	Data Quality Objective
ELTF	Excess Liability Trust Fund
FID	Flame Ionization Detector
FSI	Further Site Investigation
GC/MS	Gas Chromatograph/Mass Spectrometry
GIS	Geographic Information System
GPS	Geographic Positioning System
IAC	Indiana Administrative Code
IC	Indiana Code
IDEM	Indiana Department of Environmental Management
IS	Internal Standard
ISC	Initial Site Characterization
LCS	Laboratory Control Sample
LEL	Lower Explosive Limit
LUST	Leaking Underground Storage Tank
MB	Method Blank
MCL	Maximum Contaminant Level
MDDR	Minimum Data Documentation Requirements
MQO	Measurement Quality Objectives
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MSR	Management System Review
NFA	No Further Action
OLQ	Office of Land Quality
OSHA	Occupational Safety and Health Administration
PARCC	Precision, Accuracy, Representativeness, Comparability, Completeness
PID	Photoionization Detector
PM	Project Manager
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAM	Quality Assurance Manager
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	Quality Control
QMP	Quality Management Plan
RCG	Remediation Closure Guide
RCRA	Resource Conservation and Recovery Act
RPD	Relative Percent Difference
RPG	Remediation Program Guide
SC	Section Chief
SEM	Senior Environmental Manager
SOP	Standard Operating Procedure
SRM	Standard Reference Material
SS	Surrogate Spike

APPENDIX B LIST OF ACRONYMS

SSB	Science Services Branch
STARS	Strategic Targeted Activities for Results System
ULCERS	Underground Leaking, Community Right-to-Know and Emergency Response System
U.S. EPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VFC	Virtual File Cabinet
WP	Work Plan

APPENDIX C

Remediation Program GUIDE – Section 3

(http://www.in.gov/idem/files/remediation_program_guide_chap_3.pdf)

APPENDIX D

Remediation Closure Guide

(http://www.in.gov/idem/files/remediation_closure_guide.pdf)