Investigation of Underground Storage Tank Releases

Office of Land Quality
Petroleum Remediation Branch

Quality Assurance Program Plan

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Office: Office of Land Quality

Branch: Petroleum Remediation Branch

Section: Underground Storage Tanks Compliance Section
Petroleum Remediation Section

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QAPP Summary:

The quality assurance program plan (QAPP) 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.

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Introduction

The U.S. EPA Chief Information Officer Directive CIO 2105.1 effective March 31, 2021 (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 2018 Quality Management Plan (E. References #12). IDEM's Office of Land Quality (OLQ) developed the resulting QAPP 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), (E. References #3)
- U.S. EPA Guidance for QAPPs, (QA/G-5), U.S. EPA/240/R-02/009, December 2002, (E. References #4)
- IDEM 2018 Quality Management Plan, IDEM, May 1, 2018 (E. References #12)

A. Program Management

A.1. Distribution List

The QAPP is available via a link on IDEM's Leaking Underground Storage Tank web site (E. References #27). The QAPP is also electronically distributed to staff in the Petroleum Branch and Science Services Branch (SSB) and is available in the extranet IDEM QA Library. U.S. EPA Region 5 is provided a copy.

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A.2. 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 #9). 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.

An organizational chart for the IDEM Programs is provided in Figure 1. The narrative describes roles and responsibilities, as they pertain to this QAPP.

OLQ Assistant Commissioner (AC)

- Communicates needs to IDEM's commissioner.
- Oversees all OLQ Operations.
- Approves the Investigation of Underground Storage Tank Releases QAPP.

OLQ Deputy Assistant Commissioner (DAC)

- Oversees SSB and Petroleum Branch operations.
- Approves the Investigation of Underground Storage Tank Releases QAPP.

Petroleum Branch Chief (BC)

- Oversees all Petroleum Branch operations.
- Approves the Investigation of Underground Storage Tank Releases QAPP.

Petroleum Branch QA Coordinator

- Reviews and updates the Investigation of Underground Storage Tank Releases QAPP.
- Provides technical support to the BCs, SCs, and program staff.

Petroleum Remediation Section (PRS) Section Chief (SC)

- Oversees PRS staff review of owner or operator compliance with statutes, rules, guidance, standard operating procedures (SOP), and Investigation of Underground Storage Tank Releases QAPP.
- Approves site closure documentation, typically in the form of No Further Action (NFA) letters.
- Approves the Investigation of Underground Storage Tank Releases QAPP.

PRS Project Managers (PM)

- Evaluate 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.

UST Compliance SC and UST Closure Coordinator

- Inspect UST closure activities and sampling.
- Evaluate owner or operator compliance with UST program statutes, rules, and regulations.

IDEM OLQ Science Services Branch Roles and Responsibilities
The following roles provide technical evaluation services for the UST program.

OLQ Science Services Branch Chief

- Ensures SSB compliance with Indiana Statutes, Indiana Administrative Code, IDEM guidance, QAPPs, SOPs, and work summaries.

OLQ Chemists

- Provide review, verification, and validation of data generated for the UST program.
- Evaluate project goals, and review sample collection documentation, analytical methods, data reviews, and data acceptability based on analytical data results, laboratory quality assurance and quality control (QA/QC), sampling reports, and procedures.
- Site specific sampling data
    - 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, or TO-15 SIM (all canister-based methods) 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
- Review Investigation of Underground Storage Tank Releases QAPP.

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, and appropriateness of engineering and institutional controls (ICs).

OLQ Engineers

- Evaluate effectiveness and design of remediation systems.

OLQ Risk Assessors

- Provide technical support for PRS sites seeking risk-based closure.
- Evaluate potential exposure pathways.

Owner or Operator and Consultant Roles and Responsibilities

- Comply with UST program applicable Indiana Statutes (13-23) (E. References #10), Indiana Administrative Code (329 IAC 9) (E. References #11), and IDEM guidance.

Figure 1 IDEM Management Organizational Chart

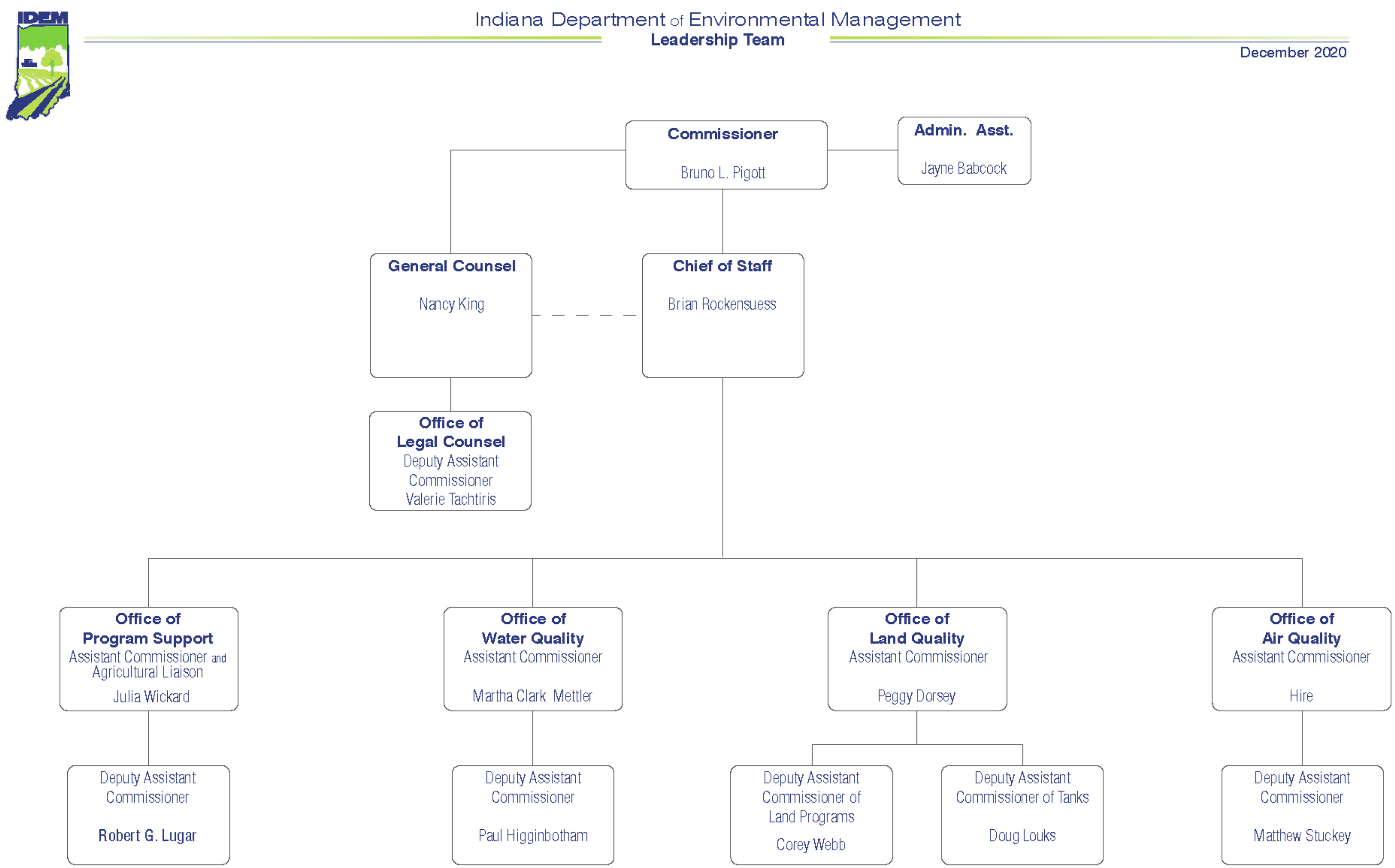


Figure 2 Office of Land Quality Branches and Sections

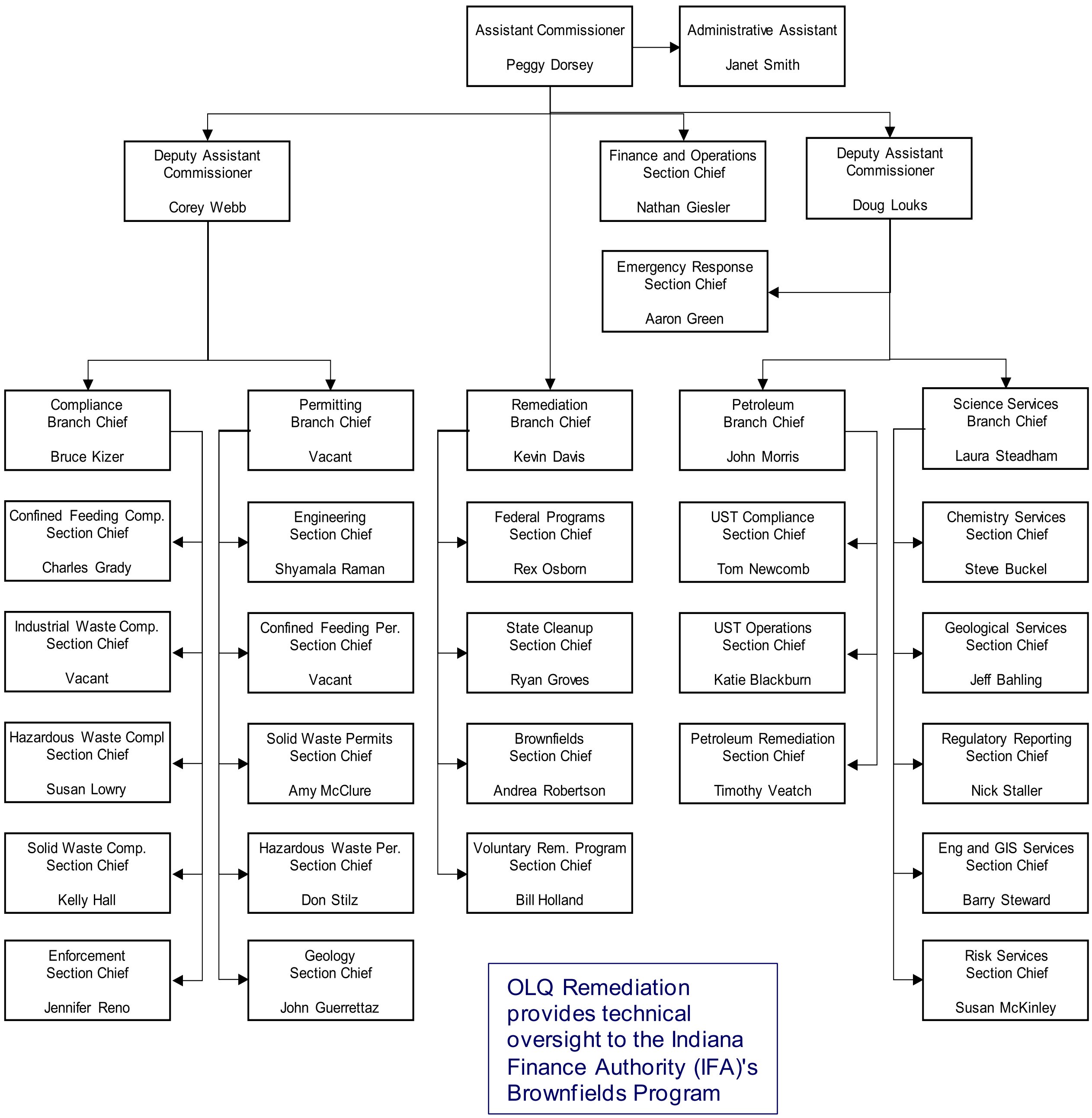
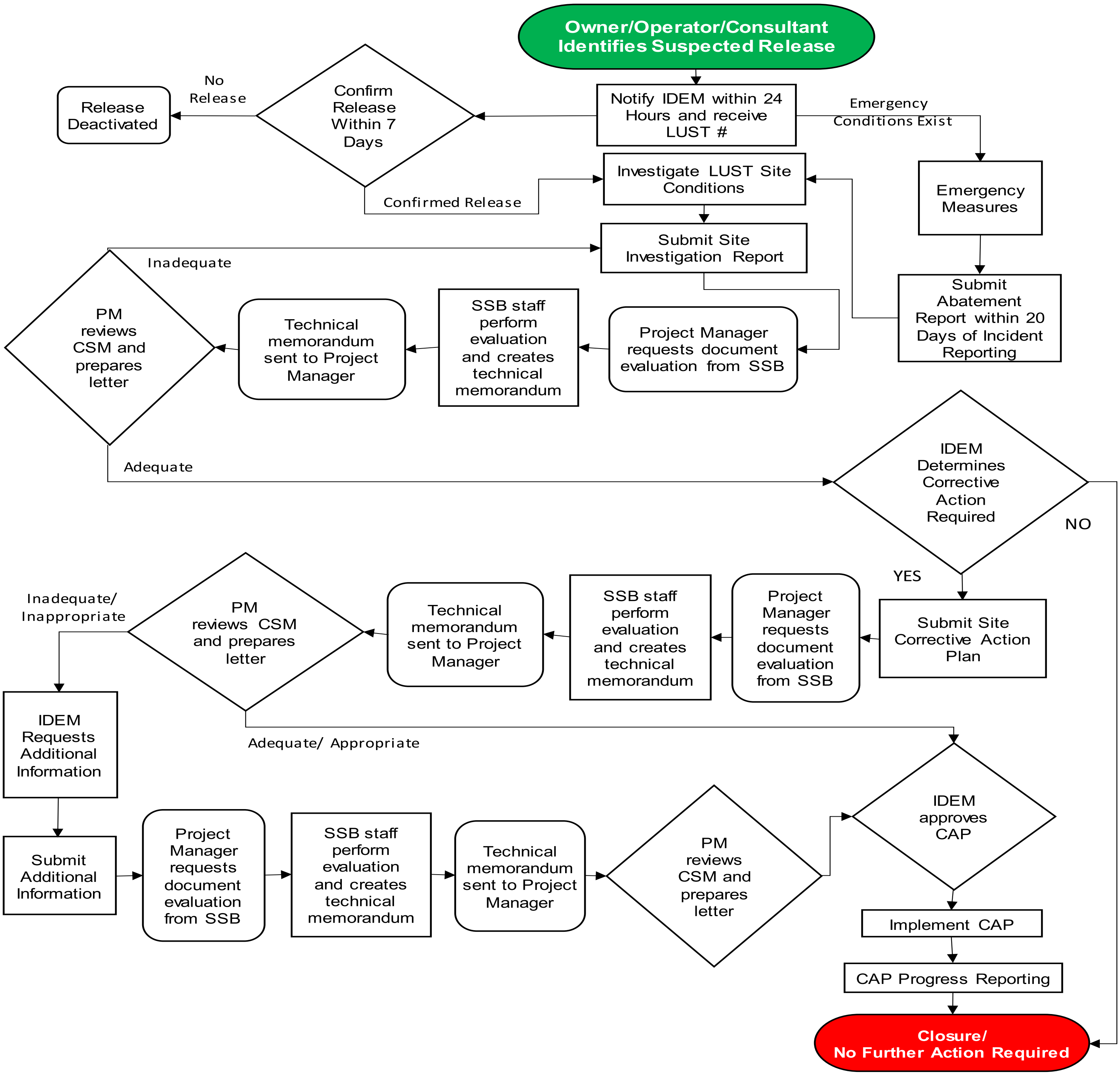


Figure 3 Document Flow Between the OLQ Petroleum and Science Services Branches



A.3. 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 Remediation Closure Guide (E. References #15) describes how to achieve consistent closure of contaminated media by documenting:

- How to assess contamination present at a site.
- How to evaluate and mitigate potential exposure pathways to contamination.
- Options for determining risk-based site closure levels, remedy selection, and implementation.
- How to achieve closure and NFA status.
- The use of ICs as a closure option to manage residual contamination and exposure risk.

A.4. 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.

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 I summarizes tasks within the categories, includes references to sources for additional information and includes project schedule dates. The three categories make up the 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 #7). As required by U.S. EPA's systematic planning process (E, References #5) for the collection and evaluation of environmental data, developing a Conceptual Site Model (E. References #16) is an integral step in clarifying cleanup objectives for a site and determining appropriate data quality objectives (DQOs).

Table 1 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 7 days the RP confirms release or no release	329 IAC 9-1-1(c) which incorporates 40 CFR Part 280.52 329 IAC 9-5-2
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 9-5-3.2 329 IAC 9-5-4.2
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 9-5-5.1
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 9-5-6
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 9-5-7
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 9-5-7
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 9-5-7

A.5. Quality Objectives and Criteria

A.5.1. 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 (E. References #5) 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 contaminants, 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 screening levels and 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 detected contamination in soil and groundwater to the screening levels (RCG sections 1.3.1, 1.3.2, and Appendix A, E.

References #15). The screening levels are risk-based numerical values for each contaminant 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. Table 2 shows the requirements for both MDDR and full QA/QC data packages.

In addition to the elements in Table 1, the following sampling-related items should support every investigation:

- 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, or TO-15 SIM (all canister-based methods) and use of 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 (RCG Appendix IV E. References #15 or similar)

Table 2 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 RCG Table A-6.

Step 4: Define the Study Boundaries
The spatial and temporal boundaries of each site may vary. As necessary, collect samples on-site or off-site to determine the nature and extent 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. (RCG Chapter 6, E. References #15)

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. (RCG Chapter 6, E. References #15)

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 RCG Section 3.9 (E. References #15), evaluate all useable 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 exposure point concentrations (EPCs). Methods for deriving EPCs vary according to sampling approach. For judgmentally collected samples, the individual sample results for each potential contaminant are generally the EPCs. Where judgmentally collected samples are of sufficient density and spacing, estimating the upper confidence limit (UCL) of the mean 49 to represent the EPC may be appropriate. 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 EPC, particularly where a few individual sample results exceed remediation objectives. For systematically collected samples, the EPC is an appropriate UCL calculated for each potential contaminant using results from a sample array corresponding to the area under evaluation. The resulting UCL is the EPC. For more details, refer to RCG Section 8.4 (E. References #15).

A.5.2. 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 3 identifies the potential petroleum contaminants.

Table 3 Potential Petroleum Contaminants

Potential Petroleum Contaminants[1]

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 June 21, 2012

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 4 and Table 5 provide a general program listing of MQO and DQI elements for project field and analytical control standards respectively.

Table 4 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 5 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.6. Special Training or Certification

All reports 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.7. Documents and Records

A.7.1. IDEM Investigation of UST Releases QAPP

The most current, approved version of this QAPP is available in three places. Owner or operators and their consultants access the document on the Leaking UST Program Website (E. References #27). IDEM staff access the document on the IDEM SharePoint site for the Petroleum Branch, INFODump QA System Tools page under Active QAPPs, IDEM QA Library, and Leaking UST Program Website (E. References #27).

A.7.2. 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 RCG 2012 (E. References #15) and State Rules 329 IAC 9 contain detailed guidance for sampling procedures.

B.1. Sampling Process Design

B.1.1. Rationale for the Design and Design Assumptions

Typically, collect samples from subsurface soil and groundwater media. Collect samples from surface soil (spills or overfills) and surface water, when applicable and if needed. In addition, and if needed, 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 does allow flexibility in the selection of sampling points if appropriate justification is provided to the agency from the consultant performing the work (e.g., the sampling point location is inaccessible). Maintain and update a CSM as new information becomes available.

Include the contaminants of concern in the analytical suite for petroleum USTs in four main groups: gasoline, diesel, hydrocarbon oils, and waste oil. Additional information is available in Table 2 and Table 3.

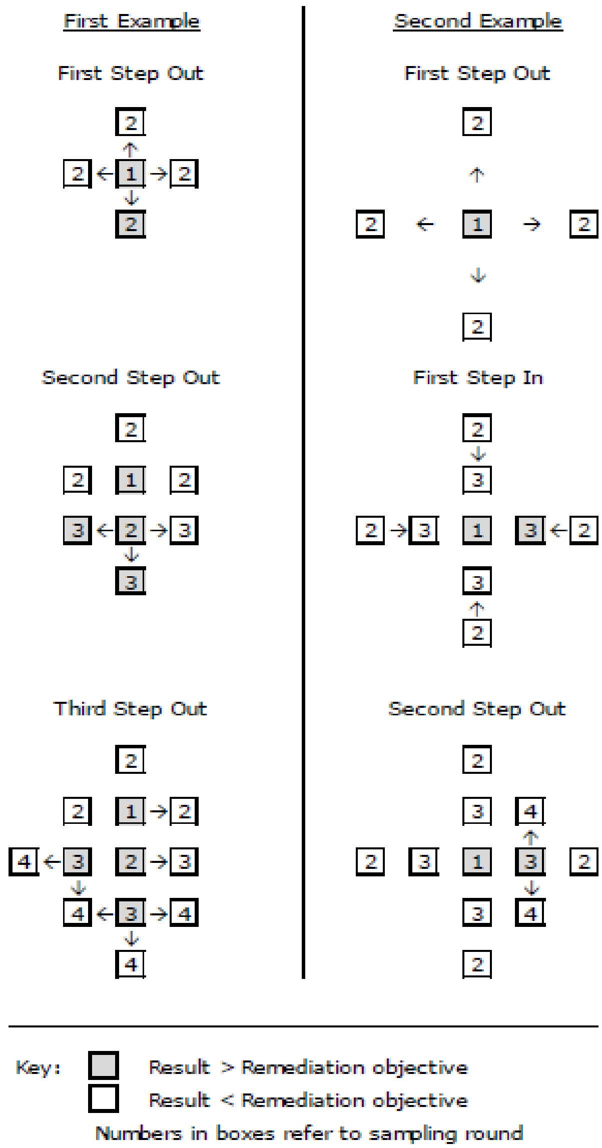
B.1.2. Procedures for Locating and Selecting Environmental Samples

The RCG page 41 Figure 3-A describes possible horizontal delineation efforts by employing a step-in or step-out procedure (Figure 4). In the figure, each box represents a sample location and the numbers within the boxes correspond to sampling round. A box containing a 1 identifies the sample collection location during the first sampling round. A box containing a 3 identifies the sample collection location during the third sampling round. Shaded boxes represent sample results significantly exceeding the remediation objective.

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 second example in Figure 4 illustrates the step-in procedure. In this example, a bounded exceedance is more tightly bound using a second set of samples placed closer to the initial exceedance. Step-in procedures are especially useful when attempting to reduce the size of an area proposed for active remediation or ICs.

Figure 4 Step-in or Step-out Method of Sample Location



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 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 RCG guidance document and 329 IAC 9.

UST program reports (Table 1) 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 such as equipment failure or a need for additional supplies arises. Thoroughly document all deviations and corrective actions.

B.3. Sample Handling and Custody

Remediation Closure Guide Section 3.1 (E. References #15), 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 in which 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 4 ± 2 ºC

- 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 sampler's signature.

Label all sample containers using waterproof ink at the time of sample collection but prior to filling. 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 permits performance of analyses within the prescribed holding time. Shipping samples by courier or overnight mail to the laboratory is allowed. IDEM recommends use of bubble-wrap packing materials and resealable plastic bags containing ice. Tape the cooler 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 4 ± 2 °C. 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 Supplemental Guidance for Sampling Soil and Waste for VOCs technical guidance document (E. References #22) 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.5.2. 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. In the event questions may arise during data evaluation, IDEM reserves the right to request full QA/QC documentation from the sampling event and the laboratory utilized.

B.5.1. 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.5.2. 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.5.3. 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.5.4. Completeness

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

B.5.5. 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.5.6. 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 6 and Table 7 provide a general program list of DQI elements for project field and analytical control standards. Site-specific criteria modification may occur.

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.
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 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 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 full QA/QC documentation from the sampling event and the 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 (computer modeling, Indiana Department of Natural Resources 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 RCG Table 3-A (E. References #15).

- 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 signs all field records. The 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 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

The current guidance for program documentation submittals is on IDEM's OLQ Document Submittal Guidelines website (E. References #17).

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 (EPA Data Quality Assessment: A Reviewer's Guide (QA/G9R, E. References #6)

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. 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 (release reports, investigation reports, CAPs, quarterly monitoring reports, etc.,) 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). Archive documents 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 43 (E. References #12).

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 Section' and PRS' responsibilities with the U.S. EPA, which provides the program with partial funding through federal funds. The UST Section and PRS develop an annual work plan, and report progress 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 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 #12). 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 Science Service Branch QA Coordinator, and technical staff (e.g., chemists, geologists, risk assessors). Non-Petroleum Branch staff assessments, such as the IDEM quality managers and by SSB staff, 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 (QAPP 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 are referenced in the IDEM 2018 Quality Management Plan.

C.1.2. Assessment of Individual Program Activities

- Surveillance
  The PM is responsible for monitoring the status of a project and, 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 (e.g., reports, memoranda, and correspondence) are subject to review by other PMs, senior environmental managers, or SCs. The BC, AC, or commissioner may also review 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 staff 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 #8)
  Sampling Soil and Waste for Volatile Organic Compounds (VOCs) Technical Guidance Document (E. References #22)
  Conceptual Site Model Technical Guidance Document (E. References #16)
  Drilling Procedures and Monitoring Well Construction Guidelines Nonrule Policy Document (E. References #14)
  The Micro-Purge Sampling Option Technical Guidance Document (E. References #25)
  The Non-Purge Sampling Option at Petroleum Sites Technical Guidance Document (E. References #26)
  Groundwater Sampling with Peristaltic Pumps (E. References #24)
  Investigation of Manmade Preferential Pathways (E. References #19)

Proper Investigative Techniques for Shallow Bedrock (E. References #21)
Aquitard and Fine Grained Sediment Characterization (E. References #18)
Vapor Intrusion Investigation Documentation (E. References #23)
Sampling and Analysis of Ground Water for Metals at Remediation Sites Waste-0057-NPD (E. References #13)
Polyethylene Diffusion Bag Samplers (E. References #20)

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 Science Services Branch 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 RCG section 3.7. 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 to the sampling design, or for adequate documentation and justification when sampling design modifications occur.

D.1.2. Sample Collection Procedures

Data submittals' (Table 1) 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 (RCG Section 3.9.1).

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 and laboratory instrument calibration information to ensure performance of calibrations.

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.

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
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Appendix A

List of Acronyms

CSM	Conceptual Site Model
COC	Contaminant of Concern
DQO	Data Quality Objective
GC	Gas Chromatography
GC/MS	Gas Chromatography and Mass Spectroscopy
U.S. EPA	U.S. Environmental Protection Agency
IAC	Indiana Administrative Code
IC	Initial Calibration
IDEM	Indiana Department of Environmental Management
LUST	Leaking Underground Storage Tank
MDDR	Minimum Data Documentation Requirement
MS/MSD	Matrix Spike and Matrix Spike Duplicate
OLQ	IDEM Office of Land Quality
PAH	Polycyclic Aromatic Hydrocarbons
PM	IDEM Project Manager
PRS	Petroleum Remediation Section
QA	Quality Assurance
QA/QC	Quality Assurance and Quality Control
QAPP	Quality Assurance Program Plan
RCG	IDEM Remediation Closure Guide
RCRA	U.S. EPA Resource Conservation and Recovery Act
RPD	Relative Percent Difference
SAP	Sampling and Analysis Plan
SC	IDEM Section Chief
SOP	Standard Operating Procedure
VOC	Volatile Organic Compounds
SSB	IDEM Science Services Branch
UST	Underground Storage Tank