Investigation of Underground Storage Tank Releases

Office of Land Quality
Petroleum Branch

Quality Assurance Program Plan

B-001-OLQ-PET-UST-24-Q-R5

Office: Office of Land Quality

Branch: Petroleum Branch

Section: Underground Storage Tanks Compliance Section
Petroleum Remediation Section

Federal Identification number(s) of any direct grant funding:

Contract number(s) of any IDEM contract(s):

QAPrP lead investigators: Robyn Raftis, Tim Veatch, Shay Hartley

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QAPrP authors: Robyn Raftis

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A. Program Management

The elements under this section address basic project management elements such as roles, communications, personnel, and responsibilities of participants. These elements ensure the project has a defined goal, the participants understand the goal and the planned approach, and planning outputs are documented.

A.1. Title and Approval Sheet

U.S. EPA Approvals

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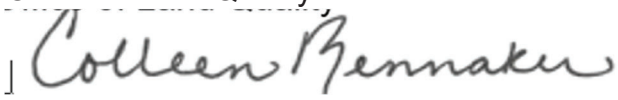
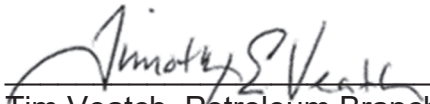
IDEM Approvals

Brian Wolff, Assistant Commissioner
Office of Land Quality — 10/1/2024 Date



Colleen Rennaker, Deputy Assistant Commissioner
Office of Land Quality — 10/1/2024 Date



Tim Veatch, Petroleum Branch Chief
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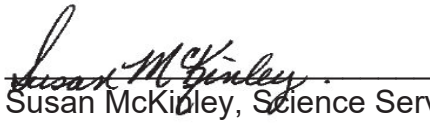
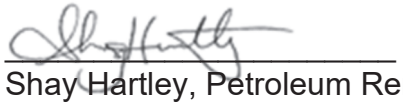


Susan McKinley, Science Services Branch Chief
Office of Land Quality — 09/17/24 Date



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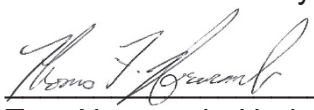

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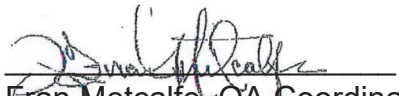

Fran Metcalfe, QA Coordinator and Technical Environmental Specialist E7 for Science Services Branch and QA Officer for Office of Land Quality — 09/17/2024 Date

Robyn Raftis, Technical Environmental Specialist E7,
QA Coordinator Petroleum Branch
Office of Land Quality — 9/17/2024 Date

Patrick Colcord

IDEM Quality Assurance Staff

10/24/2024
Date

QAPrP Summary:

The quality assurance program plan (QAPrP) outlines the quality requirements for the investigation of underground storage tank (UST) releases. U.S. Environmental Protection Agency (U.S. EPA) Region 5 supports IDEM's program activities through a cooperative agreement.

Site investigations and characterizations are the responsibility of the owner or operator and their consultant under the oversight of the Petroleum Branch management and staff. This program QAPrP documents the management of the program, data generation and acquisition, assessment and oversight, and data validation and verification of sites seeking closure from IDEM.

The U.S. EPA Chief Information Officer Directive CIO 2105-S-02.1 effective August 21, 2023 (E. References #2), reaffirms and establishes requirements for the agency's mandatory quality system. Because UST activities include environmental information and environmental technology, IDEM is required by U.S. EPA regulations (40 CFR Section 35.100) to develop and implement a quality system. IDEM's quality system is documented in IDEM 2023 Quality Management Plan (E. References #9). IDEM's Office of Land Quality (OLQ) developed the resulting QAPrP pursuant to the requirements of the directive as noted in Section E. References.

QAPrP Contact Information:
Robyn Raftis, Petroleum Branch

Program office:
Petroleum Branch, Office of Land Quality

Lead investigators:
Robyn Raftis, Tim Veatch, Shay Hartley

Laboratory contact information:
Laboratories are selected by site owners or operators and consultants.

Laboratory accreditation and performance testing information:
Laboratory accreditation may be requested from the laboratories used by the owner or operator and consultants.

A.2 Table of Contents

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A.3. Distribution List

The QAPrP is available via a link on IDEM's Leaking Underground Storage Tank web site (E. References #24). The QAPrP is also electronically distributed to staff in the Petroleum Branch and Science Services Branch (SSB) and is available in the QA Library on IDEM's SharePoint InfoHub. U.S. EPA Region 5 is provided a copy.

The IDEM staff listed in Table 1 will be notified by email and copied on the most recent version of this QAPrP each time:

- This QAPrP is revised and replaced by a more up-to-date version.
- For a program QAPrP, this QAPrP has passed its expiration date and is either replaced by a reauthorized version of this same QAPrP or a revised QAPrP, or the program under which this QAPrP was implemented is ended. Program QAPrPs are effective for multiple years and repeated at numerous times or locations.

Table 1: Distribution List, Name, Title or Role, Telephone, Email

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A.4. Program Roles, Responsibilities, and Organization

IDEM is authorized to manage environmental issues and conditions in the state of Indiana. The state of Indiana applied for approval of the UST program under U.S. EPA Subtitle I of the Resource Conservation and Recovery Act (RCRA) (E. References #6). U.S. EPA granted approval effective July 12, 2006, authorizing IDEM to operate the state UST program in lieu of the federal UST program. UST owners are required to follow applicable Indiana Statutes (13-23), Indiana Administrative Code (329 IAC 9), and IDEM guidance.

OLQ SSB supports the Petroleum Branch by performing data review. Chemists, engineers, GIS data services staff, geologists, and risk assessors review the submitted data to determine whether the information collection and analyses are satisfactory.

Table 2 describes roles and responsibilities, as they pertain to this QAPrP.

Table 2: Key QAPrP Individuals

IDEM Management and Petroleum Branch Roles	Tasks
Petroleum Remediation Section (PRS) Section Chief (SC) and Underground Storage Tank (UST) Closure Coordinator	• Oversees PRS staff review of owner or operator compliance with statutes, rules, guidance, standard operating procedures (SOP), and Investigation of Underground Storage Tank Releases QAPrP. • Inspect / oversight of the UST closure activities and sampling as described in 329 IAC 9-6-2.5 and 2.6. • Approves site closure documentation, typically in the form of No Further Action (NFA) letters. • Approves the Investigation of Underground Storage Tank Releases QAPrP.
PRS Project Manager (PM)	• Evaluates owner or operator compliance with UST program statutes, rules, and regulations. • Coordinate and compile the IDEM SSB technical documents' reviews. • Analyze site specific conceptual site models (CSMs) and determine the next steps. • Write owner or operator site correspondence. • Maintain site-specific records and update IDEM's databases. • Track development and resolution of corrective action. • Perform field oversight at a minimum of 3 field and/or sampling observation events.

Petroleum Branch Technical Environmental Specialist E7/QA Coordinator	• Reviews and updates the Investigation of Underground Storage Tank Releases QAPrP. • Provides technical support to the BCs, SCs, and program staff.
Petroleum Branch Chief (BC)	• Oversees all Petroleum Branch operations. • Approves the Investigation of Underground Storage Tank Releases QAPrP.
UST Compliance SC	• Evaluate owner or operator compliance with UST program statutes, rules, and regulations.
OLQ Deputy Assistant Commissioner (DAC)	• Oversee Petroleum Branch operations. • Approves the Investigation of Underground Storage Tank Releases QAPrP.
OLQ Assistant Commissioner (AC)	• Communicates needs to IDEM's commissioner. • Oversees all OLQ Operations. • Approves the Investigation of Underground Storage Tank Releases QAPrP.
Science Services Branch Roles	**Tasks**
OLQ Science Services Branch Chief	• Ensures SSB compliance with Indiana Statutes, Indiana Administrative Code, IDEM guidance, QAPrPs, SOPs, and work summaries.
OLQ Chemists	• Provide review, verification, and validation of data generated for the UST program. • ~~Evaluation of project goals~~ Review of the sample collection documentation, evaluate the purpose of the sampling events, analytical methods, data reviews, and data acceptability based on analytical data results, laboratory quality assurance and quality control (QA/QC), sampling reports, and procedures to determine applicability to the overall project goals per the CSM. • Perform sampling implementation review (audit). The audit will be conducted if the field oversight by the PM observes questionable sampling protocols, and the observations impact the usability of results. • Review Investigation of Underground Storage Tank Releases QAPrP.
GIS/Data Services staff	• Provide technical support as required, including geographic positioning system data, GIS mapping, and electronic data submission and storage. • Verify legal property descriptions for Environmental Restrictive Covenants.

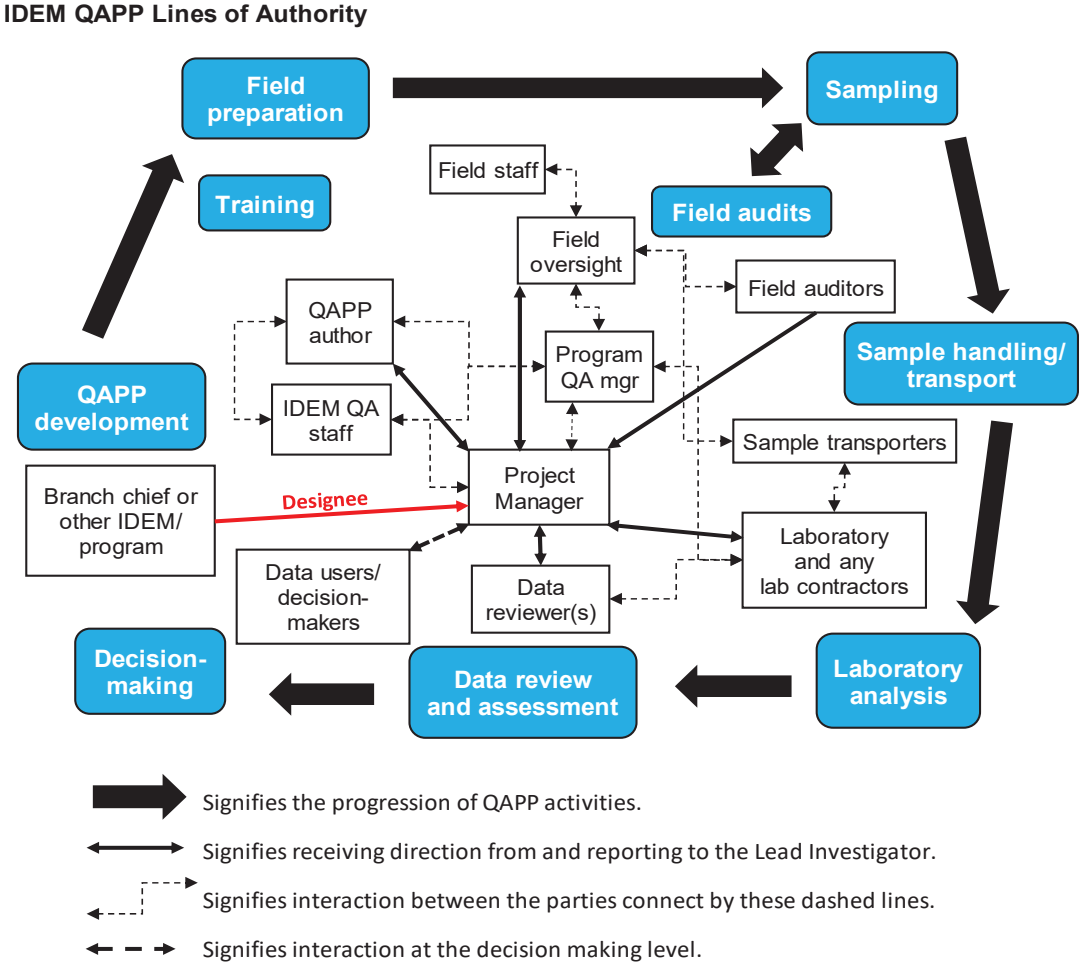
OLQ Geologists	• Provide technical review services, including report review, sample collection review, evaluation of proposed remedy options, evaluation of plume behavior. • Perform field oversight based on PM request.
OLQ Engineers	• Evaluate effectiveness and design of remediation systems and appropriateness of engineering controls.
OLQ Risk Assessors	• Provide technical support for PRS sites seeking risk-based closure. • Evaluate potential exposure pathways. • Evaluate the appropriateness of institutional controls (ICs).
Owner or Operator or Consultant Roles	**Tasks**
	• Comply with UST program applicable Indiana Statutes (13-23) (E. References #7), Indiana Administrative Code (329 IAC 9) (E. References #8), and IDEM guidance.

The organizational chart, “IDEM QAPrP Lines of Authority” in Figure 1, depicts the relationships and the lines of communication among the key program participants. listed in Table X, throughout the various stages of this QAPrP. This QAPrP is a product of planning by the lead investigator, or program leader and a team of program area staff, which could include any of the staff depicted in the organizational chart, plus other program area staff with expertise in the topic of this QAPrP.

Nearly all standard IDEM data operations (QAPrPs) include the same basic staff relationships, with these primary exceptions:

- Some of the positions shown may be staffed by more than one person.
- One person may staff more than one of the positions shown below.

Figure 1: QAPrP Lines of Authority



Note: Staff requesting, developing, and implementing this QAPrP should remain mindful of the importance of organizational and operational independence of QA staff with oversight and assessment responsibility for the preparation and implementation of this QAPrP (data operation).

An organizational chart of the IDEM senior level management is provided in Figure 2. The organizational structure of the Office of Land Quality including the Petroleum and Science Services branches is provided in Figure 3. Figure 4 depicts the flow of documents between the SSB and Petroleum Branch.

Figure 2 IDEM Management Organizational Chart

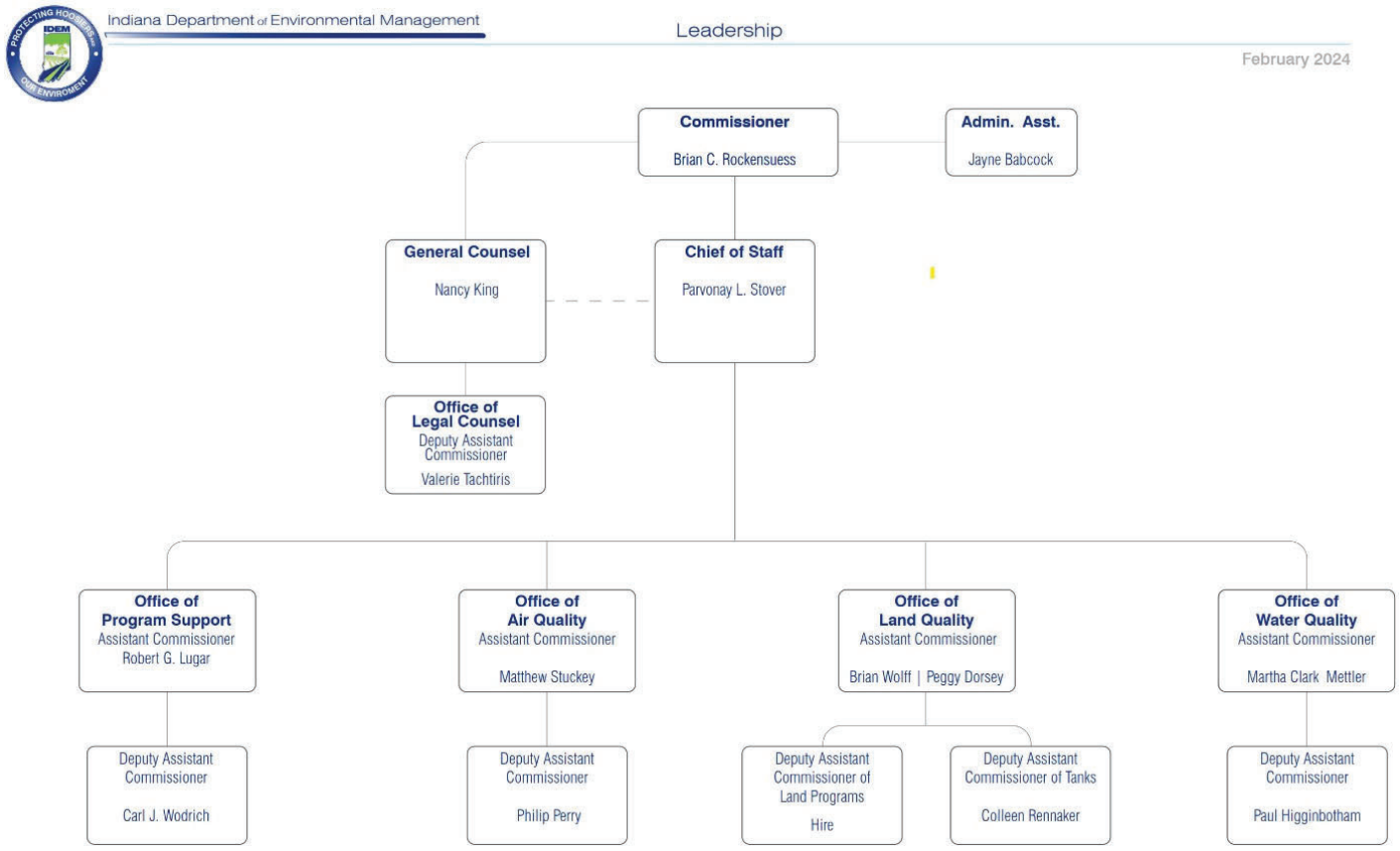


Figure 3 Office of Land Quality Petroleum and Science Services Branches organizational structure for QA matters

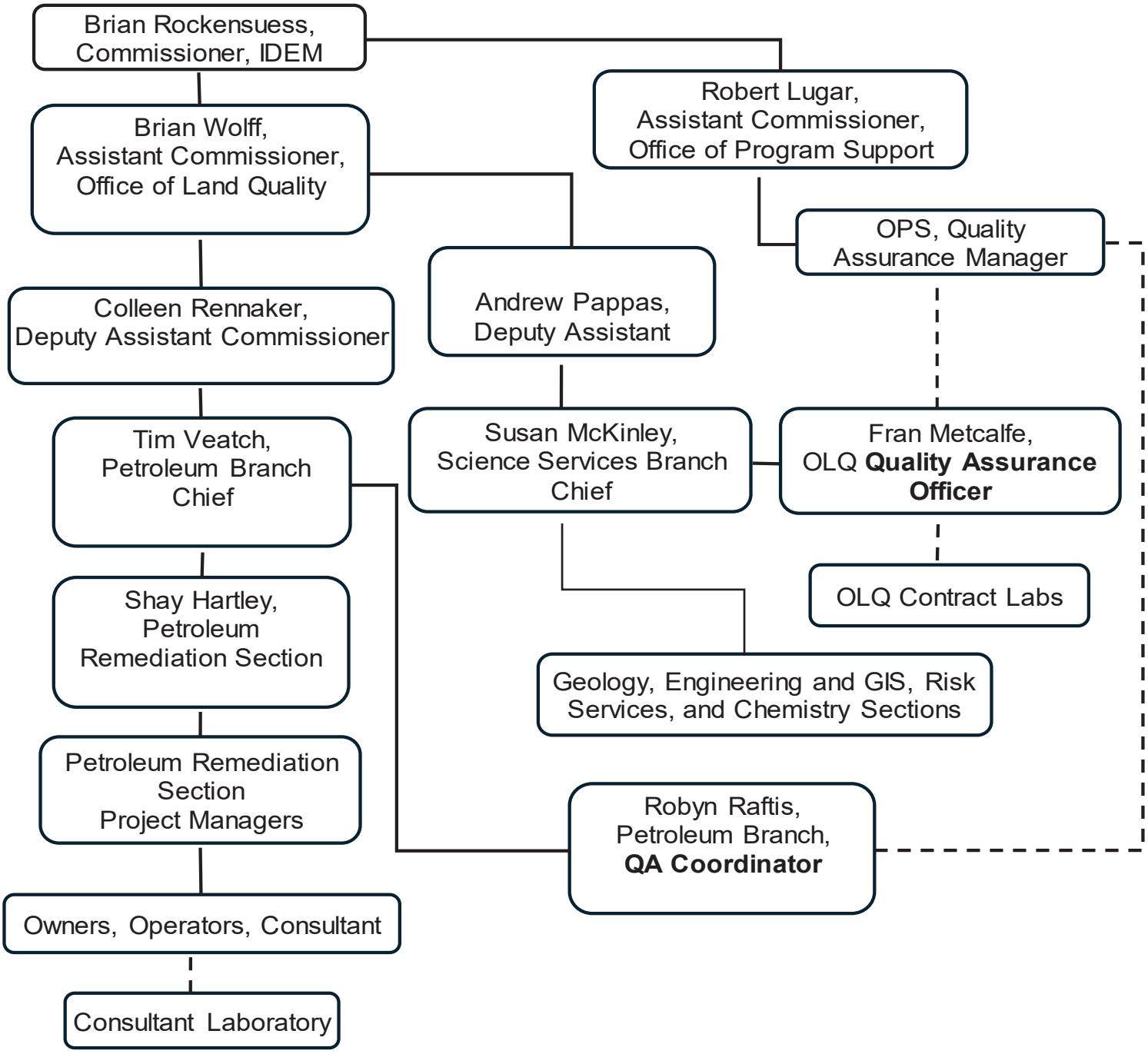
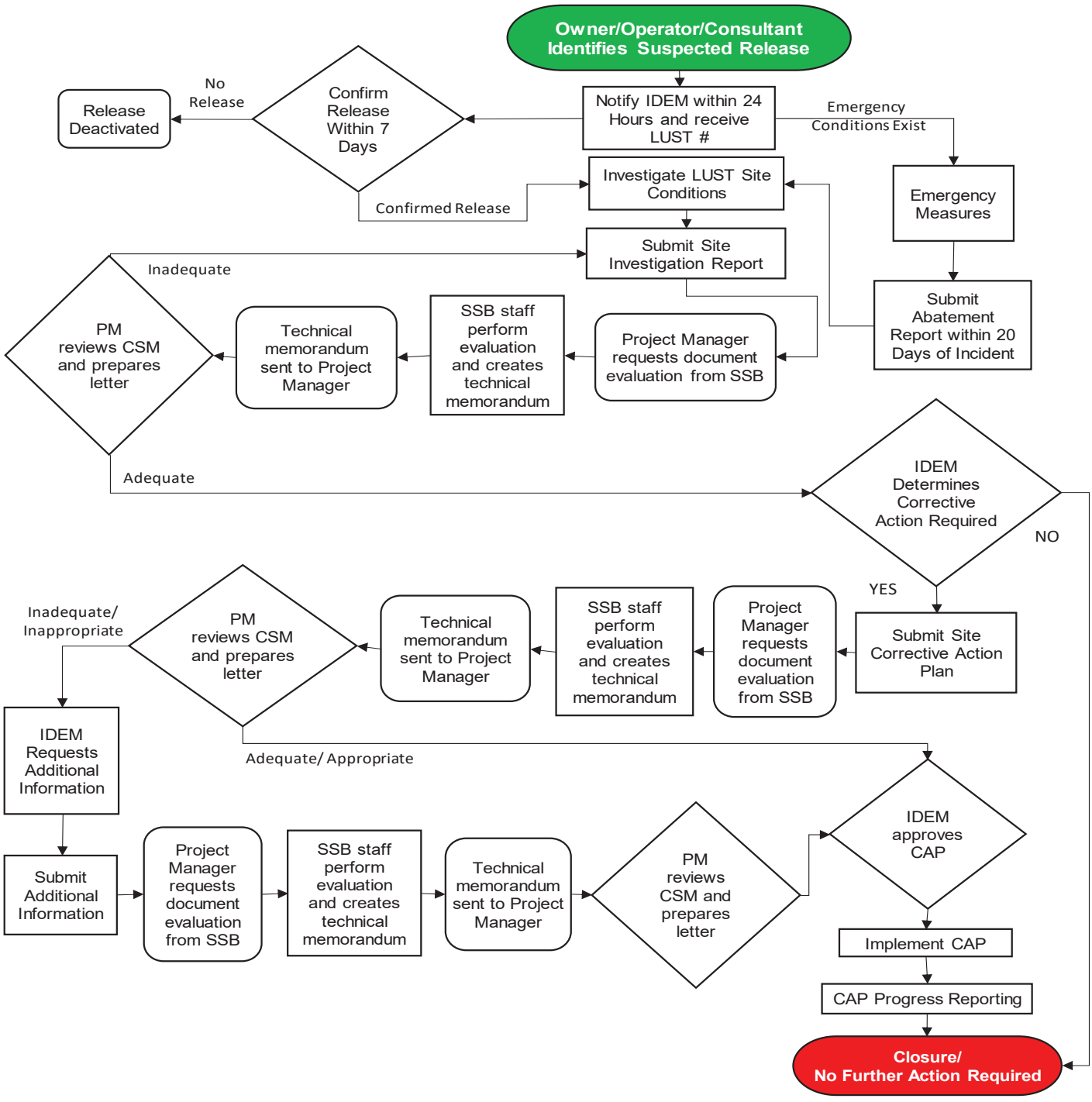


Figure 4 Document Flow Between the OLQ Petroleum and Science Services Branches



A.5. Problem Definition and Background

IDEM's mission statement is to implement federal and state regulations to protect human health and the environment while allowing the environmentally sound operations of industrial, agricultural, commercial, and government activities vital to a prosperous economy.

IDEM's OLQ utilizes a risk-based corrective action approach to assess and remediate UST releases. The Risk-based Closure Guide (R2) (E. References #12) describes how to achieve consistent closure of contaminated media by documenting:

- Release sources, types, and extents of release-related chemicals (RRCs) present at a site. How to assess contamination present at a site.
- Remediation objectives and remedy determinations. How to evaluate and mitigate potential exposure pathways to contamination.
- Remedy selection and implementation.
- The use of ICs as a closure option to manage residual contamination and exposure risk.

A.6. Program Task Description

IDEM manages approximately 4,100 active UST sites across the state of Indiana. On average, approximately 150 leaking underground storage tank (LUST) incidents are reported each year. IDEM publishes a nonrule policy document (NPD) and the Petroleum Remediation Program Guide (RPG, E. References #23), to assist UST owners, operators, and their environmental consultants with program-specific guidance for release investigation, corrective action, and closure processes.

Within the UST program, the number and type of tasks required may vary based upon site characteristics. Each completed task may lead IDEM to request additional investigation, corrective action, or consideration of NFA status. 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.
3) Remedial strategy, risk assessment, and closure tasks.

Table 3 summarizes tasks within the categories, includes references to sources for additional information and includes project schedule dates. The three categories make up the Conceptual Site Model (CSM).

The CSM is an iterative living representation of a contaminated site or property. The model provides a simplified and concise summary of contamination sources and distribution; release mechanisms; exposure pathways and migration routes; and human and ecological receptors (E. References #3). As required by U.S.

EPA’s systematic planning process for the collection and evaluation of environmental data, developing a CSM (E. References #13) is an integral step in clarifying cleanup objectives for a site and determining appropriate data quality objectives (DQOs).

Table 3 UST Program – Releases Project Category Summary

Category	Task	Description or Contents	Schedule	References for More Detail
Notification and Response	Suspected or Confirmed Release	Documentation to include owner or operator details; UST system description; and a description of the suspected release.	Responsible parties (RPs) notify IDEM within 24 hours. Within 30 days the RP confirms release or no release	329 IAC 9-1-1(c) which incorporates 40 CFR Sect. 280.50, 280.52 and 280.53
Notification and Response	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.	Reports due 20-days for mitigation or 45 days for FP recovery from date of notification to IDEM	329 IAC 9-1-1(c) which incorporates 40 CFR Sect.280.61, 280.62 and 280.64
Investigation	UST Closure Report	Report provides the details of UST closure, including sampling results which may or may not indicate a release from the UST system. Required for removal, closure in-place, and change of service.	Within 30 days of UST decommissioning or closure	329 IAC 9-6
Investigation	Initial Site Characterization (ISC)	Initiate investigation to define nature and extent of contamination, evaluate exposure pathways and receptors, and evaluate remediation alternatives.	Within 60 days of release confirmation	329 IAC 9-1-1(c) which incorporates 40 CFR Sect. 280.63
Investigation	Further Site Investigation (FSI)	Further investigation when ISC fails to define nature and extent of contamination; and evaluation of remedial alternatives.	Due as directed by IDEM for additional site investigation after the submittal of the ISC.	329 IAC 9-1-1(c) which incorporates 40 CFR Sect. 280.65
Remediation, risk assessment, and closure	Corrective Action Plan (CAP)	Plan describing remedial strategy for site.	Due as directed by IDEM 60-90 days from request for CAP. CAP must include progress milestone timetable.	329 IAC 9-1-1(c) which incorporates 40 CFR Sect. 280.66
Remediation, risk assessment, and closure	CAP Progress Report	Required: 1) When requested by IDEM prior to corrective action; 2) For corrective action monitoring; 3) For monitored natural attenuation or other closure monitoring such as plume stability demonstration.	Quarterly, or as documented in approved CAP	329 IAC 9-1-1(c) which incorporates 40 CFR Sect. 280.66
Remediation, risk assessment, and closure	Request for NFA	Documents closure decision justification including risk assessment.	After successful implementation of CAP and cleanup objectives achieved	329 IAC 9-1-1(c) which incorporates 40 CFR Sect. 280.66

A.7. Quality Objectives and Criteria

A.7.1. Data Quality Objectives (DQOs)

DQOs are qualitative and quantitative statements clarifying the study objective and defining the collection of the appropriate type of data. 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 the intended use.

The US EPA's Guidance on Systematic Planning Using the Data Quality Objectives Process EPA/QA –G-4 describes the seven steps of the DQO Process. The approach to each step for IDEM's UST program is described below.

Step 1: State the Problem
Identification of release or suspected release from a regulated UST occurs.

Step 2: Identify the Goal of the Study
Five main decision statements exist to consider:

- Decision statement I –Confirm whether the release of potential RRCs, petroleum, or hazardous substance from an UST system occurred.
- Decision statement II – Determine whether the release presents an immediate threat to human health or the environment (e.g., fire, explosion, chemical burns, or vapor hazards) and requires accelerated response activities. Sites presenting an immediate health or environmental threat undergo additional accelerated response requirements.
- Decision statement III – Delineate the areal extent of the release above the published levels and complete a CSM to identify lists of potential exposure pathways, and potential exposure scenarios.
- Decision statement IV – Determine whether the site contamination requires active remediation or use of engineering controls or ICs.
- Decision statement V – Determine whether the remedial actions performed meet remedial objectives, and limit exposure to potential contaminants.

Step 3: Identify Information Inputs
Collect and analyze groundwater and soil samples to assess and document releases to the site media. In addition, evaluate potential exposure pathways, and identify and possibly sample sensitive areas (e.g., surface water and well head protection areas). Compare concentrations of RRCs in soil and groundwater to the published levels (R2, Section 2, E. References #12). The published levels are risk-based numerical values for each RRC based on chemical characteristics, media concentration, toxicity, and exposure pathway.

Laboratory data documented with minimum data documentation requirements (MDDR) are sufficient for most sampling information. However, IDEM staff may specifically request the full QA/QC data package on a site-specific basis, if

necessary. Per R2, Section 2.2.10, the data evaluation process assesses whether the sample results meet project objectives. Table 4 shows the requirements for both MDDR and full QA/QC data packages.

In addition to the elements in Table 4, the following sampling-related items should support every investigation. Justification must be provided if any of the items are omitted.:

- Completed chain of custody with sample date, time, and identification.
- Map or diagram of sample locations.
- Sample field sheets documenting sample identifiers, locations, date and time, sampling methods and equipment, samplers, calibration methods, and any notable observations (color, clarity, texture, reactions with preservatives, etc.).
- Blanks: trip, field, or equipment rinsate blanks, as appropriate.
- Field duplicates' identity: typically, at least one per twenty samples per matrix for each method.
- Adequate sample volume.

The following laboratory-related items should support every investigation:

- Completed chain of custody with date and time of receipt.
- Sample's condition upon receipt.
- Sample identification: site identification and laboratory identification.
- Sample preparation logs with extraction, clean up, or digestion details.
- Certificates of analysis with method, analysis date, results, method detection limits, reporting limits, and any dilution factors.
- Case narrative detailing any deviations, problems, and corrective actions.

If the purpose of sampling is a stand-alone assessment of the vapor intrusion pathway, IDEM recommends U.S. EPA Methods TO-14A, TO-15, TO-15 SIM, or TO-17 and using a fixed laboratory when analyzing air, soil gas, or subslab gas samples The following sampling-related items should support every vapor intrusion investigation:

- Field records of the initial and final canister pressures, canister filling start and stop times, and approximate fill rates.
- Field measurement records: ambient temperature and pressure, screening results.
- Records of any leak tests performed.
- Documentation of canister cleaning (batch or individual certification).
- A completed copy of the Indoor Air Building Survey Checklist Vapor Intrusion Investigation Documentation (R2, E. References #22 or similar).

Table 4 Elements for Minimum Data Documentation Requirements (MDDR) and Full QA/QC DQOs

Element	Method Type	MDDR	Full QA/QC
Sample introduction method (e.g., direct injection, purge-and-trap)	Specific gas chromatography (GC) detector method	✓	✓
Tuning criteria and results	Gas chromatography/mass spectroscopy (GC/MS)		✓
Initial calibration (IC) and IC verification	All		✓
Continuing calibration(s)	All		✓
Blank results (e.g., field, prep, method)	All	✓	✓
Laboratory control sample	All	✓	✓
Internal standard summary	GC/MS, GC	✓	✓
Surrogate recoveries	GC/MS, GC	✓	✓
Matrix spike/matrix spike duplicate recoveries	All (except TO-14A, TO-15, and TO-15 SIM)	✓*	✓
Interference check sample	Inductively coupled plasma (ICP) methods		✓
Serial dilutions	ICP methods		✓
Method of standard additions (if applicable)	ICP methods		✓
Raw data (instrument printouts, chromatograms, and/or mass spectra as applicable)	All		✓
Confirmation on second column (or GC/MS)	Pesticides, polychlorinated biphenyls (PCBs), benzene, toluene, ethylbenzene and xylenes (BTEX) and other VOCs by GC		✓

*Only necessary during initial and final sampling.

If site conditions warrant and if necessary, evaluate soil gas or indoor air samples to evaluate the risk due to vapor intrusion. Compare soil gas or indoor air samples to criteria in the "Published Level Table" on the Screening and Closure Level Tables webpage.

Step 4: Define the Study Boundaries

The spatial and temporal boundaries of each site may vary. As necessary, collect samples on-site and/or off-site to determine the nature and extents of contamination.

The owner or operator, and consultant should follow the U.S. EPA recommendation for eight to ten samples to determine a background threshold value. In some cases, more than ten samples may be necessary to support a background demonstration, depending on methodology and site characteristics. Investigators should document whether 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, collecting extra samples during the initial sampling effort may be prudent. (R2 Appendix B, E. References #12)

The owner's or operator's, and consultant's representative should collect background samples 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.
2) Underlain by the same soil layers as the source area. (R2, Section 3.2, E. References #12).

Step 5: Develop an Analytical Approach and Step 6: Specify Performance and Acceptance Criteria

Decision rules are "if and then" statements determining how a project proceeds by evaluating the data. Upon completion of data verification and validation in accordance with R2 Section 2.2.9 (E. References #12), evaluate all usable data to ensure investigative criteria are met. Examples of decision rules are:

- Decision rule I – If a suspected or confirmed release of one or more potential contaminants occurs, then an incident number is generated. Perform additional assessment, if necessary.
- Decision rule II– If the release causes an immediate threat to human health or the environment, then initiate the appropriate mitigation responses to the threat.
- Decision rule III – If the areal extent of the released regulated substance has not been completed, then conduct additional investigations as necessary, to delineate the site, to assess pathways, and to assess receptor effects in the CSM.
- Decision rule IV– If based on the CSM and IDEM review corrective action is necessary, the owner or operator must submit a CAP to IDEM.
- Decision Rule V– If the CSM can be satisfactorily addressed with an appropriate closure strategy, then the site is eligible for NFA.

Step 7: Develop the Plan for Obtaining Data
Expected spatial sampling and analytical variations are key inputs to designing judgmental sampling schemes.

Judgmental sampling uses professional judgment and existing site knowledge to identify sample locations. Judgmental sampling works best at sites with known potentially contaminated areas' locations, receptors, or other sampling indicators. In such cases, judgmental sampling may simplify sample location siting. Therefore, consider sampling points near UST components (UST, piping connections, dispensers, etc.,) which previously leaked in the sampling design.

The UST program sampling design considers spatial and sampling variations and results in conducting soil sample evaluation by calculating the upper confidence level (UCL) as the representative concentration. For judgmentally collected samples, the simplest and most common approach is to treat each observed concentration as a representative concentration. Where judgmentally collected samples are of sufficient special density and distribution to adequately cover the area under evaluation, it may be appropriate to use the data to calculate a UCL for use as a representative concentration. If the sampling locations are judgmentally guided using field instruments (e.g., photoionization detector), the resulting UCL is likely biased high. Nevertheless, some investigators may wish to use this approach to derive a conservative representative concentration, particularly where a few individual sample results exceed remediation objectives. For systematically collected samples, the representative concentration is an appropriate UCL calculated for each potential contaminant using results from a sample array corresponding to the area under evaluation. For more details, refer to R2 Section 3.2.2.1 (E. References #12).

A.7.2. Measurement Quality Objectives

Measurement quality objectives (MQOs) are acceptance criteria for the quality attributes measured by project data quality indicators (DQIs) (B.5.) The principal DQIs are precision, accuracy (as bias), representativeness, comparability, completeness, and sensitivity (PARCCS). DQI criteria apply not only to the laboratory, but also to 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. Table 5 identifies the Chemicals Often Associated with Various Facilities and Releases (R2, Section 2.2.2, Table 2-A).

Table 5 Chemicals Often Associated with Various Facilities and Releases

	Chemical or Chemical Class									
Release Type/Industry	VOCs	PAHs[1]	PCBs	SVOCs	Metals	CVOCs[3]	Phenols	Cresols	Cyanide	Misc.
Dry Cleaning Industry	X[4]					X				
E-85 Fuel	X[5]									
Manufactured Gas Plants	X	X	X[7]		X[6]		X	X	X	X[2]
Auto Salvage Yard	X	X	X		X[6]					X[2]
Metal Finishing	X			X	X[6]				X	X[2]
Gasoline Range Product[9]	X[5,8]				X[8]					
Diesel Range Product[10]	X	X								
Hydrocarbon Oil Range Product[11]		X								
Waste/Used Oil; Unknown Petroleum Product	X[8]	X								

Notes:

[1]Polyaromatic hydrocarbons (PAHs) should include all chemicals on the U.S. EPA SW-846 Method 8310 analyte list.

[2]For manufactured gas plants, include pH and ammonia. For auto salvage yards, include pH, asbestos, ethylene glycol, and propylene glycol. For metal finishers, include pH.

[3]Chlorinated volatile organic chemicals (CVOCs) include, among other chemicals, tetrachloroethene, trichloroethene, 1,1,1-trichloroethane, 1,2-cis- and 1,2-trans-dichloroethenes, and vinyl chloride.

[4]Analyze full VOCs if solvents other than tetrachloroethene, trichloroethene, and/or 1,1,1-trichloroethane were used.

[5]Include naphthalenes (naphthalene, 1-methylnaphthalene, 2-methylnaphthalene)

[6]Contact IDEM for list of metals.

[7]Where electrical generation occurred, or if transformers are/were present, analyze for and report total polychlorinated biphenyls (PCBs) and Aroclors.

[8]Report total lead and lead scavengers (1,2-dibromoethane and 1,2-dichloroethane) for aviation gas and racing fuel releases, or when automotive gas was used or stored before January 1, 1996, unless previous investigations performed at the property and available in IDEM files have ruled out lead and lead scavengers.

[9]Includes automotive gas, aviation gas, racing fuel, Stoddard solvent, naphtha, JP-4, and ethanol fuel

[10]Diesel #1 and 2, kerosene, JP# 5, 7, & 8, light oil, heating oil, and biodiesel <100%

[11]Fuel oil #4, #5, #6, bunker oil, virgin motor oil, hydraulic oil

The following sections provide a brief description of each sampling measurement systems' selected performance indicator. Tables 4 and 5 provide project field MQO and DQI elements and analytical control standards.

Precision

Precision is usually expressed as a relative percent difference (RPD). Precision is the degree of agreement among repeated measurements of the same characteristic (analyte, parameter, etc.) under the same or similar conditions. Precision data indicate field sampling or analytical procedure consistency and

reproducibility. Comparing field and laboratory precision helps identify sources of imprecision when a problem exists. Poor precision may result from field instrument variation, analytical measurement variation, poor or inappropriate sampling technique, sample transport problems, or matrices' heterogeneity.

Accuracy (as Bias)
Accuracy is usually expressed as a percent recovery (%R). Accuracy is the extent of agreement between the parameter's observed value, sample results, and the accepted or true value. Analyte accuracy evaluation uses different types of QC samples, such as a standard reference material or laboratory control sample (LCS). Because environmental samples contain interferences (e.g., other compounds which may interfere with the analysis of specific analytes), evaluate the accuracy for a specific analyte in relation to the sample matrix. Evaluate accuracy by analyzing matrix spike and matrix spike duplicate (MS/MSD) samples and computing the %R.

Field sample collection and transport contamination, or contamination introduced at the time of sample preparation or analysis impacts accuracy. Sample contamination may either result in negative or positive bias. For example, metals may adsorb on plastic sampling materials. Absorption from the collected sample results in lower reported metal concentrations than actual site concentrations (i.e., negative bias).

Representativeness
Representativeness is a qualitative term which describes the extent to which a sampling design adequately reflects the environmental conditions of the site. Representativeness also reflects the sample team's ability to collect samples and laboratory staff's ability to analyze samples in a manner which the data generated accurately and precisely reflects the conditions at the site. If field duplicate or colocated precision checks indicate potential spatial variability, then additional coordination with IDEM and subsequent resampling to collect more representative samples from the site may be needed.

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 then multiplied by 100. A lack of data completeness may require additional sampling.

Comparability
Comparability is an expression and a qualitative measurement of the confidence with which one set of data compares to another. Comparability is a careful identification of the equivalency of two data sets measuring a parameter or set of parameters. Comparability is dependent upon proper sampling design which may

be satisfied by ensuring the field sampling plan is followed, utilizing proper sampling techniques, establishing the proper analytical methods, and using and documenting proper QA objectives.

Sensitivity
Sensitivity indicates a method's capability or an instrument's capability 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. Sensitivity represents the minimum difference in concentration distinguishable between two samples with a high degree of confidence.

Table 6 and Table 7 provide a general program listing of MQO and DQI elements for project field and analytical control standards respectively.

Table 6 Quality Assurance and Quality Control – Soil (SW 846)

QC Sample	Frequency and Number	DQI	MQO	Conclusion
Equipment blank	1 per sample location when using nondisposable sampling equipment	Effectiveness of field decontamination procedures	All analytes < reporting limit	Consider all affected data biased (high or unknown) due to possible cross-contamination. Review field decontamination procedures.
Field duplicate	1 per 20 samples	Effectiveness of field sampling procedures	RPD ≤ 40%	Consider all affected data biased (high, low, or unknown) due to sampling error. Review sample collection procedures.
LCS	Per method or laboratory SOP	Evaluation of laboratory and instrument capability	%R and RPD per method or laboratory SOP	Consider all affected data biased (high, low, or unknown) due to laboratory or instrument error.
Internal Std (IS)	Per method or laboratory SOP	Evaluation of laboratory analysis procedures	%R per method or laboratory SOP	Consider all affected data estimated (high, low, or unknown) due to cross-contamination during transport or storage.
MS/MSD	1 per 20 samples	Evaluation of matrix interferences	RPD ≤ 40% and %R as per method or laboratory SOP	Consider all affected data biased (high, low, or unknown) due to matrix interference.
Method blank (MB)	Per method or laboratory SOP	Evaluation of laboratory and instrument conditions	All analytes < reporting limit	Considered all affected data biased (high or unknown) due to laboratory or instrument cross-contamination.
Surrogate spike (SS)	Per method or laboratory SOP	Evaluation of instrument capability	%R and RPD as per method or laboratory SOP	Consider all affected data biased (high, low, or unknown) due to laboratory or instrument error.

Table 7 Quality Assurance and Quality Control – Groundwater (SW 846)

QC Sample	Frequency and Number	DQI	MQO	Corrective Action if Out of Control
Equipment blank	1 per sample location when using nondisposable sampling equipment	Effectiveness of field decontamination procedures	All analytes < reporting limit	Consider all affected data biased (high or unknown) due to possible cross-contamination. Review field decontamination procedures.
Field duplicate	1 per 20 samples	Effectiveness of field sampling procedures	RPD ≤ 20%	Consider all affected data biased (high, low, or unknown) due to sampling error. Review sample collection procedures.
LCS	Per method or laboratory SOP	Evaluation of laboratory and instrument capability	%R and RPD per method or laboratory SOP	Consider all affected data biased (high, low, or unknown) due to laboratory or instrument error.
IS	Per method or laboratory SOP	Evaluation of laboratory analysis procedures	%R per method or laboratory SOP	Consider all affected data estimated (high, low, or unknown) due to cross-contamination during transport or storage.
MS/MSD	1 per 20 samples	Evaluation of matrix interferences	RPD ≤ 20% and %R per method or laboratory SOP	Consider all affected data biased (high, low, or unknown) due to Matrix Interference.
MB	Per method or laboratory SOP	Evaluation of laboratory and instrument conditions	All analytes < reporting limit	Consider all affected data biased (high or unknown) due to laboratory or instrument cross-contamination.
SS	Per method or laboratory SOP	Evaluation of instrument capability	%R and RPD per method or laboratory SOP	Consider all affected data 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	Consider all affected data estimated (high, low, or unknown) due to cross-contamination during transport or storage.

A.8. Special Training or Certification

All reports should 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.9. Documents and Records

A.9.1. IDEM Investigation of UST Releases QAPrP

The most current, approved version of this QAPrP is available in three places. Owner or operators and their consultants access the document on the Leaking UST Program Website (E. References #24). IDEM staff access the document on the IDEM SharePoint site for the Petroleum Branch, InfoHub QA System Tools page under Active QAPPs, IDEM QA Library, and Leaking UST Program Website (E. References #24).

A.9.2. Deliverables to UST Program

PMs maintain the Petroleum Branch site files and reports submitted to the agency by UST owners or operators and consultants and are available to the public online in the Virtual File Cabinet (VFC).

B. Data Generation and Acquisition

IDEM does not routinely collect samples for the Petroleum Branch. Liable parties hire consultants to collect samples for analysis. The R2 (E. References #12) contains detailed guidance for sampling procedures.

B.1. Sampling Process Design

B.1.1. Rationale for the Design and Design Assumptions

Typically, sampling involves the collection of subsurface soil and groundwater. Collect samples from surface soil (spills or overfills) and from surface water, when applicable and if needed. If necessary, collect soil gas or indoor air samples 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 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 allows flexibility in the selection of sampling points if appropriate justification is provided to the agency from the consultant performing the work such as when the sampling point location is inaccessible). Maintain and update a CSM as new information becomes available.

Include the RRCs in the analytical suite for petroleum USTs in four main groups: gasoline, diesel, hydrocarbon oils, and waste oil. Additional information is available in Table 4 and Table 5.

B.1.2. Procedures for Locating and Selecting Environmental Samples

The R2 Section 2.3.2.2 describes possible horizontal delineation efforts by employing a step-in or step-out procedure. When selecting sample points for the step-out procedure, start at locations where RRC are likely to be highest. Factors to consider when selecting sample locations include:

- Known release points.
- Vertical location of highest concentrations (surficial, buried, under a barrier).
- Phase (soil, non-aqueous phase liquid (NAPL), mixture).
- Release-related chemical solubility and volatility.

The step-out procedure investigates each significant unbound exceedance of the remediation objectives by collecting additional samples in unsampled cardinal directions (north, east, south, west). Step-out distances can vary as suggested by site characteristics. The process is iterative, with step-outs surrounding each successive exceedance until delineation of the horizontal extent of contamination.

Employing a step-in procedure is advisable in some cases. The step-in approach may be preferable when there is concern that unacceptable exposures are already occurring. The step-in approach should not stop once soil extents based on unconditional remediation objectives are determined. It will be necessary to continue at least until excavation worker levels are delineated. For volatile release-related chemicals, continuing the step-in process until the source point is reached allows focus of soil gas screening efforts.

Use field screening instrumentation such as photoionization detectors or flame-ionization detectors, as applicable for the relevant contaminants, to assist in selecting soil samples for laboratory analysis submission. Also, select soil samples based on obvious signs of contamination. In the absence of positive screening results or visual cues, submit the samples from borings for laboratory analysis from a material within the core interval displaying the greatest apparent effective porosity. Collect ground water samples from the initial water-bearing unit.

B.1.3. Validation of Nonstandard Approaches

IDEM project management staff must approve the description and applicability of all nonstandard sampling or measurement methods in advance. IDEM may request collection of additional data when utilizing nonstandard sampling or measurement methods without prior approval.

B.2. Sampling Methods

Conduct UST release site sampling in accordance with IDEM's R2 guidance document, Indiana Code (IC) 13-23-1 and 329 IAC 9.

UST program reports (Table 3) shall include, but not be limited to, a description of the sample and data collection procedures followed. IDEM recognizes deviations from procedures may occur from time to time due to site-specific conditions or due to problems which may occur such as equipment failure. The owner or operator and consultant should have contingency plans in the event problems arise, such as equipment failure or a need for additional supplies. Thoroughly document all deviations and corrective actions.

B.3. Sample Handling and Custody

Under the Risk-based Closure Guide, Section 2.2 (E. References #12), proper sample handling and custody procedures are crucial to ensuring the quality and validity of data obtained through field sampling and laboratory analysis. Standard field sample handling and documenting procedures are important for ensuring high-quality, representative samples. A site-specific sampling and analysis plan or similar sampling document describes sample handling and field documentation procedures. IDEM's OLQ does not currently offer a general guidance document for sample handling. OLQ does not typically require specific field documentation forms. The admissibility of environmental data as evidence in a court of law is dependent on the custody of the data. Document the possession and handling of samples from the time of collection to delivery to the laboratory. A sample is considered in custody if:

- In a person's possession.
- In view of the person after being in their possession.
- Sealed in a manner whereby tampering cannot occur after leaving the person(s) physical possession.
- In a secure area restricted to authorized personnel.

B 3.1. Owner or Operator and Consultant Sampling Events

Review all site reports submitted by owner or operator and consultants and assess the following elements for appropriate sample handling:

- Preservatives.
- Cooler temperature 4ºC ±2ºC.
- Holding times.
- Designation of persons responsible for maintaining field notebooks, sample custody, and laboratory sample receipt.
- Project sample tracking system including a unique project numbering system.

- Chain of custody information including 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 signature.

At the time of sample collection but prior to filling container, use waterproof ink to label sample containers . Each label will indicate, at a minimum:

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

The owner or operator and consultant ensure packaging and transport of samples maintains the integrity of the sample, and ensures analyses are performed within the prescribed holding time. Shipping samples by courier or overnight mail to the laboratory is allowed. IDEM recommends the use of bubble-wrap packing materials and resealable plastic bags containing ice. The cooler used during transport shall be taped closed using custody seals.

B 3.2. Laboratory Custody

For owner or operator and consultant sampling events, the laboratory utilized must sign the chain of custody upon receipt of samples. The laboratory verifies receipt of all samples listed and sample packaging is intact. The laboratory must store the samples in a secure refrigerated area which maintains the temperature at 4ºC ±2ºC. The laboratory is responsible for samples disposal. The laboratory must submit a cooler inspection report, or equivalent, along with the laboratory report.

B.4. Analytical Methods

The type of petroleum or, in rare instances, hazardous substances stored in the UST system indicates potential contaminants for evaluation. Table 5 lists typical petroleum categories, standard target contaminants, and analytical methods for each group. In addition, consult the Sampling Soil and Waste for VOCs technical guidance document (E. References #18) for all sites requiring volatile organic chemical (VOC) analysis.

Owner or operator and consultants ensure samples analyses within the recommended holding time.

B.5. Quality Control

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

IDEM requires collection of QA/QC data throughout the different stages of site characterization, corrective action, and closure process. Should questions arise

during data evaluation, IDEM reserves the right to request full QA/QC documentation from the sampling event and the laboratory utilized.

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, or analytical error. Assess sampling or field error using field QC samples. Assess the magnitude of analytical error by evaluating the laboratory QC samples.

The SSB chemist determines the usability of data. Evaluate field sampling activities as a component of the overall data usability. In some cases, data of poor quality may necessitate the collection of new or additional samples.

B.5.3. Precision

Assess field precision through the collection and analysis of field duplicate samples. Groundwater matrix samples are readily duplicated due to their homogenous nature. Conversely, soil sample duplication is much more difficult due to the heterogenous nature. Due to this discrepancy by media type, use a maximum RPDs of ≤ 20% for groundwater samples and ≤ 40% for soil sample field duplicates as advisory limits for analytes detected at concentrations greater than or equal to five times the quantitation limit.

B.5.4. Accuracy

Use accuracy 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 compound analyses) or recovery of spike analyses (inorganic compound analyses). For all analytes, the referenced DQO analytical method lists the accuracy recovery ranges.

Base laboratory precision upon laboratory MS/MSD analyses. The precision criteria are specific to the parameter measured.

B.5.5. Completeness

For this program the desired goal is at least 90% of samples yielding valid data.

B.5.6. Comparability

Compare sample collection and handling methods, sample preparation and analytical procedures, holding times, stability issues, and QA protocols for usability purposes and meeting the MQOs.

B.5.7. Sensitivity

Determine the minimum concentration or attribute measured by a method (method detection limit), by an instrument (instrument detection limit), or by a laboratory (quantitation limit).

Table 8 and Table 9 provide a general program list of DQI elements for project field and analytical control standards. Site-specific criteria modification may occur.

Table 8 Quality Assurance and Quality Control – Soil (SW 846)

QC Sample	Frequency and Number	DQI	MQO	Conclusion
Equipment blank	1 per sample location, when using nondisposable sampling equipment	Effectiveness of field decontamination procedures	All analytes < reporting limit	Consider all affected data biased (high or unknown) due to possible cross-contamination. Review field decontamination procedures.
Field duplicate	1 per 20 samples	Effectiveness of field sampling procedures	RPD ≤ 40%	Consider all affected data biased (high, low, or unknown) due to sampling error. Review sample collection procedures.
LCS	Per method or laboratory SOP	Evaluation of laboratory and instrument capability	%R and RPD per method or laboratory SOP	Consider all affected data biased (high, low, or unknown) due to laboratory or instrument error.
IS	Per method or laboratory SOP	Evaluation of laboratory analysis procedures	%R per method or laboratory SOP	Consider all affected data estimated (high, low, or unknown) due to cross-contamination during transport or storage.
MS/MSD	1 per 20 samples	Evaluation of matrix interferences	RPD ≤ 40% and %R per method or laboratory SOP	Consider all affected data biased (high, low, or unknown) due to Matrix Interference.
MB	Per method or laboratory SOP	Evaluation of laboratory and instrument conditions	All analytes < reporting limit	Consider all affected data biased (high or unknown) due to laboratory or instrument cross-contamination.
SS	Per method or laboratory SOP	Evaluation of instrument capability	%R and RPD per method or laboratory SOP	Consider all affected data biased (high, low, or unknown) due to laboratory or instrument error.

Table 9 Quality Assurance and Quality Control – Groundwater (SW 846)

QC Sample	Frequency and Number	DQI	MQO	Corrective Action if Out of Control
Equipment blank	1 per sample location when using reusable sampling equipment	Effectiveness of field decontamination procedures	All analytes < reporting limit	Consider all affected data biased (high or unknown) due to possible cross-contamination. Review field decontamination procedures.
Field duplicate	1 per 20 samples	Effectiveness of field sampling procedures	RPD ≤ 20%	Consider all affected data biased (high, low, or unknown) due to sampling error. Review sample collection procedures.
LCS	Per method or laboratory SOP	Evaluation of laboratory and instrument capability	%R and RPD per method or laboratory SOP	Consider all affected data biased (high, low, or unknown) due to laboratory or instrument error.
IS	Per method or laboratory SOP	Evaluation of laboratory analysis procedures	%R per method or laboratory SOP	Consider all affected data estimated (high, low, or unknown) due to cross-contamination during transport or storage.
MS/MSD	1 per 20 samples	Evaluation of matrix interferences	RPD ≤ 20% and %R per method or laboratory SOP	Consider all affected data biased (high, low, or unknown) due to Matrix Interference.
MB	Per method or laboratory SOP	Evaluation of laboratory and instrument conditions	All analytes < reporting limit	Consider all affected data biased (high or unknown) due to laboratory or instrument cross-contamination.
SS	Per method or laboratory SOP	Evaluation of instrument capability	%R and RPD per method or laboratory SOP	Consider all affected data 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	Consider all affected data estimated (high, low, or unknown) due to cross-contamination during transport or storage.

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

The owner or operator and consultant ensure equipment is tested, inspected, calibrated, and maintained. The owners or operators and consultants are expected to have documented maintenance and calibration of field and laboratory equipment SOPs. Copies of SOPS are not routinely requested as submittals. When questions arise during data evaluation, IDEM reserves the right to request copies of SOPs and full QA/QC documentation from the sampling event and from 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.7. Instrument and Equipment Calibration and Frequency

B.7.1. Instrument Calibration and Frequency

Calibrate instruments for gathering, generating, or measuring environmental data and document the consistency of resulting accuracy and reproducibility with the manufacturer's specifications. Trained staff operate and calibrate field measurement equipment in accordance with manufacturer's specifications.

B.7.2. Laboratory Equipment, including Mobile Laboratories

Calibrate equipment using reference standards with known relationships to nationally recognized standards or accepted values of physical constants.

B.8. Inspection and Acceptance of Supplies and Consumables

The owner or operator and consultant are responsible for inspection and acceptance of supplies utilized for investigative purposes.

B.9. Nondirect Measurements

IDEM’s SSB’s technical evaluation staff must review and approve data from secondary sources such as computer modeling, Indiana Department of Natural Resources Water Well logs, topographic maps, and sewer maps. Owners, operators, or consultants are encouraged to contact the IDEM PM for approval prior to utilizing nondirect measurement methods.

B.10. Data Management

B.10.1. Data Recording

- Laboratory Data

When a required report contains environmental sampling, the report shall present all sample results, including all QA/QC samples. Record and submit laboratory data in accordance with R2 Table 2-B (E. References #12).

- Field Data

The owner or operator consultant field staff record data such as groundwater elevation data, calibration data, field screening readings, and pilot test results on field forms or in field logbooks. The staff performing the analysis or data collection are required to sign all field records. Raw data may require transfer to computer databases or spreadsheets (e.g., field screening equipment with data download capabilities).

B.10.2. Data Transformation or Data Reduction

Data transformation is the conversion of individual data point values into related values or possible symbols using conversion formulas. Reduce data resulting from the analyses of samples according to protocols described in the laboratory procedures. The 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 reporting results on a dry weight basis.

B.10.3. Data Transmittal or Transfer

IDEM requests PRS correspondence, reports, and related documents under 15MB be submitted electronically to the appropriate email address. Paper copies and CDs are no longer necessary as previously required in OLQ Document Submittal Guidelines.

B.10.4. Data Assessment

QA review consists of internal and external assessments to ensure QA/QC procedures are in use and to ensure laboratory staff conform to these procedures. The SSB chemist also reviews field records for compliance with IDEM and U.S. EPA guidance.

B.10.5. Data Storage and Retrieval

Records provide direct evidence and support for the necessary technical interpretations, judgments, and discussions concerning project activities. The records, particularly for the anticipated use as evidentiary data, must directly support technical studies and activities, and provide historical evidence required for later reviews and analyses. Records should be legible, identifiable, retrievable, protected against damage and deterioration, unauthorized modification, and loss.

Project related documents such as release reports, investigation reports, CAPs, quarterly monitoring reports, etc., which are submitted to or generated by IDEM, are indexed and imported or scanned into IDEM's electronic image storage system the VFC (https://vfc.idem.in.gov/DocumentSearch.aspx). Documents are archived in accordance with the applicable retention schedules.

B.10.6. Data Security

All data and analytical reports, including QA/QC results, become part of the project file record, and are retained in the VFC in accordance with the applicable retention schedules IDEM QMP p 42 (E. References #9).

C. Assessment and Oversight

C.1. Assessments and Response Actions

C.1.1. Assessment of the Program

External Assessments

- Semiannual Performance Measures Report
  A cooperative agreement documents the UST Compliance Section's and PRS' responsibilities with the U.S. EPA, which partial funding through federal funds. The UST Compliance Section and PRS develop an annual work plan, and report on progress to the U.S. EPA LUST4" database. EPA summarizes the data provided which is reported in the Semiannual Performance Measures Report https://www.epa.gov/ust/ust-performance-measures.

Internal Assessments

- IDEM Quality System Audits
  The IDEM quality managers perform agencywide quality system audits of each IDEM branch at least once every five years. The audits focus on both agencywide and branch level quality system components. Details on IDEM quality system audits are in in the IDEM Quality Management Plan paragraph 9.1.1 (E. References #9). Staff involved in assessment of the Petroleum Branch quality system include the IDEM quality managers, Petroleum Branch management, members of the OLQ quality team, the SSB QA Coordinator, and technical staff (e.g., chemists, geologists, risk assessors). IDEM staff outside the Petroleum Branch including IDEM quality managers and SSB, ensure performance of an independent assessment.
- Periodic Internal Reviews
  From time to time, staff or managers identify quality system strengths or shortcomings. Send recommendations to QA staff or supervisors for potential revision. The need for updates to program planning documents, technical guidance, and SOPs are dictated by periodic QA document (or SOP) review, rule changes, technology changes, extramural agreements, or changes in internal practices.
- Performance Evaluations
  All staff's technical knowledge is evaluated annually as a component of individual performance appraisals and addressed at any time problems arise. Further information about the types of training available for staff is referenced in the IDEM 2023 Quality Management Plan.

C.1.2. Assessment of Individual Program Activities

- Surveillance
  The PM is responsible for monitoring the status of a project, reviewing records and reports, ensuring project requirements are met. Note deficiencies and any corrective actions in writing and complete a follow-up audit if the PM deems necessary.
- Peer Review – PMs
  PM work products such as reports, memoranda, and correspondence are subject to peer review by other PMs, senior environmental managers, or SCs. The BC, AC, or commissioner may also review the PM work products depending on the nature of the document.
- Peer Review – Technical Review Staff
  At the PM's request, technical staff in the SSB perform data quality assessments (DQAs) to confirm data meets the requested criteria in accordance with the project standards. Each technical review staff specialty area has a peer review function. Peer reviewers have technical expertise in the subject area and are not in the Petroleum Branch management chain, thus ensuring an independent review. A chemist performs peer reviews of the site chemist's data QA reviews.
- Field Evaluations
  IDEM PM, chemist, geologist, and risk assessors periodically perform field oversight activities to obtain qualitative assessments of environmental data collection activities. Consider the listed documents in the evaluation:
  Volatile Organic Compounds in Soil, SW-846 5035A, Appendix A (E. References #5)
  Sampling Soil and Waste for Volatile Organic Compounds (VOCs) Technical Guidance Document (E. References #18)
  Conceptual Site Model Technical Guidance Document (E. References #13)
  Drilling Procedures and Monitoring Well Construction Guidelines Nonrule Policy Document (E. References #11)
  The Micro-Purge Sampling Option Technical Guidance Document (E. References #21)
  The Non-Purge Sampling Option at Petroleum Sites Technical Guidance Document (E. References #22)
  Groundwater Sampling with Peristaltic Pumps (E. References #20)
  Investigation of Manmade Preferential Pathways (E. References #15)
  Proper Investigative Techniques for Shallow Bedrock (E. References #17)
  Aquitard and Fine Grained Sediment Characterization (E. References #14)
  Vapor Intrusion Investigation Documentation (E. References #19)
  Sampling and Analysis of Ground Water for Metals at Remediation Sites Waste-0057-NPD (E. References #10)
  Polyethylene Diffusion Bag Samplers (E. References #16)

Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells (E. References #4)

C.2. Reports to Management

- Reports to U.S. EPA

IDEM periodically reports to the U.S. EPA on LUST program performance, typically referred to as semiannual performance measures. Currently, the reporting includes the number of confirmed releases; number of cleanups initiated; and the number of cleanups completed. Data for the report is currently pulled from the Underground Leaking, Community Right-to-Know, and Emergency Response System database. In addition, IDEM provides U.S. EPA with a Financial Status Report.

- IDEM Quality System Audits

Audit planning and reporting involve the participation of the appropriate levels of IDEM management (ACs, DACs, BCs, and SCs). Staff involved with the Petroleum Branch quality system assessment include: the IDEM quality managers, Petroleum Branch management, members of the OLQ quality team, the SSB QA Coordinator, and technical staff. Assessments by non-Petroleum Branch staff, such as the IDEM quality managers and SSB staff, ensure an independent audit.

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, elevation of the issues to the SCs may occur. If adequate resolution is not achievable at the SC level, subsequent escalation of the issue may occur to the BCs and then to the senior management.

D. Data Validation and Usability

D.1. Data Review, Verification, and Validation

Data review is the examination of recorded data to ensure correct transmission and processing. Checking data includes data entry, transcription, calculation reduction, and transformation errors. Also, includes ensuring a complete list of sample information exists, such as field documentation, sample matrices, blanks, duplicates, shipping date, preservatives, and holding times.

Data verification evaluates performance against the predetermined 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, laboratory method, or contractual compliance criteria used to

meet the project objective. In a laboratory analysis: for example, the data verification process might identify spike recoveries which fell below project specifications and the validation process then determines the root cause of the deficiency. Perform data validation procedures for both field and laboratory operations. Evaluation criteria 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, described in R2 Section 2.2.2. Document and review any subsequent changes in the sampling design to ensure adequate decision data are available.

The PM and technical reviewers should check for compliance with the sampling design, or for adequate documentation and justification when sampling design modifications occur.

D.1.2. Sample Collection Procedures

Data submittals' (Table 3) review includes 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

Data review includes a review of sample handling. The assigned SSB chemist typically notes deviations from approved handling practices, such as the length of the holding time or storage temperature, in the technical review memorandum.

D.1.4. Analytical Procedures

Verify each sample to ensure implementation and use of specified procedures to generate the data and the results met expected project parameters. Use data validation activities to evaluate the potential effects of any deficiencies (R2 Section 2.2.8).

D.1.5. Quality Control

Perform QC checks specified in Sections B4 and B5 during sample collection, handling, and analysis. During data validation, document corrective actions taken, affected samples, and the potential effect of the actions on data validity.

D.1.6. Calibration

Evaluate field instrument calibration information to ensure performance of calibrations, if needed. Field screening instrumentation being calibrated in the field is typically documented in field notes and the resulting readings are utilized as a real-time screening tool to determine if additional investigation and/or delineation is needed.

Evaluation of instrument initial and continuing calibration information is conducted by examining the calibration criteria which are performed per requirements of analytical methods.

D.1.7. Data Reduction and Processing

SSB chemists provide checks on data. The checks include duplicate rekeying of data which resulted in data entry errors. To avoid IDEM review staff's rekeying errors, chemistry staff are advised not to retabulate sample results in the technical review memoranda.

D.2. Verification and Validation

Verification assesses field data by reviewing field records (e.g., screening results, field equipment, monitoring well diagrams, and soil boring logs), chain of custody records, IDEM Initial Site Characterization Checklist, and laboratory analytical results packages. Check reports to ensure documentation of field work (e.g., Initial Site Characterization Checklist, FSI Report Cover Sheet and Report Format). Verify laboratory data with respect to the contaminant, units of measure, and citation of analytical methods, including method and method criteria.

Examples of deviations include sample relocation due to access issues, low soil recovery from a boring, dry wells, or analytical error. In some cases, the verification process may reveal the presence of data gaps.

For UST release sites, MDDR laboratory data are sufficient for most sampling information. However, IDEM staff may request the full QA/QC data package on a site-specific basis, if necessary.

Validation is an analyte specific and method specific process comparing data quality (e.g., accuracy and precision) against predetermined quality criteria during the planning phase. Validation demonstrates whether the data are reliable enough to meet project objectives when reviewing Site specific sampling data as per IDEM Chemistry Services Section Data Verification and Validation SOP. In addition, the information in the bulleted items are key points in the SOP.

- Completed chain of custody with sample date, time, signature, and identification.
- Map or diagram of sample locations.
- Sample field sheets documenting sample identifiers, locations, date and time, sampling methods and equipment, samplers, calibration methods, and any notable observations (color, clarity, texture, reactions with preservatives, etc.).
- Blanks: trip, field, or equipment rinsate blanks, as appropriate.
- Field duplicates identities: typically, at least one per twenty samples per matrix for each method.
- Adequate sample volume.
- The following laboratory-related items should support every investigation:

- Completed chain of custody with signature, date, and time of receipt.
- Condition of samples on receipt.
- Sample identification: site identification and laboratory identification.
- Sample handling.
- Sample preparation logs with extraction, cleanup, or digestion details.
- Certificates of analysis with method, analysis date, results, method detection limits, reporting limits, and any dilution factors.
- Case narrative detailing any deviations, problems, and corrective actions.
- If the purpose of sampling is a stand-alone assessment of the vapor intrusion pathway, IDEM recommends U.S. EPA Methods TO-14A, TO-15, TO-15 SIM, or TO-17 and using a fixed laboratory when analyzing air, soil gas, or subslab gas samples. The following sampling related items should support every vapor intrusion investigation:
- Field records of the initial and final canister pressures, start and stop times for canister filling, and approximate fill rates.
- Field measurement records (ambient temperature and pressure, screening results).
- Records of any leak tests performed.
- Documentation of canister cleaning (batch or individual certification).
- Copy of a completed Indoor Air Building Survey Checklist (Remediation Closure Guide (RCG) Appendix IV or similar).
- Evaluate background samples.

D.3. Reconciliation with User Requirements

The chemist conducts a 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, the chemist documents the evaluation in a memorandum to the PM which addresses:

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 meets with chemistry staff, as needed, to discuss the significance of problems and writes correspondence to the owner or operator documenting 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 unusable.

PMs and chemistry staff estimate the potential effect which each deviation or deficiency may have on the usability of the associated data item and the contribution to the quality of the reduced and analyzed data. Retain all SSB technical review memoranda and program correspondence generated in the data review, verification, and validation process in the project file. The official agency decision record is publicly available via the public interface to the electronic filing system, VFC, discussed in section B.10.

The analytical laboratory results, submitted by the owner, operator, or consultant's chosen laboratory for each investigative phase and site activities change the CSM as understanding of the site improves. Submit, review, and store each document in the VFC to assist with the development of the CSM.

E. References

1. (EPA 2006) EPA Final Approval of IDEM Underground Storage Tank Program 40 CFR 281 https://www.gpo.gov/fdsys/pkg/FR-2006-07-12/pdf/E6-10866.pdf

2. (EPA 2023) Environmental Information Quality Policy, Chief Information Officer 2105.S-02.1 https://www.epa.gov/irmpoli8/quality-assurance-project-plan-qapp-standard. All necessary components are located within the Quality Program Directives webpage, https://epa.gov/quality-program-directives.

3. (EPA 2011) U.S. EPA's Environmental Cleanup Best Management Practices: Effective Use of the Project Life Cycle Conceptual Site Model, EPA 542-F11-011 quick reference https://www.epa.gov/sites/production/files/2015-04/documents/csm-life-cycle-fact-sheet-final.pdf

4. (EPA 2017) Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples From Monitoring wells Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells, Revised: September 19, 2017 (epa.gov)

5. (Method 5035A) Volatile Organic Compounds in Soil, SW-846 5035A https://www.epa.gov/sites/production/files/2020-12/documents/5035a_r1.pdf

6. U.S. EPA Subtitle I of the Resource Conservation and Recovery Act (RCRA) webpage https://www.epa.gov/rcra/resource-conservation-and-recovery-act-rcra-overview

7. Indiana UST Statutes 13-23 http://iga.in.gov/legislative/laws/current/ic/titles/013/articles/023/

8. Indiana UST Rules 329 IAC 9 http://www.in.gov/legislative/iac/T03290/A00090.PDF

9. (IDEM 2023) IDEM 2023 Quality Management Plan https://www.in.gov/idem/resources/publications/quality-management-plan/

10. (IDEM 2005) Sampling and Analysis of Ground Water for Metals at Remediation Sites https://www.in.gov/idem/resources/nonrule-policies/effective-nonrule-policies/waste-0057-npd

11. (IDEM 2009) Drilling Procedures and Monitoring Well Construction Guidelines Nonrule policy https://www.in.gov/idem/files/nrpd_waste-0053.pdf

12. (IDEM 2022) Risk-based Closure Guide https://www.in.gov/idem/files/nrpd_waste-0046-r2_attch.pdf

13. (IDEM 2014) Conceptual Site Model https://www.in.gov/idem/cleanups/files/remediation_tech_guidance_conceptual_model.pdf

14. (IDEM 2019a) Aquitard and Fine Grained Sediment Characterization https://www.in.gov/idem/cleanups/files/remediation_tech_guidance_aquitard_characterization.pdf

15. (IDEM 2019b) Investigation of Manmade Preferential Pathways https://www.in.gov/idem/cleanups/files/remediation_tech_guidance_mpp.pdf

16. (IDEM 2019c) Polyethylene Diffusion Bag Samplers https://www.in.gov/idem/cleanups/files/remediation_tech_guidance_pdb_sampler.pdf

17. (IDEM 2019d) Proper Investigative Techniques Shallow Bedrock https://www.in.gov/idem/cleanups/files/remediation_tech_guidance_shallow_bedrock.pdf

18. (IDEM 2020a) Sampling Soil and Waste for Volatile Organic Compounds Technical Guidance Document https://www.in.gov/idem/cleanups/files/guidance_soil_sampling_vocs.pdf

19. (IDEM 2020b) Vapor Intrusion Investigation Documentation https://www.in.gov/idem/cleanups/files/remediation_tech_guidance_vi_investigation.pdf

20. (IDEM 2021a) Groundwater Sampling with Peristaltic Pumps https://www.in.gov/idem/cleanups/files/remediation_tech_guidance_peristaltic_pump.pdf

21. (IDEM 2021b) The Micro-Purge Sampling Option Technical Guidance Document https://www.in.gov/idem/cleanups/files/guidance_sampling_micro-purge.pdf

22. (IDEM 2021c) The Non-Purge Sampling Option at Petroleum Sites Technical Guidance Document https://www.in.gov/idem/cleanups/files/guidance_sampling_non-purge.pdf

23. (IDEM 2022) Petroleum Remediation Closure Guide Nonrule Policy Petroleum Remediation (in.gov)

24. IDEM Leaking Underground Storage Tank Website https://www.in.gov/idem/tanks/underground-storage-tanks/leaking-underground-storage-tanks/

25. (IDEM 2019) Use of High Resolution Site Characterization Tools

F. IDEM Standard Operating Procedures

1. IDEM Sampling DB User's Manual

2. IDEM Remediation Services Branch Disposal of Investigative Derived Waste SOP

3. IDEM OLQ Management of Investigative Derived Waste Technical SOP

4. IDEM MultiRae Plus PID/Multiple Gas Monitor SOP

5. IDEM OLQ Underground Utility Clearance Procedures SOP

6. IDEM OLQ Geographic Information System (GIS) Data Creation SOP

7. IDEM OLQ Geographic Information System (GIS) Data Maintenance SOP

8. IDEM OLQ Global Positioning System (GPS) Data Correction SOP

9. IDEM Chemistry Services Section Data Verification and Validation SOP

10. IDEM Chemistry Services Section Residential Well Sampling SOP

11. IDEM Chemistry Services Section Soil Sampling for Non-Volatile Organic Compounds SOP

12. IDEM OLQ Chemistry Services Section Soil Sampling for Volatile Compounds SOP

13. IDEM OLQ Sampling Soil and Waste for Volatile Organic Compounds (VOCs) Technical Guidance Document

14. IDEM Groundwater Sampling from Monitoring Wells SOP

15. IDEM Grab Groundwater Sampling from Boreholes SOP

16. IDEM Aquitard and Fine Grained Sediment Characterization Technical Guidance Document

17. IDEM Investigation of Manmade Preferential Pathways Technical Guidance Document

18. IDEM Proper Investigative Techniques in Karst Technical Guidance Document

19. IDEM Proper Investigative Techniques for Shallow Bedrock Technical Guidance Document

20. IDEM Vapor Intrusion Investigation Documentation Technical Guidance Document

21. IDEM Policy - Records Management

Appendix A

List of Acronyms

CFR	Code of Federal Regulations
CIO	Chief Information Officer
CSM	Conceptual Site Model
DQA	Data Quality Assessment
DQO	Data Quality Objective
FID	Facility Identification Number
FID	Flame Ionization Detector
GC	Gas Chromatography
GC/MS	Gas Chromatography and Mass Spectroscopy
GIS	Geographic Information Services
U.S. EPA	U.S. Environmental Protection Agency
IAC	Indiana Administrative Code
IC	Initial Calibration
IC	Indiana Code
IC	Institutional Control
IDEM	Indiana Department of Environmental Management
LUST	Leaking Underground Storage Tank
MDDR	Minimum Data Documentation Requirement
MS/MSD	Matrix Spike and Matrix Spike Duplicate
NAPL	Non-aqueous Phase Liquid
NFA	No Further Action
NPD	Nonrule Policy Document
OLQ	IDEM Office of Land Quality
PAH	Polycyclic Aromatic Hydrocarbons
PID	Photo-ionization Detector
PM	IDEM Project Manager
PRS	Petroleum Remediation Section
QA	Quality Assurance
QA/QC	Quality Assurance and Quality Control
QAPrP	Quality Assurance Program Plan
QMP	Quality Management Plan
R2	IDEM Risk-based Closure Guide
RCRA	U.S. EPA Resource Conservation and Recovery Act
RPD	Relative Percent Difference
RRC	Release-Related Chemical
PRPG	Petroleum Remediation Program Guide
SAP	Sampling and Analysis Plan
SC	IDEM Section Chief
SOP	Standard Operating Procedure

TO	Total Organics
VOC	Volatile Organic Compounds
SSB	IDEM Science Services Branch
UCL	Upper Confidence Limit
UST	Underground Storage Tank