Delaware Department of Natural Resources and Environmental Control

Division of Waste and Hazardous Substances

Quality Assurance Program Plan

Effective May 2026-May 2031

Version 1

Applicable Grants:

1. Brownfield Revitalization-Bipartisan Infrastructure Law (BIL) Funds: 95308601
2. Brownfield Subtitle C CERCLA 128(a): 97379704
3. UST Prevention: 98316111
4. RCRA C Hazardous Waste Management Program: 98315614
5. Leaking UST Corrective Action: 00339021
6. Pre-Remedial Response: 96397801

Memorandum of Agreement:

1. Memorandum of Agreement between the State of Delaware Department of Natural Resources and Environmental Control and the United States Environmental Protection Agency Region III Underground Storage Tank, April 1, 2019
2. Memorandum of Agreement between the State of Delaware and the United States Environmental Protection Agency Region III RCRA C, October 7, 2022
3. Voluntary Cleanup Program Memorandum of Agreement between USEPA Region 3 and the Delaware Department of Natural Resources and Environmental Control, August 6, 1997
4. Memorandum of Agreement and Quality Assurance Review Guidance for the Land, Chemicals, & Redevelopment Division's Brownfields & Revitalization Branch and the Laboratory Services & Applied Science Division's Applied Science & Quality Assurance Branch, February 28, 2022

Approval Sheet

5/11/2026

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5/11/2026

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Table of Contents

Acronyms

BIL	Bipartisan Infrastructure Law
CA	Corrective Action
CAPS	Compliance and Permitting Section
CBF	Certified Brownfield
CBFI	Certified Brownfield Investigation
CCV	Continuing Calibration Verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Program
COC	Chain of Custody
COPC	Contaminant of Potential Concern
CSM	Conceptual Site Model
DAG	Delivery of Analytical Services
DEN	Delaware Environmental Navigator
DERAC	Delaware Risk Assessment Calculator
DERBCAP	Delaware Risk Based Corrective Action Protocol
DNREC	Department of Natural Resources and Environmental Control
DOT	Department of Transportation
DQA	Data Quality Assessment
DQO	Data Quality Objective
DWHS, or Division	Division of Waste and Hazardous Substances
EDD	Electronic Data Deliverables
EDP	EQuIS Data Processor
ELS	Department of Water-Environmental Laboratory Section
EPA	Environmental Protection Agency
EPA R3	Environmental Protection Agency Region 3
ESA	Environmental Site Assessment
FE	Facility Evaluation
FOIA	Freedom of Information Act
FS	Feasibility Study
FSP	Field Sampling Plan
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
GIS	Geographical Information System
HI	Hydrogeologic Investigation
HIG	Hydrogeologic Investigation Guidance
HSCA	Hazardous Substance Cleanup Act
IATA	International Air Transport Association
ICAL	Initial Calibration
ICV	Initial Calibration Verification
IS	Internal Standard
LCS/LCSD	Laboratory Control Sample/Laboratory Control Sample Duplicate

LOD	Limit of Detection
LOQ	Limit of Quantitation
LUST	Leaking Underground Storage Tank
MB	Method Blank
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NELAC	National Environmental Laboratory Accreditation Conference
NPL	National Priorities List-Superfund
PARCCS	Precision, Accuracy, Representativeness, Completion,
PA/SI	Preliminary Assessment/Site Inspection
PCB	Polychlorinated Biphenyl
PE	Performance Evaluation
PID	Photoionization Detector
PO	Purchase Order
PQL	Practical Quantitation Limit
QA	Quality Assurance
QAM	Quality Assurance Manager
QAPP or Lapp	Quality Assurance Project Plan
QAPrP	Quality Assurance Program Plan
QC	Quality Control
QL	Quantitation Limit
QMP	Quality Management Plan
RAIS	Risk Assessment Information System
RAS	Routine Analytical Services
RBCA	Risk Based Corrective Action
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RL	Reporting Limit
RP	Responsible Party
RRF	Relative Response Factor
RS	Remediation Section
SA	Site Assessment
SAP	Sampling and Analysis Plan
SL	Screening Level
SOP	Standard Operating Procedure
SOPCAP	Standard Operating Procedures for Chemical Analysis Programs
SOQ	Statement of Qualifications
SSA	Site Specific Assessment
SSD	Site Status Database
SSTL	Site Specific Target Level
SW-846	Test Methods for Evaluating Solid Waste: Physical/Chemical Methods Compendium
TMS	Tanks Management Sites

TNI	The NELAC Institute
TSDF	Treatment, Storage, and Disposal Facility
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	Underground Storage Tank
VCP	Voluntary Cleanup Program
VOC	Volatile Organic Compound

GROUP A: PROGRAM MANAGEMENT

Program Purpose, Problem Definition, and Background

The Delaware Department of Natural Resources and Environmental Control (DNREC), Division of Waste and Hazardous Substances (DWHS or Division), is charged with protecting public health and the environment by ensuring the safe management of hazardous and solid wastes, preventing releases of hazardous substances and petroleum products, and overseeing the investigation and remediation of contaminated sites throughout the State of Delaware. The Division carries out this mission through regulatory oversight, permitting, compliance monitoring, inspections, enforcement, assessments, investigations, and corrective action activities. Central to all these responsibilities are the collection, evaluation, and application of reliable environmental data to support sound technical decisions, regulatory determinations, and effective risk management. In order to accomplish this, the Division receives funding from the Environmental Protection Agency (EPA) for several programs.

HSCA and Certified Brownfields

The Division is responsible for identifying, investigating, and remediating sites contaminated with hazardous substances to protect human health and the environment. This responsibility is established under the Delaware Hazardous Substance Cleanup Act (HSCA), 7 Del. Code Chapter 91, and is implemented in accordance with the Regulations Governing Hazardous Substance Cleanup, 7 DE Admin. Code 1375. Under HSCA, the Division oversees the investigation and cleanup of contaminated properties, including sites addressed through Delaware's Certified Brownfield (CBF) Development Program and the Voluntary Cleanup Program (VCP). These programs are designed to facilitate the assessment and remediation of environmentally contaminated properties while promoting redevelopment and reducing risks to surrounding communities.

CERCLA and Pre-Remedial

The EPA administers and enforces the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in Delaware. One of the key responsibilities of the Division is to perform various investigatory tasks at CERCLA sites. The Division performs preliminary assessment and site inspection activities at Pre-Remedial sites. The Division is also responsible for assisting and/or overseeing investigation and remediation at National Priorities List (NPL) sites.

RCRA C

The Division implements federal hazardous waste requirements under the Resource Conservation and Recovery Act (RCRA). RCRA established the nation's primary framework for managing solid, hazardous, and industrial waste through three interrelated programs, including management of nonhazardous solid waste under Subtitle D, comprehensive control of hazardous waste from generation through disposal under Subtitle C, and compliance with applicable air emission standards, including the collection and analysis of air stack samples to evaluate compliance with 40 Code of Federal Regulations (CFR) Part 63, Subpart EEE. The Division is authorized by the EPA to implement the Subtitle C hazardous waste program in the State of Delaware.

Underground Storage Tanks Prevention and Leaking Underground Storage Tanks

The Division has also been approved to implement Subtitle I of RCRA, which was enacted to address leaking underground storage tanks (LUST). DWHS has regulatory responsibility for underground storage tank (UST) systems under 7 DE Admin. Code 1351, enacted pursuant to 7 Del. C. Chapter 60 and 7 Del. C. Chapter 74, the Delaware Underground Storage Tank Act. The Division administers prevention and compliance programs designed to reduce the risk of releases from regulated tank systems, as well as corrective action oversight for LUST sites.

Across all these programs, the activities conducted by the Division involve a wide range of inspections, investigations, assessments, permitting actions, compliance determinations, corrective action oversight, and data reviews. Many of these activities rely on the gathering and analysis of environmental data. Ensuring that these data are accurate, consistent, and defensible is essential to supporting the decisions and actions implemented by the Division.

The purpose of this *Quality Assurance Program Plan* (*QAPrP*) is to establish and document the quality assurance (QA) and quality control (QC) requirements necessary to ensure that sampling and analytical data collected by or on behalf of the Division are scientifically valid, legally defensible, and of sufficient quality to support compliance and enforcement decisions. This *QAPrP* provides a standardized framework to promote consistency in compliance evaluation, sampling practices, data review, and document preparation across Division programs. By ensuring that data meets established data quality objectives, this *QAPrP* supports the Division's mission to protect human health and the environment through sound science and effective regulatory oversight.

This *QAPrP* was prepared in accordance with 40 CFR Part 35 and EPA CIO 2105.4 and follows the EPA *QA/G-5 Guidance for Quality Assurance Project Plans* and the EPA *Quality Assurance Project Plan Standard*. It is consistent with the DNREC *Quality Management Plan* (*QMP*) and serves as a tool to ensure consistent, reliable, and defensible data quality across all DWHS waste management and contaminated site activities.

Program Task Description

The Division conducts a wide range of environmental information operations under the various programs within it. The policies and procedures detailed in this *QAPrP* apply to the programs described below. Certain programs may require program-specific policies and procedures. Any such requirements and the programs to which they apply will be delineated in this *QAPrP*.

HSCA

Delaware's Hazardous Substance Cleanup Act (HSCA) (7 Del.C. Ch. 91) provides DNREC with the authority to take enforcement actions against responsible parties to ensure cleanup at sites with a release, or imminent threat of release of hazardous substances. State-led projects follow the HSCA statute and regulations and the cleanup is financed by the HSCA fund until the responsible party can be identified. Enforcement occurs when the responsible party fails to comply with the HSCA statute and regulations. The investigation process may consist of an Initial Investigation (II), followed by a Facility Evaluation (FE), then a Remedial Investigation (RI). Other HSCA activities may include Risk Assessments, which may occur at various stages of the HSCA process, remedial design, and site closure. HSCA activities are guided by the *Standard Operating Procedures for Chemical Analysis Programs* (*SOPCAP*), which can be found in Appendix A.

The DNREC CBF Development Program encourages the cleanup and redevelopment, reuse, or expansion of real properties which are or may be perceived to be environmentally contaminated. The DNREC CBF Development Program operates under the authority of the Delaware HSCA 7 Del. Code Chapter 91. The Program guides the investigation and cleanup of contaminated or potentially contaminated sites. DNREC provides comprehensive guidance and technical oversight throughout the CBF redevelopment process, including reviewing and interpreting environmental reports and directing technical and programmatic consistency for site assessment and remediation. DNREC may also receive funding through the USEPA Brownfields Program to conduct environmental site assessments and related activities at eligible CBF properties within Delaware. Using this funding, DNREC assists applicants in performing Phase I and Phase

II Environmental Site Assessments (ESAs), and other environmental investigations at properties with suspected releases of hazardous substances.

Owners of contaminated sites may enter the Voluntary Cleanup Program (VCP) pursuant to HSCA and the Delaware Regulations Governing Hazardous Substance Cleanup, 7 Del. Admin. Code § 1375. Within the VCP, it is the responsibility of DNREC to oversee the investigation and cleanup of the site, while the owner conducts one of the activities listed in the subsequent section. DNREC reviews and approves investigation work plans, sampling and analysis strategies, remedial action proposals, and final completion reports to ensure compliance with applicable state requirements and consistency with program objectives.

Pre-Remedial/Preliminary Assessment Site Inspection/Site Assessment

The Pre-Remedial/Preliminary Assessment Site Inspection/Site Assessment program includes sites that have been evaluated using the U.S. EPA Pre-CERCLA screening (PCS) process and have been deemed candidates for further assessment. These sites are evaluated via a site assessment, which involves performing a preliminary assessment and a site inspection on the site. The program will herein be referred to as “Pre-Remedial” for the remainder of this document.

National Priority List (NPL)

NPL sites are sites that pose a long term remedial response action that are carried out by EPA with DNREC involvement and assistance. EPA is the lead regulatory agency on NPL sites. The remedial response action should “permanently and significantly reduce the dangers associated with the releases or threats of releases of hazardous substances that are not immediately life threatening.” National Priorities List sites are governed under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA).

RCRA C

The RCRA Subtitle C program applies to owners and operators of hazardous waste treatment, storage, and disposal facilities (TSDFs) and hazardous waste generators. The program includes both a regulatory compliance component and a corrective action component. The compliance component ensures that facilities adhere to applicable hazardous waste management requirements, including waste identification, storage, treatment, recordkeeping, and reporting standards, through permitting, inspections, and enforcement activities. The Corrective Action program addresses the investigation and

cleanup of releases of hazardous substances. The facility is assessed to determine if human exposures and groundwater releases are under control. The corrective action process is implemented in four phases: RCRA Facility Assessment (RFA), RCRA Facility Investigation (RFI), Corrective Measures Study (CMS), and Corrective Measures Implementation (CMI). RCRA C sites are cross referenced as HSCA sites.

Underground Storage Tank (UST) Prevention

The DNREC UST compliance program is responsible for ensuring the safe operation of over 400 Federally regulated underground storage tanks and 150 State regulated underground storage tank heating oil facilities in the state. The program oversees the installation, retrofitting, and removal of underground storage tank systems to verify the work is completed properly and by qualified, trained, and certified individuals and companies. Underground storage tank systems which are subject to the requirements of the underground storage tank compliance program can be found at gas stations, manufacturing facilities, schools, and hospitals.

Leaking Underground Storage Tank (LUST)

The Division oversees the investigation and cleanup of petroleum and chemical contamination at properties where a confirmed release has occurred from USTs to ensure the appropriate corrective action is pursued. Remediation and investigation activities are guided by the *Delaware Risk-Based Corrective Action Protocol* (*DERBCAP*), a risk-based clean up approach that assesses the human-health and environmental risks associated with petroleum and chemical impacts to soil and groundwater. *DERBCAP* can be found in Appendix B.

Within each of these programs, various investigations, assessments, and other activities are performed. Table 1 below provides more information. It is important to note that not all the activities listed in Table 1 require sampling. The activity description will indicate whether sampling is required.

Table 1 Program Activities

Type of Activity	**Description**
Initial Investigation	If DNREC receives information indicating that a suspected release has occurred or is imminent, typically an initial investigation will take place to determine if further action is warranted. This investigation usually includes a site visit and an evaluation of reports, audits and other records. Based on the initial investigation, the Department may decide to conduct a facility evaluation (FE), require an

	immediate response action, or decide no further action is warranted at the present time.
Facility Evaluation (FE)	If the initial investigation indicates a release or imminent threat of release, the RS conducts an FE to assess the related risk. This evaluation may consist of a review of general facility and existing information and/or a field investigation, including sampling of soil, air, groundwater, surface water, sediments and biota as appropriate. The scope of the FE is flexible and dependent on the specific conditions of the facility.
Remedial Investigation (RI)	A RI is conducted at a facility to determine the nature and extent of the release of hazardous substances and what risks are posed to public health, welfare and the environment. The RI typically includes site characterization, field investigations, as well as collection of engineering data that may be required to complete a remedial design.
Feasibility Study (FS)	A FS is performed after a Risk Assessment has determined that the release of hazardous substances on a Site poses an unacceptable risk to human health or the environment and there is a complete pathway from the source to a receptor (present or future). The purpose of the FS is to identify and screen remedial technologies, develop, and evaluate each Remedial Action alternative using technologies carried through the initial screening, and recommend the Remedial Action most appropriate for the Site based on the Remedial Action Objectives. A FS evaluates multiple remedial alternatives, and the scope is dependent upon the complexity of the remedial action needed at the site.
Certified Brownfield Investigation (CBFI)	The CBFI only applies to Certified Brownfield sites. Its purpose is to assess the nature, extent, and impact of actual or perceived release of hazardous substances at the real property defined as a Certified Brownfield at a site. It also aims to address the risk posed by the release of hazardous substances that exist at that real property.
Phase I Environmental Site Assessment (ESA)	The Phase I ESA uses existing information to understand the property conditions by examining current and historical uses of the site and potential threats to human health or the environment. The assessment may include a review of existing records and databases, visiting the site to visually inspect it and the surrounding area, and interviewing owners, neighbors, and past workers. Environmental samples are not collected during a Phase I ESA.
Phase II Environmental Site Assessment (ESA)	The Phase II ESA is recommended if the Phase I ESA results reveal known or potential contamination found on the property. It involves a field investigation where areas of concern may have been identified through the Phase I ESA. Samples are collected to determine the type and distribution of contamination. The requirements described in this *QAPrP* are applicable to federally funded Phase II ESAs.
Site Specific Assessment (SSA)	SSAs are conducted to evaluate environmental conditions at individual properties and to determine the presence or potential presence of hazardous substances. These assessments may include activities such as record reviews, site reconnaissance, environmental sampling, and Phase I and II ESAs. Data generated through SSAs are used to characterize site conditions and support decisions regarding additional investigation, and potential cleanup actions.
Preliminary Assessment/Site Inspection (PA/SI)	Preliminary Assessment (PA) and Site Inspection (SI) are programs under the EPA Superfund program that examine locations reported to DNREC as potential hazardous substance release sites. A Preliminary Assessment is conducted to determine whether a site should be considered for further study because it poses a risk to human health and the environment. The process usually consists of reviewing historical and current data, such as aerial photographs, previous

	investigations, deed searches, and interviewing present and past owners. A Preliminary Assessment is conducted according to guidance issued by the U.S. EPA and the Preliminary Assessment and Site Inspection State Cooperative Agreement Guidance. If the Preliminary Assessment reveals that a relevant risk(s) may exist but does not pose an immediate threat, a more extensive study called a Site Inspection will be performed. A Site Inspection builds upon the information gathered during the Preliminary Assessment, and also includes sampling of soil, groundwater, and other media, as applicable. This is necessary to better define the extent of the potential risk at a site and provide sufficient data to determine the next action (i.e., additional investigations, emergency response, enforcement, and/or remedial response).
RCRA Facility Assessment (RFA)	An RFA is an initial site assessment of site conditions, potential releases and exposure pathways to determine whether a cleanup may be needed. See EPA's RCRA Facility Assessment Guidance here for details.
RCRA Facility Investigation (RFI)	RFIs are performed to determine the nature and extent of contamination of a site to support selection and implementation of appropriate remedies. An RFI consists of four tasks: 1. Description of Current Conditions, including facility background, nature and extent of contamination, implementation of Interim Measures, and an Environmental Indicator (EI) Assessment, 2. RFI Workplan Requirements, including project management plan, data collection quality assurance project plan, data management plan, community relations plan, 3. RCRA Facility Investigation, including environmental setting, source characterization, contamination characterization, potential receptor identification, risk assessment, and data analysis, 4. Reports, including the Description of Current Conditions, RFI Workplan, RFI Report, and Progress Reports. See EPA's RCRA Facility Investigation Guidance, Volumes I, II, III, and IV for details.
Tanks Management Site Assessment (SA)	This type of assessment is specific to Tank Management Sites (TMS) and involves an investigation and report that measures the presence of a release where contamination is most likely to be present at a petroleum impacted site. DNREC implements a tiered system of assessments for investigating TMS where a release has occurred. Selection of sample types, sample locations, and measurement methods shall be based on the nature of the stored substance, the type of backfill, the depth to groundwater, and other factors appropriate for identifying the presence of a Release. A SA is not restricted to the property boundary. Further information can be found in *DERBCAP*.
Hydrogeologic Investigation (HI)	According to Part E, §4.1.1 UST Regulations, a hydrogeologic investigation is required whenever a UST leak has been confirmed. The goal of the HI is to determine the nature and extent of the release, and estimate the potential risks to human health, safety, and the environment. HIs are conducted in accordance with the *Hydrogeologic Investigation Guidance* (*HIG*) in Appendix C.
Compliance Evaluation Inspection (CEI)	A CEI evaluation is primarily an on-site evaluation of the compliance status of the site with regard to all applicable RCRA Regulations and Permits (except for groundwater monitoring and financial assurance requirements). Although portions of a CEI evaluation may routinely be conducted in an agency office setting, such "office" evaluations are considered an integral part of a CEI in terms of completing an evaluation. The overall evaluation of a site's compliance status may take place over multiple days necessitating multiple site visits and activities. The entire set of activities and associated effort is considered a single CEI. The major function of a CEI is an overall review of the site's performance. The inspection includes an on-site examination of records and other documents maintained by the site and an evaluation of the site's compliance with all

	applicable requirements and adequate sampling, when necessary. Where appropriate, it includes groundwater monitoring assessment outlines or plans, closure/post-closure plans, contingency plan reviews, waste analysis plan reviews, and preparedness and prevention plan reviews. Specifically excluded from the CEI type of evaluation are financial assurance requirements and inspections of groundwater monitoring systems. A review of financial assurance requirements is most often conducted by "agency experts" and appropriately coded as a Financial Record Review (FRR) evaluation. Inspections of groundwater monitoring systems are coded as either a Groundwater Monitoring Evaluation (GME) or Operation and Maintenance Inspection (OAM).
Case Development Inspection (CDI)	A CDI is an on-site inspection conducted for the sole purpose of gathering additional information that supports the evidence (i.e., samples, on-site record review, interview, etc.) for a potential or pending enforcement case. A CDI is performed only after an initial evaluation has resulted in the observation of potential violations.
Groundwater Monitoring Evaluation (GME)	A GME is a detailed evaluation of the adequacy of the design and operation of a site's groundwater monitoring system as per EPA's *Final RCRA Compliance Groundwater Monitoring Evaluation Guidance Document*. Evaluation of the groundwater monitoring system design should be conducted by a hydrogeologist and includes the review of the owner/operator's characterization of the hydrogeology beneath hazardous waste management units, monitoring well placement and depth/spacing, and well design and construction. It is essential that the GME ensure that the owner/operator has designed an adequate groundwater monitoring system. In addition, an integral part of the GME is the review of the operation of the groundwater monitoring system through an evaluation of the owner/operator's sampling and analysis plan and its implementation. GMEs should be scheduled, to the maximum extent possible, to coincide with owner/operator sampling events to permit the field evaluation of sampling techniques. Inspectors should collect splits or conduct EPA/State sampling as a random check of groundwater quality data at any wells that may have indicated releases to support enforcement of corrective action.
Operation and Maintenance Inspection (OAM)	The Operation and Maintenance Inspection is a periodic inspection of how well a groundwater monitoring system continues to function once it is considered well designed. The inspection focuses on the condition of wells and sampling devices. Evaluation of well recovery notes, turbidity of water, total depth, depth to water, etc. should be made and compared to historic data. Sampling devices should be tested and if necessary, pulled and visually inspected. The findings of an O&M inspection will indicate whether case development is warranted and/or will serve to focus future GMEs. The inspector should be experienced in evaluation of groundwater monitoring systems, e.g., hydrogeologist. This inspection can include sampling.
Closure Procedures	Each RCRA facility must have an approved closure plan which meets regulatory requirements. Facilities are required to remove all hazardous waste from waste management units prior to closure.
Post-Closure Procedures	Each RCRA facility performing post-closure care on a regulated hazardous waste management facility must have an approved post-closure plan.
Enforcement Procedures	The DNREC enforcement process begins with violations being noted during compliance monitoring, then classification of definitive violations and non-compliance, followed by the issuance of enforcement actions.

Permitting Procedures*	All facilities that treat, store, or dispose of hazardous waste require a permit prior to construction and operation of a waste management facility. The EPA and the Division work together to coordinate permitting activities including technical review, enforcement, public notice, response to comments, permit determination, permit appeal, and permit modifications.
Permitting Procedures-Transporters*	All transporters of hazardous waste must have a permit from DNREC, CAPS which involves a completeness review, public notice, permit determination, enforcement, and appeal.
Notification*	All hazardous waste generators and owners/operators of hazardous waste treatment, storage, and disposal facilities are required to notify the state of their hazardous waste activities.
Manifest Procedures*	Tracks hazardous waste shipped to and from TSD of the facility accepting hazardous wastes.
Annual Report Procedures*	Large Quantity Generators and treatment, storage and disposal facilities are required to file an annual report which indicates the quantity of hazardous waste and the disposal methods for the year. This information is then compared with the manifests from the transporters to determine if any violations or noncompliance have occurred.
Variance, Waivers and Delisting Procedures*	A person may petition the Secretary to delist a hazardous waste by proving that said material does not contain chemical constituents or characteristics that would cause the waste to be hazardous or present a threat to human health and the environment. Variance is an approved deviation from an established rule or regulation, or plan or standard or procedure.
Enforcement Procedures*	The DNREC CAPSD enforcement process begins with violations being noted during compliance monitoring, then classification of definitive violations and non-compliance, followed by the issuance of enforcement actions.
* Projects that require non-direct data review, see Section B for more information.	

Information/Data Quality Objectives and Performance/Acceptance Criteria

In general, environmental information and non-direct data collected for Division activities will be used to:

- Ascertain if there is a threat to public health or the environment
- Locate and identify potential sources of contamination
- Perform risk assessments
- Ascertain if additional remediation is required
- Formulate remediation strategies and estimate remediation costs
- Determine treatment and disposal options
- Identify all those participating in the management of hazardous waste in the state including generators, treatment, storage, and disposal facilities
- Monitor and ensure regulatory compliance with state and federal hazardous waste rules and regulations

The purpose of data quality objectives (DQOs) is to define how environmental information will be collected and evaluated for its quality and suitability for its intended use. The Division uses the systematic planning process as outlined in the EPA's *Guidance on Systematic Planning Using the Data Quality Objectives Process*. The DQO process is used to systematically plan for generating environmental data of a known quality to support decisions. This is done through focused, documented sampling, testing, and data evaluation activities. The DQO process must be followed for every Site and must be included in the sampling plan. The seven step process is as follows:

1. **State the Problem:** Identify the problem, the leader, members of the planning team, the hazard to be investigated, and the resources to be utilized (i.e. budget, personnel, and schedule).
2. **Identify the Decision:** The principal study question must be identified along with potential outcomes or actions that may be taken in response to the study question.
3. **Identify the Inputs to the Decision:** Identify the information that is needed, the sources of information, the action levels that will be used, and the sampling and analysis methods that meet data requirements.
4. **Define Study Boundaries:** Identify the target population of interest. Determine what factors may limit the scope of the project, i.e. political, temporal, and spatial boundaries, practical constraints.
5. **Develop a Decision Rule:** The decision statement is replaced by the decision rule, which involves three separate components: select the appropriate population parameter, verify that the action level is clearly identifiable, and formulate if/then statements that can guide decision making.
6. **Specify Tolerable Limits on Decision Errors:** The purpose of this step is to define how much uncertainty can be tolerated when making a decision(s). Performance and acceptance criteria should be established in order to ensure uncertainty is within acceptable limits.
7. **Optimize the Design for Obtaining Data:** Use the information produced from the first six steps to select a sampling design that achieves the goals of the project. This would include finalizing analytical methods and determining sample numbers and techniques.

An enhanced DQO process is required for an EPA Brownfields SSA in order to expedite sampling plan reviews. The enhanced data quality objective process is as follows:

1. **State the Problem:** A site maybe contaminated or unsuitable for redevelopment because of the potential risk(s) associated with chemicals of potential concern. (COPC). The nature and extent of that contamination must be evaluated before redevelopment. DNREC RS must resolve all human health and ecological risks at the site before a Proposed Plan of Remedial Action is published for public comment.

2. **Identify the Decision:** Establish a principal study question that the study will address and describe potential outcomes or actions that may be taken in response. This will involve determining if contamination is present and evaluating whether the nature and extent of the contamination exceed HSCA risk based concentration values. Select remedies that prevent unacceptable risk to human health and the environment.
3. **Identify Inputs to the Decisions:** COPC may be identified in various environmental matrices including shallow surface and subsurface soils, groundwater, surface water, sediment, indoor air, and sub slab soil gas. The concentrations of COPC will be compared to HSCA risk based screening concentrations to initiate the site decision making process. Additionally, historical information such as previous site investigations, site history, potential ecological receptors and any other relevant information may be considered when making site decisions. All historical information should be included in the sampling plan.
4. **Define the Study Boundaries:** A current geographical area of the environmental investigation should be documented in the sampling plan. The sampling plan should include the full site boundary, specifying its dimensions including depth and altitude, as well as all site environmental receptors. Budgetary and temporal constraints should be identified in the sampling plan. The extent of the release and therefore actual site boundaries will result from the sampling.
5. **Develop a Decision Rule:** If the COPC(s) are below the HSCA risk based screening value, then no further action is required. If the COPC(s) are above HSCA risk based screening values, then a formal site specific risk assessment must be conducted according to the *Guidance for Human Health Risk Assessments under HSCA*, which can be found in Appendix D. If an unacceptable risk(s) is identified, then a remedial alternative(s) must be evaluated through a Feasibility Study. The remedial alternative(s) or no further action for a site is published in a Proposed Plan for Remedial Action per DNREC RS regulations.
6. **Specify Tolerable Limits on Decisions Errors:** The first step in the evaluation process to see if there is a potential for risk is to screen a chemical or contaminant found in a sample against the HSCA Screening Level Table. This can be done by generating a 95% upper confidence level of the mean for a contaminant from the data or using the maximum concentration and comparing that value to the Screening Level (SL). If a contaminant exceeds the SL, then it could be an environmental risk and needs further evaluation. A contaminant that exceeds the SL is called a COPC. The data quality utilized to determine or characterize the nature and extent of COPC(s) must comply with the PARCCS parameters described in the following section.
7. **Optimize the Design for Collecting Data:** Use the information produced from the first six steps to select a data collection design that achieves the goals and adheres to the DQOs. The outcome of the project will be evaluated to determine if it meets the

environmental investigation objectives. The environmental investigation will be required to follow all standard operating procedures, guidance, policy, and applicable standards to adhere to the DQOs.

PARCCS Parameters

Data quality indicators are assessed by evaluating the Precision, Accuracy, Representativeness, Comparability, Completeness, and Sensitivity (PARCCS) of environmental data to ensure its reliability and quality. PARCCS parameters should be followed during both sample collection and analysis phases of the project. The PARCCS parameters are defined as follows:

Precision: Precision is a measure of the reproducibility of a set of analytical results obtained under similar conditions. Precision is dependent on analytical methods, equipment, and sample matrix. The Division evaluates precision through the analysis of duplicate samples (matrix spike and matrix spike duplicate pairs, field duplicates, and laboratory control sample and laboratory control sample duplicate pairs) using the calculation for Relative Percent Difference (RPD) shown below. Acceptance criteria for RPD may vary by matrix and analysis but generally soil and aqueous samples will have acceptance criteria of no more than 50% and 30%, respectively. RPD limits will be defined in the laboratory's SOP, and in the absence of laboratory generated acceptance criteria, the criteria in *SOPCAP* Tables 6.2 and 6.3 will be used.

$$RPD = \frac{X1 - X2}{(X1 + X2) \div 2} \times 100$$

Where: X1= first sample value andX2= second sample (duplicate) value

Accuracy: The degree of agreement between a measured value and the "true value" for a sample. Since true values are not always available, accuracy is often estimated by adding (i.e. spiking) known amounts of the target parameters into the sample at various points in the sampling and/or analytical process and then measuring their concentrations through the Percent Recovery (%R) or Percent Bias (%B) equations shown below. Accuracy can be evaluated by determining the %R or %B for laboratory control samples and matrix spikes. The acceptance criteria for %R will be derived either from the laboratory's SOPs or *SOPCAP*, but %R acceptance criteria is generally 70-130%. Requirements will be specified in the site-specific plan.

$$\%R = \frac{C_r}{C_a} \times 100$$

$$\%B = \frac{C_r - Ca}{Ca} \times 100$$

Where: C_r= reported concentration and C_a= actual concentration

Representativeness: Representativeness is a qualitative measure of the degree to which a sampling design, field activities, and laboratory analyses accurately and precisely reflect environmental conditions and variations at a site. It is achieved through the selection of sample locations, quantities, and analytical methods, as well as through the ability of field personnel to properly collect samples and laboratory personnel to analyze them in accordance with established procedures. Field measures supporting representativeness include implementation of site-specific plan, adherence to sampling procedures, use of proper sample containers and preservation, and collection of an adequate number of samples. Representativeness in a laboratory setting is maintained through proper sample homogenization and dilution and meeting technical hold times.

Comparability: Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Field measures of comparability include comparisons of previous data points, comparison to similar data points, and ensuring similar methods are used each time samples are collected at a site. It may be evaluated in the lab via the GC/MS tune and instrument calibration. Comparability may also be measured by comparing analytical screening results and confirmatory results, although there is no acceptance criteria for this. Compound nomenclature and reporting units will be in conformance with the current SOPCAP, and any subsequent clarifications, amendments, modifications, or revisions. CAS numbers and units of ppm, ppb, mg/Kg, ug/Kg, mg/L, ug/L, will be standard. It is the goal of this *QAPrP* that all data generated by the Division can be utilized in other DNREC programs for evaluation and consideration and be made available for projects unrelated to DNREC RS oversight.

Completeness: A measure of the amount of valid data obtained as compared to the amount expected from the project at its inception. Data completeness will be assessed individually for each sampling matrix and site. The closer the completeness percent is to 100, the more complete the measurement process. If at any time, data for a particular matrix or sample fraction is less than 85% complete, or non-representative of the hazard, the QAM will initiate a review of field and laboratory procedures to determine the source of deficiency, and corrective action will be taken as necessary. Field measures of completeness include percent planned samples collected and having all critical samples collected. Corrective action in the field via re-sampling may be necessary if data completeness or the objective of the project is not achieved. More information on corrective action procedures can be found in Section C. Completeness will be calculated as follows:

$$Completeness\ (\%) = \frac{V}{P} \times\ 100$$

Where V=Number of valid measurements and P =Number of planned measurements

Sensitivity: Sensitivity refers to the ability to achieve method detection limits (MDLs) and reporting limits (RLs) that are sufficiently low to identify contaminants at concentrations relevant to risk-based screening levels and applicable regulatory criteria. Field measures of sensitivity may include equipment blanks/field blanks and collecting the appropriate sample volume or mass. Laboratory measures of sensitivity may include reporting limits and the analysis of method blanks and instrument blanks. Laboratories will employ EPA approved methods with demonstrated capability to meet these limits consistently, and must verify sensitivity through routine calibration, method performance checks, and instrument tuning.

Distribution List

Table 2 Distribution List

Name/Contact Information	Title/Organization
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Evelyn Velazquez 4 Penn Center 1600 John F Kennedy Blvd 215-814-5412 velazquez.evelyn@epa.gov	Project Officer, U.S. EPA Region 3, Land, Chemicals, and Redevelopment Division
Rina Murasaki 4 Penn Center 1600 John F. Kennedy Blvd 215-814-2145 murasaki.rina@epa.gov	Program Manager, U.S. EPA Region 3, Resource Conservation and Recovery Act Programs Section
Kia Long 1650 Arch St. (3LS10) Philadelphia, Pa. 19103	Quality Assurance Manager, U.S. EPA Region 3

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Carlos Gonzalez 391 Lukens Drive New Castle, DE 19720-4801 302-395-2526 carlos.gonzalez@delaware.gov	Program Manager, State Department of Natural Resources and Environmental Control Division of Waste and Hazardous Substances, Compliance and Permitting Section, Tanks Compliance
Laura Lucas 391 Lukens Drive New Castle, DE 19720-4801 302-395-2617 laura.lucas@delaware.gov	Quality Assurance Manager, State of Delaware Department of Natural Resources and Environmental Control Division of Waste and Hazardous Substances

Program Organization

DNREC DWHS is the sole State agency responsible for hazardous waste and hazardous substance management and is responsible for administering various programs in Delaware. The mission of the Division is to encourage waste reduction, reuse, and recycling; ensure compliance with waste and hazardous substance management laws; ensure the investigation and clean-up of contaminated sites; regulate installation, operation, removal and remediation of tanks storing petroleum and hazardous substances; ensure boilers and pressure vessels are inspected to prevent catastrophic failures; provide comprehensive emergency planning; and provide 24-hour response to emergency and non-emergency environmental and hazardous materials incidents.

The Division investigates sites working cooperatively with EPA Region 3 (R3). The Division and EPA R3 have entered several Memorandum of Agreement (MOA) that permits the Division to perform environmental oversight on hazardous substance release sites. The MOAs are described below.

- The Voluntary Cleanup Program (VCP) MOA defines the roles and responsibilities of EPA R3 and DNREC with respect to activities related to DNREC's VCP. This MOA states that DNREC will take the lead and will address sites as appropriate under the HSCA program. When a site has been investigated or remediated in accordance with the practices and procedures of HSCA and (a) DNREC has issued a "no action" determination, or (b) DNREC has issued a "Certificate of Completion of Remedy," then EPA R3 will consider the site of "no federal interest" under CERLA. EPA R3 will provide assistance to state government agencies to facilitate the revitalization of contaminated or potentially contaminated properties in Delaware. Please note that assistance for this program is now provided by other grants.
- The RCRA C MOA states that both parties, DNREC and EPA R3, are responsible for ensuring that its obligations under Subtitle C of RCRA are met. Upon final authorization by EPA R3, DNREC will assume primary responsibility for implementing the hazardous waste program in a manner consistent with EPA program policies and guidance. EPA R3 is responsible for ensuring full and faithful execution of the requirements of RCRA. EPA R3 will assess DNREC's administration and enforcement by reviewing information submitted by the DNREC in accordance with the MOA, DNREC's RCRA §3011 grant work plan, and through periodic reviews of DNREC program activities. EPA R3 will have access to all DNREC files and any other information that may be requested for reviewing and evaluating the program administration and enforcement. EPA R3 will keep DNREC informed of content and meaning of Federal statutes, regulations, guidelines, standards, policy decision, directives, and any other factors that affect DNREC's program.

- The UST Prevention MOA establishes policies, responsibilities, and procedures pursuant to 40 CFR 281 for the State of Delaware UST Program and the EPA R3. This MOA states that DNREC assumes primary responsibility for implementing Subtitle I of RCRA through its UST Prevention Program. The EPA assumes a management role upon granting final approval to DNREC. DNREC allows the EPA access to all files and other information requested by the EPA that may be necessary for reviewing the Program administration and enforcement. DNREC will monitor the compliance by owners and operators of applicable facilities by conducting compliance inspections and assessments.

Within the Division, there is a Compliance and Permitting Section (CAPS) and a Remediation Section (RS). CAPS has primary responsibility for carrying out the duties and responsibilities related to compliance monitoring and enforcement for treatment, storage, and disposal facilities as well as generators and transporters of hazardous waste. The RS is responsible for identifying and cleaning up releases of hazardous waste, petroleum and other hazardous substances in the environment to an acceptable level of human-health and environmental risk, and supporting the continued safe use, re-use or enhanced productive use of remediated properties. Within CAPS and the RS there is a Tanks Compliance Branch (TCB) and Corrective Active Branch (CAB); these two branches share responsibility for the enforcement of regulations and for the administration of the corrective action requirements of the tanks programs and hazardous waste facilities, respectively, to best protect human health, safety, welfare, and the environment.

Individual Roles and Responsibilities

Division staff within both Sections are charged with the responsibility of carrying out the duties of the authorized hazardous waste program, have the administrative expertise, technical background, and experience necessary to effectively administer the hazardous waste management program. Division staff consists of Environmental Program Administrators, Program Managers, technical staff (i.e. Project Officers), management analysts, and administrative support staff. In accordance with the DNREC *QMP*, the DNREC DWHS Director is the Quality Administrator. The DWHS Director has delegated that authority to the Division Quality Assurance Manager (QAM). See below for descriptions and responsibilities of key personnel.

<u>Environmental Program Administrators:</u>

- Implement the values of the Department
- Implement Statute, regulation, and policy
- Plan, budget, coordinate, and oversee implementation of the program
- Provide oversight to the Program Managers
- Oversee the drafting of grant applications and budget proposals

- Plan, coordinate, and conduct meetings with EPA, staff, other agencies, and private sector
- Manage personnel matters by conducting hiring interviews and selecting the candidate, reviewing and selecting training programs, and conducting performance appraisals of direct reports
- Work closely with other agencies and the private sector, statewide and regionally, to coordinate and achieve Departmental environmental goals and objectives
- Oversee staff activities related to facility investigations, permitting, corrective action, compliance monitoring and enforcement
- Regularly assess direct report employee performance
- Review programmatic documents
- Perform related work as required

Program Managers:

- Implement the values of the Department
- Implement Statute, regulation and policy
  Oversee program activities and provide technical direction and oversight to technical staff/Project Officers
- Implement federal/state grants proposals and may participate in other fiscal responsibilities as assigned by the Environmental Program Administrator
- Manage personnel matters such as training, staffing, and performance
- Perform related work as required
- Review documents related to the program
- Perform the following functions with the assistance from management analysts:
  - Provide fiscal planning, evaluation and analysis of programs and projects to the Environmental Program Administrator with the help from accounting and Division management analysts
  - Ensure compliance with applicable accounting rules, regulations, guidelines, goals and objectives of Federal and state governments
  - Review operating and capital budget request(s)
  - Monitor all Section budgetary accounts and records and review reports and financial statements to determine the financial status of the grants and to ensure that the funds are properly spent
  - Prepare financial reports for the Environmental Program Administrator

Quality Assurance Manager (QAM):

- Implement the Values of the Department
- Implement Statute, regulation and policy

- Oversee and provide technical assistance to project officers in analytical chemistry data review/validation
- Serve as the Division Quality Assurance Officer
- Assist Project Officers in the development of sampling plans for sites
- Review reports and work plans as necessary
- Stay current with training and research to be qualified to conduct audits
- Conduct audits, see Section C for more information
- Maintain the Division *QAPrP* and HSCA *SOPCAP*
- Perform related work as required
- Coordinate laboratory services

Management Analysts:

- Implement the Values of the Department
- Implement Statute, regulation, and policy
- Provide fiscal planning, evaluation, and analysis of programs and projects to the Environmental Program Administrator
- Ensure compliance with applicable accounting rules, regulations, guidelines, goals and objectives of the federal and state governments
- Review operating and capital budget request(s)
- Monitor all DWHS budgetary accounts and records and review reports and financial statements to determine the financial status of the grants and to ensure that the funds are properly spent
- Prepare financial reports for the Program Manager
- Perform related work as required
- Maintain EQuIS database and Governance across Delaware Agencies including DNREC

Administrative Support:

- Complete administrative and support activities as assigned

Receptionists:

- Date and time stamp any correspondence, letters, monetary compensation, etc. that may be received at the front desk

Paralegals and Department of Justice Staff

- Determine if DNREC documents are suitable for the public record

CAPS and RS serve different functions; therefore, certain staff duties vary. The following responsibilities are for staff within the RS. Staff members that manage sites are referred to as "Project Officers" for the remainder of this document, but they may have specialized technical

expertise such as engineering, environmental science, or hydrology, or specific certification or licensure.

Hydrologists:

- Implement the Values of the Department
- Implement Statute, regulation and policy
- Perform all geological work under the "supervision of" a Licensed Professional Geologist employed in DWHS
- Oversee and provides technical assistance to the project officer in groundwater and surface water data review and evaluation
- Required to work independently to plan and manage projects
- Development of sampling plans
- Review sampling plans prepared by the consultants and provide oversight to field sampling
- Prepare environmental reports, such as PA reports, SSA reports, CBFI reports, etc.
- Perform related work as required
- Perform and/or oversee installation of wells (if the Hydrologist has the proper certifications and/or licensure, i.e. a drillers license)
- Perform and/or oversee environmental sampling
- Document field work that includes well logs, groundwater elevations, and site stratigraphy
- Review and prepare reports and work plans as necessary
- Review sampling protocols during field sampling activities
- Review methods for groundwater and soil remediation
- Perform related work as required

Environmental Scientists:

- Determine applicable health standards and guidelines
- Implement the Values of the Department
- Implement Statute, regulation and policy
- Perform and review human health and ecological risk assessments
- Develop and review risk education strategies
- Perform related work as required
- Review toxicological reports and references
- Required to work independently to plan and manage projects
- Development of sampling plans
- Review sampling plans prepared by the consultants and provide oversight to field sampling

- Prepare environmental reports, such as PA reports, SSA reports, CBFI reports, etc.
- Perform related work as required

Engineers:

- Oversee and provide technical assistance to project officers involved in engineering projects and programs
- Implement the Values of the Department
- Implement Statute, regulation and policy
- Review engineering plans and specifications of proposed projects or sites
- Perform related work as required
- Required to work independently to plan and manage projects
- Development of sampling plans
- Perform all engineering work under the "supervision of" a Licensed Professional Engineer employed in DWHS
- Review sampling plans prepared by the consultants and provide oversight to field sampling
- Prepare environmental reports, such as PA reports, SSA reports, CBFI reports, etc.
- Perform related work as required

The following responsibilities are for staff within the CAPS.

Hydrologists:

- Responsible for the hydrogeologic aspects of compliance monitoring, permitting, closure, corrective action, and program development activities
- Complete facility compliance assessments
- Review facility investigative work plans and report
- Develop statutes and regulations

Environmental Scientists:

- Responsible for the scientific aspects of compliance monitoring, permitting, closure, corrective action, and program development activities
- Complete compliance assessments
- Review facility investigative work plans and reports
- Develop statutes and regulations

Environmental Specialist:

- Responsible for the scientific aspects of compliance monitoring, permitting, closure, corrective action, and program development activities
- Complete compliance assessments
- Review facility investigative work plans and reports
- Develop statutes and regulations

Engineers:

- Responsible for the engineering aspects of compliance monitoring, permitting, closure, corrective action, and program development activities
- Complete compliance assessments
- Review and complete facility permit applications and permits, remedial action work plans and reports
- Develop statutes and regulations

Contracting Services

Contractors

Contractors are used by the Division to conduct assessments, investigations, remediation, and sampling activities for various sites and programs. The program specific requirements/specifications for contractors are as follows:

- Contractors performing work for sites within the HSCA program must undergo a certification process by the RS before any contractor services are used. This is required under Section 6 of the Regulations Governing Hazardous Substance Cleanup, 7 Del. Admin. Code § 1375. This allows contractors to perform work for a Brownfield Developer or Responsible Party (RP).
- Contractors performing work for the State must go through a public contracting process, in which they submit information about their qualifications and expertise. Once on contract with the State, contractors may provide investigation and remediation services. In addition, contractors must be HSCA certified in order to be eligible for a State contract.
- Contractors performing work for NPL sites are selected by EPA R3.
- Contractors performing work for TMS must be certified by the Tanks Compliance Branch (TCB).

Typically, contractors are responsible for drafting a sampling plan, collecting environmental samples, coordinating with the laboratories, deciding which samples undergo confirmatory testing, and preparing and submitting a report of the findings to

DNREC Project Officers. DNREC Project Officers are responsible for reviewing and approving the sampling plan, providing oversite during sampling activities, and reviewing and approving the report with the findings.

Laboratory Services

DNREC Environmental Laboratory Section

The Division and the DNREC Environmental Laboratory Section (ELS) have entered MOA which describes all roles and responsibilities between the two parties. ELS is responsible for conducting screening analyses of environmental samples using approved methods and instrumentation appropriate for soil samples. Screening analysis of soil samples from sites regulated and funded by the HSCA funds and for sites funded by federal grants will be performed by ELS. Samples from Pre-Remedial sites are typically sent to ELS for screening analysis, though this is not required. Samples from RCRA and NPL sites are not required to undergo screening analysis. Screening results will be shared with the site Project Officer and the contractor as soon as they are available. This is to provide enough time for data review, confirmatory sample selection discussions between the Project Officer and contractor, and extractions of the samples selected for confirmatory analyses without compromising hold times. ELS will use laboratory established QC criteria. ELS documents all QC results, evaluates compliance with acceptance criteria, and initiates corrective actions when needed.

DNREC Approved Commercial Laboratory or EPA Contract Laboratory Program (CLP)

The minimum requirement for commercial laboratories performing analytical testing services for Division activities is NELAP accreditation. Laboratories that perform work for the HSCA program (including state funded CBFs) must be HSCA approved. The approval process is described in further detail in Section C. Laboratories are responsible for receiving, handling, and analyzing samples using approved methodologies that support project-specific DQOs. This includes maintaining strict chain of custody procedures, meeting all holding time and preservation requirements, and performing required QA/QC measures such as calibrations, blanks, and spiked samples. The laboratory is responsible for accurate and timely reporting, including preparation of analytical reports, electronic data deliverables, complete documentation of QA/QC results, and communication of any issues that may affect data usability or compliance with established methods. Project Officers and contractors must coordinate with the laboratory regarding sampling schedules and analytical needs. Laboratory QA manuals for the Division's most commonly used labs may be found in Appendix J.

If EPA contract laboratories are to be utilized, the laboratory selection and analysis will be managed by EPA R3. Samples from NPL sites must be sent to an EPA Contract

Laboratory for analysis. If Routine Analytical Services (RAS) are needed for Superfund related field activities, including remedial activities, monitoring, enforcement actions, or removal actions, measurement methods will follow the guidelines found in the EPA *Superfund Analytical Methods Statement of Work* (SFAM01.1) and the EPA *High Resolution Superfund Methods Statement of Work* (HRSM02.1), as applicable. EPA R3 will manage all non-routine Delivery of Analytical Services (DAS) acquisitions. DAS measurement methods will follow the guidelines found in the Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition as applicable. Selection of the SW-846 method to be used will be provided in the site-specific plan.

Program QAM Independence

The Division QAM operates separately from the field activities, sampling teams, and program management responsible for project implementation. This independence ensures that QA oversight is unbiased and objective. The QAM does not report to the Program Managers, Project Officers, or other personnel directly involved in collecting or analyzing project data. This separation of duties ensures that quality assurance decisions are made without influence from data generation activities, in accordance with DNREC's *QMP* and EPA QAPP requirements. The QAM reports to the Environmental Program Administrator of the RS. The QAM therefore must maintain separation from technical influence or competing priorities the Environmental Program Administrator of RS must implement.

Program Organization Chart and Communications

The Division Organization Chart is shown in Figure 1.

Personnel Training/Certification

It is State of Delaware policy that only trained and qualified personnel will be used to perform project work. All Division technical staff (Project Officers, Hydrologists, Engineers, and Environmental Scientists) must complete a 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training before performing any project field work. After completion, an 8-hour HAZWOPER refresher training is required on an annual basis. Both HAZWOPER training courses conclude with a quiz to ensure understanding of the material. Additionally, as

per the DNREC *QMP*, annual QA refresher training is required, as well as refresher training if changes are made to QA requirements. Training records are maintained and tracked on the Delaware Learning Center. Training records are available on request. Program Managers are responsible for assigning training course work required to assist project officers in their daily routine. The QAM will conduct training as assigned by the DNREC Quality Administrator. All technical personnel must exhibit competency in addressing site related issues and QA/QC specific issues. Technical staff within the RS and CAPS are expected to have read and familiarized themselves with *SOPCAP* and the *Delaware Risk Based Corrective Action Protocol* (*DERBCAP*). All Division staff are expected to read and understand the policies and procedures in this *QAPrP*. They also participate in training from outside sources, such as the EPA, Interstate Technology and Regulatory Council (ITRC), and the National Environmental Management Academy (NEMA). All DNREC Project Officers must have a Bachelor of Science Degree in a scientific discipline before being hired by the State of Delaware.

All personnel participating in field work, including Project Officers, Hydrogeologists, Engineers, and Environmental Scientists, will be trained to calibrate equipment, perform preventive maintenance, and maintain field equipment logs. This training occurs on the job and is not formally documented. Project Officers are responsible for maintaining and performing routine maintenance on all field equipment.

All Division personnel participate in their own performance plans. As part of the annual performance plan review(s), Program Managers discuss performance criteria for each Project Officer and area(s) needed for improvement and any necessary training or retraining that may be required to help improve QA/QC procedures. Staff members that wish to advance to higher level positions are required to have professional licensure (professional engineer, professional geologist, etc.). All personnel records must be maintained at DNREC Human Resource Department.

Documents and Records

All Division personnel will have electronic access to the most current version of the *QAPrP*, SOP guidance, or any document needed before any project work or work plan is developed. These documents will be reviewed annually and updated as needed. The QAM will be responsible for maintaining the *QAPrP*, and Project Officers are responsible for maintaining SOPs and guidance documents. The most current version of the documents will identify the month the correction(s) were made during the calendar year. Every revision (per calendar year) including the track changes to the *QAPrP* will be maintained on DNREC database for period of

ten years as per the HSCA regulations. All documents will be maintained electronically at the Public Data p: drive.

RS documents will be maintained at the RS office at 391 Lukens Drive, New Castle Delaware. The building is secure, and all visitors must enter and sign in at the front desk. Employees can enter any door to the facility by electronic key entry during business and nonbusiness hours. The electronic key entry(s) are recorded at the facilities on the DNREC database and back up is conducted daily. The types of documents that are filed and scanned electronically include, but are not limited to:

- Site and data reports
- Work plans
- Work orders
- Audit memoranda
- SOPs
- Guidance documents
- Correspondence such as emails
- Compliance assessments
- Site photos
- Enforcement documentation

Documents will be filed for a period of ten years in accordance with the regulations under HSCA. In addition, all documents and correspondence are electronically image scanned and filed with a DNREC RS project code. A project code begins with the prefix DE-, followed by a chronological numerical system for BF, HSCA, and Superfund sites and an 8 for TMS as new sites are identified by DNREC. RCRA sites will receive an EPA RCRA ID Number that begins with the prefix DED- followed by a number generated by the EPA's facility tracking program. Site related documents are tracked using a chronological numbering system, which is referred to as a Chron number. Each document is assigned a unique number in sequential order.

Unless deemed to be nonpublic record, all final documents produced by DNREC are releasable under the Delaware Freedom of Information Act (FOIA), 29 Del. C. CH 100. The FOIA SOP can be found in Appendix L. Public records are information of any kind that is owned, made, used, retained, received, produced, composed, drafted, or otherwise compiled or collected by DNREC, that relates in any way to public business, or in any way of public interest, or in any way relates to public purposes, regardless of the physical form or characteristic by which such information is stored, recorded or reproduced. Any final report or work plan will follow the *Guidance for Project Officers Performing Investigations*, which can be found in Appendix I. Reports for TMS projects will follow the *Hydrogeologic Investigation Guidance*, see Appendix C. Project Officers must utilize these documents to prepare or review any final report or work plan. All information needed to prepare the documents is included in the applicable guidance.

All RCRA regulated project work is entered and stored in the federal database RCRAInfo. While the database is maintained by the EPA, the data input into the database is managed by Project Officers. Project Officers will review the data as it is entered into the database.

The Division also stores specific information on each regulated site in Delaware's Environmental Navigator (DEN), which is divided into a public database available on the DNREC's external web site and an internal database on the DNREC's intranet that is only available to DNREC personnel. Information maintained in DEN's external database includes the physical location site, generator status, permits, dates the facility was inspected, violations discovered, and enforcement actions taken. DEN's external database can be accessed here.

DNREC uses DNRECtory as a centralized, department-wide electronic document and records management system to ensure consistent storage, organization, and retrieval of program records. DNRECtory provides staff with controlled access to a wide range of documents, including policies, procedures, technical reports, correspondence, and quality assurance records. The system supports document version control, maintains records in accordance with applicable retention schedules, and helps ensure that only current, approved versions of documents are used in program activities. By maintaining standardized file structures and access permissions, DNRECtory promotes data integrity, security, and traceability, while also facilitating efficient information sharing across programs within the Division.

GROUP B: DATA GENERATION AND ACUISITION

Sampling Design

Sampling design specifies the number and location of samples to be collected at a site. Site specific plans may be in the form of a Field Sampling Plan (FSP), a Sampling and Analysis Plan (SAP), or a Quality Assurance Project Plan (QAPP or QAPjP). An SAP is usually accompanied by a Conceptual Site Model (CSM), which depicts the current understanding of site conditions. Please see below for the different types of sampling plans:

1. **FSP:** A site or project specific document that describes project objectives, sampling locations, and rationales for their selection, sampling methods, analytical methods, preservation, chain of custody, and shipping requirements. FSPs are developed for SSAs and SIs and must be sent to EPA R3 for approval. More details can be found in the subsequent sections.
2. **SAP:** Documents the procedural and analytical requirements for projects involving the collection of samples to characterize areas of potential environmental contamination. The SAP also includes QA/QC sampling requirements. Site SAPs must follow the DNREC SAP guidance.

3. **CSM:** Contains all information about a site that can easily be reviewed and used for decision making at any stage of the project. The document includes details regarding the site's location, history, potential contamination, soil, groundwater, surface water, sediment, etc. DNREC has prepared a CSM template that may be used when drafting a CSM. The CSM typically accompanies an SAP.
4. **QAPP:** A QAPP integrates all technical and quality aspects of a project, including planning, implementation, and assessment. The purpose of the QAPP is to document planning results for environmental data operations and to provide a project-specific "blueprint" for obtaining the type and quality of environmental data needed for a specific decision or use. DNREC does not prepare QAPPs for sites, instead QAPPs are only prepared by contractors performing work for NPL sites.

The number of samples to be collected depends on the area investigated (size of the site), future use of the site, previous information that hazardous substance release occurred and/or the location (e.g. next to a tributary). Sampling plans are developed from the evaluation of suspected analytes and their suspected depositional environment. Specific details regarding sampling scope, sample quantity and sample locations will be included in the sampling plan. Contents of the sampling plan will vary depending on the type of plan but will contain at minimum the items listed below. Further details will be included in the subsequent sections.

- Sample matrix
- Sample location and depth
- Number of samples to be collected
- Sample collection method
- Site maps
- Type of data to be generated (screening, confirmatory, or both)
- Analysis method
- Justification and rationale for all sampling information

To assure representativeness of potential contaminant releases, samples should be procured from areas of observed release or areas of imminent risk to human health and/or the environment. The selection of potential source sample locations is strongly dependent upon site-specific conditions encountered. The design of a sampling plan and the need to obtain representativeness in QA/QC incorporates the following sample matrix considerations:

1. **Soil:** Soil samples are normally obtained from different depths to identify different contaminants and the possible spread of contaminants. Refer to the Soil Sampling SOPs in Appendix H to determine which procedure to follow for different sampling depths. Sampling locations (site and depth) will be determined by the objectives of the investigation, surface drainage pattern, soil type, permeability, the nature of the contaminant(s), and distance to groundwater. Available information on topography,

subsurface conditions, waste locations (sources), hazardous material characteristics, and the physical and chemical characteristics of the surficial soils will also be reviewed prior to selecting soil-sampling locations. Modifications can be made in the field when conditions are warranted. All modifications must be documented and must conform to criteria of the sampling plan.

2. **Sediment:** Sediments are materials typically transported by wind or water. To obtain a representative sediment sample, considerations must be given to samples from a depositional area utilized by these two transport mechanisms. For most Site Inspections, sampling of waterborne sediment will be the primary matrix. However, the possibility of loose sediments transported offsite by the wind should not be ignored and the location of migration pathways considered. Waterborne sediments are transported proportionally to the volume and velocity of the watercourse. Therefore, the sampling location (depth and site) is affected by the physical characteristics of the analytes such as specific gravity and volatility. In general, lighter organic compounds would be expected to be found in the finer sediments and are strongly dependent upon site-specific conditions encountered such as fine grained, low flow water environment, which experiences less agitation and volatilization. Analytes of high specific gravity would be expected to be found in more turbulent areas, as their density would allow them to remain in the water environment longer.
3. **Surface Water:** Surface water samples must reflect the physical characteristics of the receiving waters, and the physical characteristics of the potential contaminants. The choice of sample locations is determined by characteristics of the waste(s) (i.e., molecular weight, volatility, immiscibility) entering the surface water and the means by which they are introduced into the surface water. Also, the stream characteristics, such as low flow tides, bank construction, etc. should be evaluated to obtain a representative sample, especially in upstream, downstream, midstream, and tidal locations.
4. **Groundwater:** Assuming proper well placement and construction, groundwater sampling can be done to obtain a representative sample of the aquifer. Several techniques and procedures should be employed to achieve representativeness. The SOP for Groundwater Monitoring Well Installation & Development is available here. A discussion on well placement, construction, evacuation techniques and other pertinent information is included in the project work plan. This will aid in a qualitative evaluation of the data gathered, and its overall representatives. At some sites, sampling of domestic wells may be necessary to determine the presence of hazardous substances.
5. **Sludge:** Sludges are residues from wastewater treatment and industrial processes. Many contaminants may be present in sludge, so therefore, sludge samples should be procured from point of observation or imminent release to the environment. Sludge sampling methods vary due to sludge characteristics. Sample location, depth consistency,

coloration, odor, total thickness of sludge at sample depth, process operations and sampling methods must be documented as part of the quality assurance.

6. **Indoor Air:** Potential interferences from indoor sources such as cleaning products, paints, solvents are inventoried using a PID or portable GC and, if possible, removed or controlled at least 72 hours before sampling to avoid biasing the results. During sampling, intake locations are selected at the "breathing zone" of occupants (typically ~3 feet above the floor), and at least one sample per exposure unit is collected. QA/QC protocols, such as replicate testing and pressure checks of canisters, help ensure that the samples truly reflect indoor air conditions without contamination or sampling artifacts. These considerations ensure that the sampling plan yields representative, reliable data that support accurate exposure assessments and risk evaluations.
7. **Soil Gas (including Sub-slab soil gas):** Sampling locations for soil gas samples may include sub-slab and exterior soil gas points. Sub slab samples should be collected as close to the center of the slab as possible because contaminant concentrations may be higher near slab centers than edges. An adequate number of locations to assess potential exposure of building occupants to volatile chemicals from a sub-surface source must be determined. For non-residential buildings, sampling should occur during normally occupied periods (i.e., times representative of typical use and exposure) unless exceptional scheduling is needed. The soil-gas monitoring points must be properly constructed and installed so that the screened interval is not influenced by surface air or shallow groundwater. The physical characteristics of the soil, such as texture, moisture content, and the presence of coarse materials or free water, must also be considered, as they influence gas movement and contaminant distribution. Proximity to preferential pathways, including fractures, voids, or buried utilities, must be avoided to prevent localized anomalies from biasing the sample.
8. **Non-Environmental Media:** Materials such as wastes, leachates, or products may be sampled for investigations or waste characterization. In order to best characterize the material of interest, the following sample locations should be considered: points of generation, storage containers such as drums or tanks, leachate collection systems, etc. If the material of interest may be heterogeneous, multiple grab samples or composite samples may be necessary to obtain representative data.

Baseline Risk Assessments will be conducted as part of CBFIs, RIs, RCRA FIs, and may also be performed at multiple stages for HSCA sites. Risk Assessment begins with an investigation that identifies exposure units, pathways, receptors, and data needs in the CSM and SAP. Using collected analytical data, COPC(s) are determined, exposure point concentrations are determined, and toxicity is evaluated. The *HSCA Screening Level Table Guidance* in Appendix G provides screening levels that will be compared to environmental sample results for HSCA sites and CBFs to determine COPC(s). Human health risk calculations are performed using the recommended Delaware Risk Assessment Calculator (DERAC), which is based on the Risk

Assessment Information System (RAIS) risk calculator or another tool approved in advance, and risk is characterized based on a no action baseline. The entire process and its results are documented in a standardized Risk Assessment Report, which is typically included within the RI or CFI report, to ensure consistency, transparency, and compliance with regulatory requirements. Human health Risk Assessments will follow the standards set forth in the *Guidance for Human Health Risk Assessments under HSCA*, see Appendix D. Typically for NPL sites, MCLs and EPA Regional Screening Levels will be used to assess risk to human health.

HSCA

SAPs will be prepared for sites and investigations that fall under the HSCA program. Contractors will prepare and submit SAPs to the DNREC site Project Officer for review and approval. Sampling plans for HSCA work that utilizes federal funding will also be sent to EPA R3 for review and approval. SAPs will be prepared in accordance with DNREC templates. An SAP may also be accompanied by a CSM, though it is not required.

CERCLA, Pre-Remedial, and RCRA C

FSPs will be prepared for any site undergoing a SSA, which may include state or federally funded CBFs, HSCA sites that may become CBFs, or Pre-Remedial sites. FSPs are more comprehensive than SAPs and CSMs. FSPs will contain the following information, in addition to the items listed previously:

- Project-specific goals and objectives
- Project team
- Site background and description
- Clearly stated DQOs
- Goals of the sampling effort and data to be generated
- Site history, previous investigations, and results
- Historical data generation, conclusions, and decisions made
- Applicable screening levels
- Project required quantitation limits
- Identification of field QC samples (field duplicates, field blanks, trip blanks, etc.)
- Identification of laboratory QC samples (MS, MSD)
- Site specific health and safety plan
- Project schedule

Sampling plans developed for federally funded sites or investigations (NPL sites, Pre-Remedial sites, RCRA facilities, or federally funded CBFs) must conform to the EPA *Quality Assurance Program Plan Standard.* DNREC will review the sampling plan before submission to EPA R3. Sampling plans for NPL sites will be accompanied by a QAPP. Site related activities may not be performed until the sampling plan is approved by EPA R3. Once the EPA has reviewed the sampling plan, DNREC and/or the contractor will complete revisions and resubmit the document. Once approved, the sampling plan is valid for the life of the project, up to five years. EPA R3 must also be notified of any modifications to the sampling plan. These requirements and timeframes are derived from the EPA R3 MOA on QA Review Guidance.

UST Prevention

Table 3 summarizes the activities that require sampling under the UST Prevention program and specific sampling requirements. Contractors performing the sampling must submit a sampling plan to the CAPS Project Officer for approval before any sampling takes place.

Table 3 UST Prevention Sampling Requirements

Activity	Sampling Requirement
Dispenser sump installation or replacement	One grab sample per dispenser must be collected from an elevation of five feet below each dispenser or at the top of the water table, whichever is encountered first.
Spill containment replacement	Soil samples must be collected when concrete is broken or backfill is exposed to install spill containment buckets. One grab sample must be collected at the bottom of the excavation for each spill containment device installed.
Tank top sump installation or replacement	Soil samples must be collected when concrete is broken or backfill is exposed to install new or replace existing tank-top sumps. At least one composite sample must be collected by taking several discrete samples from the excavated material. If no material is excavated in order to install the new sump, one composite sample must be collected from the walls of the excavation in the locations where contamination is visible or most likely to be present.
UST system removal	Sampling requirements for UST system removal depends on the size of the UST. USTs with a capacity of 0-1,100 gallons require 1 grab sample, 1 composite sample, and dispenser and piping run samples. USTs with a capacity of 1,101-30,000 gallons require 2 grab samples, 1 composite, and dispenser and piping run samples. In compartmentalized USTs each compartment is treated as a standalone tank unless all compartments contain the same product. These USTs require 2 grab samples, 1 composite sample, and dispenser and piping run samples for each compartment.
UST closure in place, change in service, or change in substance stored	Sampling requirements for these activities depend on the size of the UST. USTs with a capacity of 0-1,100 gallons requires 2 borings, with 1 grab sample and 1 composite sample per boring, as well as dispenser samples. USTs with a capacity of 1,101-15,000 gallons require 4 borings, with 1

	grab sample and 1 composite sample per boring plus dispenser samples. USTs with a capacity of 15,001 gallons or greater require 6 boring, with 1 grab sample and 1 composite sample per boring plus dispenser samples.
Over excavation	Sampling requirements for these activities depend on the size of the UST. USTs with a capacity of 0-1,100 gallons requires 5 composite samples, one from each sidewall and one from the pit bottom. USTs with a capacity of 1,101-20,000 gallons require 5 composite samples and 5 grab samples, one of each from each sidewall and the pit bottom. USTs with a capacity of greater than 20,000 gallons require 1 composite sample and 1 grab sample per 20 feet of each wall or bottom being over excavated.

LUST

Investigations for LUST sites are expected to follow the *Delaware Risk Based Corrective Action Protocol* and *Hydrogeologic Investigation Guide*, which are included in Appendices B and C, respectively. Samples must be collected if a release has been suspected or identified at a TMS. *DERBCAP* is a multi-tiered risk based corrective action process for TMS. Each Tier has different sampling requirements that can be found in *DERBCAP*. Figure 2 shows the tiered *DERBCAP* process for TMS. Contractors are responsible for preparing and submitting a work plan to DNREC for review and approval before any sampling begins. A work plan is only required to be submitted for Tier 1, Tier 2, and Tier 3 investigations. The different tiers are defined as follows:

1. Tier 0: Tier 0 applies to all regulated Tank Systems that undertake Tank System Activities and where soil is disturbed and the potential for a release must be evaluated through a Site Assessment. This section also applies to other sites where a petroleum release has occurred in absence of a tank. If the results from the Tier 0 analysis exceed the Tier 0 Action Levels, then a Tier 1 Site Assessment may be performed.
2. Tier 1: Tier 1 is the next level in *DERBCAP*. A Responsible Party may choose to enter the RBCA process at Tier 1 with any currently active LUST site or will move up to Tier 1 from Tier 0 if tank SA soil analytical results exceed applicable Tier 0 action levels. In Tier 1, specific contaminants of concern found in petroleum products are chosen for a variety of factors including, but not limited to, carcinogenicity or other health effects, persistence in the environment, mobility, solubility, vapor pressure, or aesthetic factors. If the results from the Tier 1 SA exceed the RBSLs found in *DERPCAP*, then a Tier 2 SA will be performed.
3. Under Tier 2, the RP may derive Site-Specific Target Levels (SSTLs) based on site-specific receptor locations and other site-specific soil and groundwater input parameters. Further action will be required if the results exceed the SSTLs. A Tier 2 SA includes the following:
    a. Site-specific geologic characterization

   b. Measurement or calculation of site-specific physical characteristics
   c. Calculation of SSTLs, using DNREC-approved models
4. Tier 3 offers an additional level of evaluation for projects not adequately assessed under the previous tiers due to extreme complexity of the site. Difficulty in assessment may be derived from a variability of the site's geology, an extensive or unusual suite of contaminants with complex interactions, which may require a cooperative approach with other environmental programs within the Department, or unusual temporal considerations.

Sampling Method Requirements

HSCA, CERCLA, Pre-Remedial

The objective of sampling may vary depending on the type of site or activity. For example, the purpose of sampling for a CBFI is to determine whether contamination is present at a site and, if present, to characterize the type, concentration, and distribution. Whereas in the case of Pre-Remedial SIs, sampling attempts to identify whether a release has occurred and potential impacts to nearby receptors. In any case, sampling will be conducted according to the RS SOPs listed below. Contractors may also choose to follow their own sampling SOPs, but they must be approved by DNREC. These SOPs are also provided in Appendix H. Any deviations from the SOPs must be approved by the Project Officer and QAM before use and documented in the site specific plan.

- SOP for Shallow Soil Sampling
- SOP for Deep Soil Sampling
- SOP for Surface Soil Sampling
- SOP for Sediment Sampling
- SOP for Surface Water Sampling
- SOP for Groundwater Sampling and Faucet Delivery
- SOP for Indoor Air Sampling
- SOP for Sub-Slab Air Sampling (Soil Gas)
- SOP for Active Soil Gas Sampling

Sampling activities for NPL sites are not required to be performed in accordance with DNREC RS SOPs. Samples for these sites will be collected by vendors retained by EPA R3, and in a manner consistent with the USEPA *Sampler's Guide: CLP Guidance for Field Samplers*.

Sample container requirements are detailed in Table 4. All sample bottles are pre preserved by the laboratory. All reagents used for preservation will be traceable to primary standards such as National Bureau of Standards materials and will be obtained from a certified chemical supply house.

RCRA C

RCRA C contractors collect soil, sediment, surface water, groundwater, and solid waste samples suspected of containing hazardous waste. Sample collection procedures that support data to demonstrate compliance with the RCRA program must be consistent with procedures outlined in SW-846 and EPA protocols. Contractors must provide any relevant sampling SOPs in the site-specific plan.

UST Prevention

Sampling activities for UST Prevention sites/facilities are not required to be performed in accordance with DNREC RS sampling SOPs. The methods and equipment used for sampling environmental matrices vary with the associated physical and chemical properties. EPA sampling methods will be followed. As applicable, methods and extractions will be specified in site-specific sampling plan. Guidance documents containing EPA-approved sampling SOPs are listed below.

- Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846 (Chapter 10)
- Compendium of ERT Waste Sampling Procedures (EPA/540/P-91/008) (US EPA, 1991d)
- Compendium of ERT Surface Water and Sediment Sampling Procedures (EPA/540/P-91/005) (US EPA, 1991b)
- Compendium of ERT Groundwater Sampling Procedures (EPA/540/P-91/007) (US EPA, 1991c)
- Compendium of ERT Soil Sampling and Surface Geophysics Procedures (EPA/540/P-91/006) (US EPA, 1991a)

The USEPA SOPs below will be followed during sampling events. Other sampling procedures may be used if the CAPS receives assistance from another Section of DNREC or state agency. Any procedural changes will be detailed in the project's site-specific sampling plan.

- General Field Sampling Guidelines, (EPA, SOP# 2001) 1994
- Photoionization Detector (PID) HNU, (EPA, SOP# 2114) 1994

- Water Level Measurement, (EPA, SOP# 2043) 2000
- Monitor Well Installation, (EPA, SOP# 2048) 1996
- Monitor Well Development, (EPA, SOP# 2044) 2001
- Controlled Pumping Test, (EPA, SOP# 2045) 1994
- Slug Tests, (EPA, SOP# 2046) 1994
- Groundwater Well Sampling, (EPA, SOP# 2007) 1995
- Surface Water Sampling, (EPA, SOP# 2013) 1994
- Sediment Sampling, (EPA, SOP# 2016) 1994
- Soil Sampling, (EPA, SOP# 2012) 2000
- Model 5400 Geoprobe™ Operation, (EPA, SOP# 2050) 1996
- Drum Sampling, (EPA, SOP# 2009) 1994
- Chip, Wipe, and Sweep Sampling, (EPA, SOP# 2011) 1994
- Waste Pile Sampling, (EPA, SOP# 2017) 1994
- Tank Sampling, (EPA, SOP# 2010) 1994
- Sampling Equipment Decontamination (EPA, SOP# 2006) 1994

LUST

Sampling protocols differ based on the investigation tier being conducted. Sampling protocols for LUSTs can be found in *DERBCAP*. The number and type of samples required to be collected depends on the specific activity that is being performed. Sample types include grab, composite, and piping run samples. Grab soil samples must be collected from specific spots along the sides or bottom of the tank excavation and below the product dispensers. At least one composite soil sample per tank must be collected by taking several discrete samples from soil in each soil boring/test pit and mixing them together. Piping run sampling is generally only required for piping installed prior to January 1, 1999. For piping where closure-in-place of a piping run is performed, sampling is required for every 20 feet of piping. For piping runs removed from the ground via trenching so that soil conditions beneath the piping can be evaluated, sampling will only be required from areas of the piping trench with observable staining or evidence of a release. See *DERBCAP* for more details on sampling requirements for LUST.

Sample Handling and Custody Requirements

All sample documents and logbooks are legibly written in permanent, indelible ink. Any corrections or revisions to sample documentation shall be made by lining through the original entry, initialing, and dating any changes. Sample containers, sample labels, and chain-of-custody

(COC) forms, will be obtained from the laboratory. Identifying labels will be securely affixed to each sample container. An example sample label is shown in Figure 4. Labels will clearly identify the sample, and will also include the following information:

- Project Name
- Sample name or identification number
- Date and time the sample was collected
- Sampling location
- Sample preservation method

All samples will be maintained in accordance with the COC procedures outlined in this section. A sample is under custody when it is:

- In a person's physical possession
- In view of the person after he/she has taken the possession
- Secured by that person so that no one can tamper with the sample
- Secured by that person in an area which is restricted to authorized personnel

Once samples have been collected, they are transported to a Division approved laboratory for screening or confirmatory analysis. A COC will be maintained to track sample possession. At every transfer of sample custody, the parties relinquishing and receiving the samples must sign, date, and time stamp the COC. An example COC can be found in Figure 3. The COC will include the following information:

- Project name
- Unique sample name/ID
- Sample matrix and type (grab or composite)
- Preservative
- Dates and time of collection
- Number of containers filled
- Analyses requested
- Requested Turn Around Time
- Sampler's signature and date
- DNREC site identification number
- DNREC Project Officer name and contact information

Samples shipped via courier or commercial shipper will be placed in an appropriate transport container. All sample containers will be packed to maintain a temperature of 4°C. A temperature blank will be added to each transport container. Custody labels will be placed on all shipping containers that contain samples. Upon arrival, the shipping and sample containers will be

inspected for damage, and the integrity of the custody seals will be verified. An example custody seal is shown in Figure 4. The laboratory will verify the temperature and preservation of the samples received. DNREC approved laboratories will maintain a sample receipt SOP with additional sample acceptance criteria. Once samples are logged in, the laboratory must track the custody of all samples, extracts, and digestates within the laboratory. Samples will be stored according to the requirements of the analysis protocol. If a DNREC approved laboratory must subcontract work, the approved laboratory is solely responsible for the condition of samples received during shipment. The COC used for subcontracted work must be traceable to the original COC. The laboratory has the right of first refusal to perform all analytical work. More details about sample management can be found in *SOPCAP* Section 4.

All of the appropriate U.S. Department of Transportation (U.S. DOT) regulations for packaging, marking/labeling, and shipping hazardous materials and wastes will be followed. Air Carriers that transport hazardous materials, Federal Express, will comply with the current edition of the International Air Transport Association (IATA) Dangerous Goods Regulations. The IATA regulations detail the procedures to be used to enable the proper shipment and transportation of hazardous materials by a common air carrier. Following all the current IATA regulations will ensure compliance with U.S. DOT.

Field Logbooks

Contractors performing field work for Division investigations are expected to maintain field logbooks. Field logbooks are a descriptive notebook detailing site activities and observations so that an accurate and factual account of field procedures during sampling activities may be reconstructed. All entries will be signed and dated by the individuals who are making them. All field logbook entries will document the following specifics:

- Facility name and address
- Names of personnel on site
- Dates and times of entries
- Descriptions of all site activities, including site entry and exit times
- Noteworthy events and discussions
- Weather Conditions
- Site Observations
- Identification and description of samples and sample locations
- Subcontractor information and names of on-site personnel
- Dates and times of sample collections and chain of custody information
- Records of photographs
- Facility and site sketches or maps

- All relevant and appropriate information is delineated in field data sheets and sample labels
- Field data records (real-time measurements and observations)

Analytical Methods

HSCA, CERCLA, Pre-Remedial

Samples are typically collected for the following types of investigations: FEs, RIs, CBFIs, Phase II ESAs, SIs, and SSAs. Typically, samples are analytically screened in a laboratory before undergoing confirmatory analysis. More details are provided below.

Screening

Samples collected in the field will be analytically screened at the discretion of the Project Officer for the metals, semivolatile, and volatile analytes that are listed in EPA Methods 6200, 8270D, and 8260B. Samples will be screened at DNREC ELS. Since the purpose of analytical screening is to provide preliminary qualitative and semi-quantitative information about potential areas of contamination, full QA/QC is not required. Instead, QC for screening analyses generally includes a calibration standard and a blank. QC acceptance criteria, MDLs, and Limits of Quantitation are defined in ELS SOPs. Only soil and sediment samples will be screened. Samples will be screened for metals via EPA Method 6200. For volatile and semivolatile analyses, the screening laboratory will generally follow EPA Methods 8260B and 8270D, except for the QC requirements described previously.

A detection summary report is generated by ELS and sent to the Division. Approximately 20% of all screened samples will be forwarded to an approved laboratory for confirmatory analysis. However, if all screened samples are non-detect for a given group of contaminants, the 20% confirmation requirement may not apply. Conversely, if screening results indicate widespread contamination, confirmatory analysis of more than 20% of samples may be warranted for specific analytes. Regardless of the screening outcomes, submission of an adequate number of samples for confirmatory analysis is required to perform a risk assessment. The method for selecting screened samples for confirmatory analysis shall be determined by the objectives of the sampling exercise. For example:

- In an initial investigation, the selection of confirmatory samples may be biased to demonstrate the presence or absence of a suspected environmental condition on the site.

- When the screening results are to be used in a risk assessment, the confirmatory samples shall be selected so that the results are representative of the exposure area that is subject to the risk assessment. DNREC may employ statistical techniques to ensure that the resulting exposure point concentration obtained from the results is representative of the exposure area.
- When sampling is performed to confirm the effectiveness of the remediation, then, at its discretion, DNREC may employ statistical techniques to establish a relationship between screening and confirmatory results so that remedial end points can be confirmed with the screening results.
- Samples selected for confirmatory analysis will include those with results close to the Screening Levels and at least one sample that was non-detect when screened.

Confirmatory

HSCA approved laboratories are expected to follow all procedures outlined in *SOPCAP*, as well as EPA sample preparation and analysis protocols under SW-846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods." In the event of an analysis needed that is not performed by a HSCA approved lab, the Division QAM may approve a Special Analytical Service (SAS) Request. The analysis specified in the SAS must be performed according to the most recent applicable EPA Method.

The following methods may be used for HSCA, CERCLA, and Pre-Remedial sites and investigations:

- EPA SW-846 Methods for the Analysis of Solid Waste
- EPA Methods for the Analyses of Water and Wastewater (600 series)
- EPA Drinking Water Methods (500 series)
- EPA Method 1633
    - This method will be used for PFAS analysis on all matrices except public drinking water
- EPA 537.1
    - This method will be used for PFAS analysis on public drinking water samples
- EPA 533
    - This method may be used for PFAS analysis on public drinking water samples.
- EPA Method 680
    - This method is the standard analytical method for PCB analysis of soil, sediment, and water samples collected in relation to HSCA defined releases.
    - The Division may require the use of EPA Method 1668 for any sample collected at, or in connection with investigations of, sites that are adjacent

to or are receiving waters of a Clean Water Act 303(d)-listed waterway for PCBs. The Division may also require the use of EPA Method 1668 for any media sampled at locations where site-specific conditions indicate the need for fingerprint analysis of PCBs.

- EPA Method 8082 may be the most appropriate method to use when a recent (within the last six months) known release of PCB containing material has occurred. A written request and proof must be submitted to the DNREC for approval prior to submission of the SAP.

- In the case of samples submitted for Superfund activities, the analytical methods found in the USEPA *Contract Laboratory Program Statement of Work for Superfund Analytical Methods* (SFAM01.1) and USEPA *Contract Laboratory Program Statement of Work for High Resolution Superfund Methods* (HRSM02.1), will be followed as applicable.

Confirmatory data will be compared to screening results by analyzing the reported analyte concentrations. The QAM will perform a detection-to-detection comparison. For example, if arsenic is detected in the screening analysis, then the fixed laboratory result should contain arsenic. There are no acceptance criteria for the comparison of screening and confirmatory data; however, any stark differences discovered will prompt further investigation to determine an explanation for the discrepancies. Screening results from samples that did not undergo confirmatory analysis will not be used to make site decisions.

Samples for NPL sites must be analyzed at a laboratory that is within the EPA CLP. The EPA R3 is responsible for ensuring that CLP laboratories as well as the Laboratory and Technical Services Branch (LTSB) Laboratory Section meet federal requirements. Analytical work performed for NPL sites requires the use of EPA methods. No method modification may be utilized without EPA consent.

RCRA C and UST Prevention

EPA approved analytical methods which achieve project objectives, such as "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," will be selected and included in the site event specific sampling plan. When non-routine parameters are requested, the project specific documentation will include information about analytical method requirements.

LUST

Analyses of soil and groundwater samples collected for a Hydrogeologic Investigation (HI) must be performed in accordance with the methods listed in the table below.

Table 5 HI Analytical Methods

Product Stored	Target Analytes for Soil	Analytical Method	Target Analytes for Groundwater	Analytical Method
Gasoline or Aviation Gas	Benzene Toluene Ethylbenzene Xylenes Isopropylbenzene (cumene) Naphthalene MTBE[3] TBA EDB[4] EDC[4] 1,2,4-TMB 1,3,5-TMB	EPA Method 5035/8021B or EPA Method 5035/8260	Benzene Toluene Ethylbenzene Xylenes Isopropylbenzene (cumene) Naphthalene MTBE[3] TBA EDC[4] 1,2,4-TMB 1,3,5-TMB	EPA Method 5030/8021B, EPA Method 5030B/8260B or 524.2[7]
	Lead[4]	EPA Method 6010B or 7420	EDB	EPA Method 8011 or 504.1
			Dissolved Lead	EPA Method 6020 or 7421
Kerosene or Jet Fuel	Benzene Toluene Ethylbenzene Xylenes MTBE TBA EDC Naphthalene	EPA Method 5035/8021B or 5035/8260	Benzene Toluene Ethylbenzene Xylenes MTBE TBA EDC Isopropylbenzene (cumene) Naphthalene	EPA Method 5030/8021B, EPA Method 5030B/8260B or 524.2[7]
	Benzo(a)anthracene Benzo(a)pyrene Fluorene Phenanthrene	EPA Method 8270C or 8310	Phenanthrene	EPA Method 8270C, 8310, or 525.2[7]
Diesel or Heating Fuel	Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene Ideno(1,2,3-cd)pyrene Acenaphthene Anthracene Fluoranthene Naphthalene Fluorene Phenanthrene Pyrene	EPA Method 8270C or 8310	Benzene Toluene Ethylbenzene	EPA Method 5030B/8021B, 5030B/8260B or 524.2[7]
			Chrysene Acenaphthene Naphthalene Phenanthrene	EPA Method 8270C, 8310 or 525.2[7]

Product Stored	Target Analytes for Soil	Analytical Method	Target Analytes for Groundwater	Analytical Method
Used Oil[1,2] or New Oil[8]	Benzene Toluene Ethylbenzene Xylenes MTBE[3] EDB EDC	EPA Method 5035/8021B or 5035/8260	Benzene Toluene Ethylbenzene Xylenes MTBE[3] EDC	EPA Method 5030B/8021B, 5030B/8260B or 524.2[7]
	Lead	EPA Method 6010B or 7420	EDB[4]	EPA Method 8011 or 504.1
			Lead[4]	EPA Method 6020 or 7421
	Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene Ideno(1,2,3-cd)pyrene Acenaphthene Anthracene Fluoranthene Naphthalene Fluorene Phenanthrene Pyrene	EPA Method 8270C or 8310	Chrysene Acenaphthene Naphthalene Phenanthrene	EPA Method 8270C, 8310 or 525.2[7]
	Other[2] (as required VOCs, SVOCs, Metals, or other analyte on site-specific basis)	EPA Method 5035/8021B, 5035/8260, 8270C or 8310, 6010	Other[2] (as required VOCs, SVOCs, Metals, or other analyte on site-specific basis)	EPA Method 5030B/8021B, 5030B/8260B or 524.2[7], EPA Method 8270C, 8310 or 525.2[7] EPA Method 6010
Other[5]	Other[5] (Site Specific)	To Be Determined	Other[5] (Site Specific)	To Be Determined

1. Used oil as defined in the Delaware Regulations Governing Underground Storage Tank Systems, Part A, Section 2. and the Delaware Regulations Governing Hazardous Waste.
2. Used oil Tank Systems may also be required to analyze for metals, volatiles, semi-volatiles or any other analyte as required on a site specific basis depending on the tank contents. Contact DNREC for determination.
3. MTBE analysis is required, unless conclusive documentation is submitted and pre-approved by DNREC that no portion of the tank system was in service after January 1, 1978.
4. For gasoline Tank Systems only, Lead, EDB and EDC analysis is required, unless conclusive documentation is submitted and pre-approved by DNREC documenting that all portions of the tank system were installed after January 1, 1996.
5. If the tank system contained anything other than petroleum products or if the tank system contained Racing Fuel, contact DNREC for information on sampling procedures and analytical requirements prior to any on site activities.
6. Samples collected for the analysis of volatile organic compounds must be preserved with methanol. Encore™® samplers are acceptable provided the preservative is methanol.
7. EPA 524.2 and 525.2 may be used for drinking water analysis only.
8. New Oil parameters may be modified with DNREC approval.

Quality Control

Laboratory QA/QC

The laboratory's Project Manager is responsible for ensuring laboratory SOPs and the QA manual are being followed. The number and types of internal QC checks for each analytical method must be defined in the laboratory's QA Manual. The QA Manuals for laboratories most commonly used for Division projects can be found in Appendix J.

Outside of NPL and RCRA activities, lab QC requirements will at minimum follow the criteria described in *SOPCAP*, which is a HSCA regulation. Table 6 summarizes the *SOPCAP* requirements for laboratory QC and is provided for guidance only. For some projects, the criteria in *SOPCAP* may not be sufficiently stringent to meet project DQOs. In those cases, EPA method requirements will apply. The applicable lab QC requirements will be specified in the site-specific plan. Any deviations from the requirements must be documented by the laboratory and reported to the data user. Data that does not meet the requirements will be flagged. Common laboratory flags are defined in Table 7.

Laboratory QC typically consists of the following:

- Detection Limits
    - Method Detection Limit (MDL): The minimum measured concentration of a substance that can be reported with 99% confidence that the measured concentration is distinguishable from method blank results.
    - Practical Quantitation Limit (PQL): A measure of the lowest limit of detection under the conditions of a particular method.
    - Reporting Limit (RL) or Limit of Quantitation (LOQ): the lowest analyte concentration that a laboratory can reliably report
    - Sample results will be reported with the MDL and RL/LOQ. Laboratory MDLs will be less than or equal to the HSCA Human Health Screening Levels, where technologically feasible.
- Instrument Calibration
    - Initial calibration (ICAL): Usually involves running a series of standards to establish a calibration curve
    - Initial calibration verification (ICV): A standard that is ran after an initial calibration in order to verify the calibration using a second source
    - Continuing calibration verification (CCV): A standard that is ran typically every 12 hours or every 10-20 samples to verify the ICAL.
- Laboratory Control Sample (LCS): The LCS is a blank sample that has been spiked, prepped, and analyzed the same way as field samples in order to assess the accuracy of the laboratory's procedures.

- Method Blank (MB): A MB is a blank used to evaluate the presence and/or effect of laboratory contamination.
- Internal Standard (IS): Compounds that are unlikely to be found in environmental samples that are similar to the compounds of interest. Samples are spiked with ISs typically right before analysis and are used for analyte quantitation.
- Surrogate Standard: Compounds that are unlikely to be found in environmental samples that are similar to the compounds of interest. Unlike ISs, surrogates are added at the beginning of the sample prep process in order to test the accuracy of the prep and analysis procedure.

Table 6 Lab QC

Type of Lab QC Sample	Frequency	Acceptance Criteria[1]	Corrective Action[2]
ICAL	As needed	%RSD for each analyte is ≤30%	Perform a new ICAL
ICV	1 every time an ICAL is ran	% Recovery must be between 70-130%	Rerun the ICV
CCV	Every 12 hours	Relative Response Factors (RRF) % Difference from the average RRFs must be ≤25%	Rerun the CCV, run and ICAL
LCS	At least 1 per batch of 20 samples	% Recovery must be between 70-130%	Rerun the LCS
MB	1 per batch of 20 samples	No detections greater than the MDL	Rerun the MB
Internal Standard	Added to every sample and QC sample	Areas must be within 50-200% of the average of the IS areas in the calibration standards for the CCV Areas must be within 50-200% of the areas in the CCV for samples	Check the integrity of the IS spiking solution Determine is matrix effect is responsible Rerun the sample
Surrogate	Added to every sample and QC sample	% Recovery must be between 80-120%	Check the integrity of the surrogate spiking solution Determine is matrix effect is responsible Rerun the sample

1. The acceptance criteria in this table are derived from *SOPCAP* and are for guidance purposes only. Different analytical methods will have different requirements. Please see *SOPCAP* Section 6 for more details on QC requirements for individual analyses. If the requirements in *SOPCAP* do not meet the needs of the project, then the QC requirements will adhere to those set forth in the EPA approved methodologies.
2. The corrective actions in this table are derived from *SOPCAP* and are for guidance purposes only. The corrective action procedures listed may differ depending upon the DQOs and the acceptance criteria provided in the site-specific plan.

Table 7 Common Qualifiers

Flag	Definition
A	Indicates tentatively identified compounds that are suspected to be aldol condensation products

B	Compound was found in the blank and sample
C	Pesticide identification was confirmed by GC/MS Indicates a coeluting congener peak.
D	Reported result obtained from a diluted sample analysis
E	Result exceeded calibration range
J	The reported result was an estimated value with an unknown bias
J+	The result was an estimated quantity, but the result may be biased high.
J-	The result was an estimated quantity, but the result may be biased low.
L	Indicates congeners are coeluting
N	The analysis indicates the presence of an analyte for which there was presumptive evidence to make a "tentative identification."
NJ	The analyte has been “tentatively identified” or “presumptively” as present and the associated numerical value was the estimated concentration in the sample.
U	The analyte was not detected and was reported as less than the MDL or as defined by the customer.
UJ	The analyte was not detected and was reported as less than the LOD or as defined by the customer. However, the associated numerical value is approximate.

Field QA/QC

Quality control checks will be performed on field samples through the collection and analysis of field duplicate samples, matrix spikes/matrix spike duplicates, (field) equipment blanks and field blanks. Please note the acceptance criteria provided below may be used as a guideline for DNREC projects. The field quality control requirements for a specific project will be dependent upon the DQOs of that project and may differ from those summarized below. When a project needs different requirements, the site-specific plan will specify the applicable requirements.

1. **Field Duplicate:** A field duplicate is a field sample that is collected at the same time and location as the source field sample using the same collection system and analyzed identically. The field duplicate sample is to be used as a measure of precision and representativeness. They are collected on a ratio of 1 to 20 samples, meaning for obtaining 20 or less samples, one duplicate sample will be taken. For 20 samples or more, an additional duplicate will be obtained for each group of 20. Acceptance criteria for field duplicates and parent samples is 40% relative standard deviation.
2. **Matrix Spike/Matrix Spike Duplicate:** A matrix spike (MS) is a sample to which known quantities of target analytes are added by the laboratory prior to analysis. An MS/MSD pair is analyzed to assess accuracy and precision. They are prepared and analyzed at a frequency of 1 for every preparation or analysis batch of up to 20 samples. Recovery for MS/MSDs should be within 50% of the true spike value for spikes at 10 times the MDL.

3. **Equipment Blank:** An equipment blank is obtained by running deionized, organic free water or contaminant free solid (soil or sand) over equipment, and either prior to sampling, or after decontamination. The field equipment blank is treated as any sample and used to determine the amount of bias introduced into a system through field contamination. A minimum of one equipment blank per sample matrix per day will be obtained, where the sampling equipment is subject to decontamination procedures. Field procedures are contained in Appendix H. Acceptance criteria for equipment blanks will follow criteria described in the USEPA *National Functional Guidelines*.
4. **Field Blank:** A field blank is prepared by filling the sample container with deionized, organic free water or contaminant free solid (soil or sand), transporting the blank to the field, exposing to field conditions by adding preservatives and in general treating it as a normal sample. This process is used to determine the effectiveness of laboratory glassware decontamination, the effect of preservatives, reagents, etc. used in the preparation of environmental samples and the effect of exposure to ambient on-site conditions. A minimum of one field blank per glassware type, per site will be obtained. Acceptance criteria for field blanks will follow criteria described in the USEPA *National Functional Guidelines*.
5. **Trip Blank:** A trip blank is a clean sample of a matrix that is taken to the sampling site and transported to the laboratory for analysis without having been exposed to sampling procedures. Trip blanks are routinely used to monitor for cross-contamination between samples during transport. They are typically only submitted for aqueous volatile organic compound (VOC) analysis since these compounds have the greatest potential for escaping from a sample container and penetrating other sample bottle seals.

Instrument/Equipment Calibration, Testing, Inspection, and Maintenance

Laboratory Equipment

All instruments and equipment anticipated for use on a DNREC project will be maintained in a state of readiness. Routine preventative maintenance will be performed periodically on each analytical instrument in accordance with laboratory SOPs, the laboratory QA Manual, and/or the manufacturers' recommendations. The laboratory is responsible for ensuring that their personnel are adhering to these requirements and procedures. Maintenance records will be maintained and updated when any kind of maintenance is performed on an analytical instrument, whether it is preventive or repair.

Laboratory instruments and equipment must be maintained in good operating conditions and be adequately calibrated prior to use on any DNREC project. The calibration procedures presented below in Table 8 summarize the requirements in *SOPCAP*, which are derived from the laboratory's QA Manual.

Table 8 Lab Equipment Requirements

Equipment Type	Maintenance Procedure	Schedule/Frequency	Documentation	Acceptance Criteria and Corrective Action
Balances	Verify calibration using traceable reference standards Calibration by an external calibration service	Daily prior to first use Annual	Logbooks	Laboratory defined
Refrigerators and freezers	Record temperature	Daily		
Thermometers for refrigerators and freezers	Calibrate with traceable reference standard	Annually		
IR thermometers, digital probes and thermocouples	Calibration	Quarterly		
Conductivity, pH, and turbidity meter	Calibrate with known standard or buffer solution	Prior to use		

Laboratories should at minimum follow the calibration procedures for instruments that are detailed in *SOPCAP* Section 6.5. If more stringent calibration procedures are required to achieve project DQOs, the laboratory will adhere to the requirements set forth in the applicable EPA method. These requirements will be specified in the site-specific plan.

Field Equipment

Field equipment maintenance is performed on an as needed basis. Each piece of field equipment will be checked prior to field use for proper operation. An equipment maintenance log for each instrument is filled out for each performance check in the field logbook. Malfunctioning equipment will be placed out of service, repaired and alternate equipment used.

Table 9 below summarizes the equipment and calibration frequency for DNREC fieldwork. All electronic field equipment will be calibrated in accordance with the manufacturer's specifications. All personnel involved in fieldwork will be trained to calibrate equipment, perform preventative maintenance, and maintain equipment logs in their field logbooks. Equipment logs will include usage, maintenance problems (date, dip function, operator), calibration schedules (laboratory and factory), and repair records.

DNREC Hydrologists are responsible for maintaining all field equipment. The manufacturer will conduct all necessary repairs to the equipment.

Table 9 Field Equipment Requirements

Equipment Type	Maintenance Procedure	Schedule/Frequency	Documentation	Acceptance Criteria and Corrective Action
Electronic pH and temperature meter	Calibration using two reference buffers	Manufacturer's specifications	Field Logbook	Manufacturer's specifications
Electronic conductivity meter	Calibrated to reference solutions	Manufacturer's specifications		
PID	Calibration with reference solution	Every time power is turned on		
Combustible gas indicator	Calibrate using pentane as a reference standard	Manufacturer's specifications		
Temperature/level/conductivity meter	Calibrated by manufacturer	Manufacturer's specifications		

Inspection/Acceptance Requirements for Supplies and Consumables

The DNREC Project Officer is responsible for ensuring that all necessary supplies, consumables, and contracted services are procured in accordance with DNREC procurement procedures to support project activities. This includes coordinating the establishment of contracts, where required, and the issuance of purchase orders (POs) for subcontractors, laboratory services, and other project-related needs. The QAM will assist in securing POs for laboratory services. No field work or laboratory analysis can proceed without an approved PO for that specific project. PO requests are made by filling out the following documents: a Critical Needs Statement, the Procurement Summary Form, and the Written Quotes and Letter Bids Solicitation Information Form. The Environmental Program Administrator must approve all PO requests.

All bottle ware is supplied by the laboratory. Laboratories shall inspect supplies and consumables prior to their use in analysis. Contractors performing field operations are responsible for inspecting supplies and consumables prior to their use. They are expected to note any deficiencies or problems and return any deficient item for replacement.

An example checklist utilized for field inspections which includes any items that may be used during an inspection can be found in Appendix M. Should an item, either CAPS, RS, or contractor owned, fail a viability/functionality inspection, the item is not utilized for the sampling event.

Environmental Information Management

All correspondence, reports, work plans, data submittals, and other information related to Division activities are submitted and maintained electronically. The Department does not accept or retain paper copies as part of its official records. Electronic data and documents are uploaded directly into DNRECtory, the Division's centralized electronic document management system.

Administrative support staff are responsible for ensuring that all incoming electronic documents are appropriately logged, indexed, and filed within DNRECtory using the assigned DNREC site number and applicable program codes. Document control procedures are implemented to ensure that records are complete, traceable, and readily retrievable. DNREC databases such as the Site Status Database (SSD) are restricted to DNREC staff and are not accessible to the public.

DNREC-generated internal documents are managed in accordance with established document control procedures. Project Officers prepare documents and assign a unique chronological (chron) identifier consisting of the Project Officer's initials, the two-digit year, and a sequential document number (e.g., JAS02001). These documents are uploaded and maintained in DNRECtory. Administrative support staff ensure proper indexing and filing of these records to maintain document traceability and version control. More information regarding electronic document management, record retention, and chron numbering conventions are provided in Appendix K.

DNREC staff have access to the Site Status Database (SSD). This database provides complete access and status as well as previously related site activity to the end user. All Project Officers are required to produce the weekly notes in the DNREC SSD Database. This information remains in the database indefinitely and backed up daily by the DNREC Database Administrator. By compiling this information in the SSD, any data user can obtain the case history for all DNREC sites. The SOP for producing the weekly notes is in Appendix K. More information on DNREC databases can be found in the Non-Direct Measurements section.

EQuIS Electronic Data Deliverables

DNREC maintains an EQuIS database to store and analyze both field and laboratory data about facilities and sites that are the subject of regulatory, remediation, or other management efforts of the department. Prior to submitting Electronic Data Deliverables (EDDs), Project Officers submit basic information pertaining to the site including the facility/site name, facility/site ID, Project Officer name, data provider name, facility/site address, and the program that the facility/site is part of. EQuIS formatted files are uploaded to a data management system that includes field sampling data, analytical results, and QA/QC information. The EQuIS Data Processor (EDP) is a tool used to

check data files against DNREC's EDD requirements. All EDDs must be checked for errors by data providers by loading data into the EDP and must be error free before they are submitted to DNREC. Consultants and laboratories may submit EDDs via email to the EQuIS inbox. Once submitted to the EQuIS inbox, EDDs are managed by the EQuIS Data Management Team. The Team will verify that required fields and formatting meet EQuIS requirements. Various reports can be produced from this data repository such as exceedance reports or trend reports. DNREC approved laboratories are required to maintain analytical data packages in accordance with SOPCAP including the EQuIS files. If the laboratory enters bankruptcy, DNREC will acquire all information related to site files and image them into the DNREC database. The electronic deliverables are maintained in the site files for future use by any data user.

Delaware Environmental Navigator

The Delaware Environmental Navigator (DEN) is a publicly accessible database that contains environmental information generated, collected, or maintained by DNREC. Documents are uploaded to DEN by administrative staff. DEN is backed up daily. All data for TMS is maintained on DEN. DEN includes the following types of information:

- Facility identification information
- Permitting and authorization records
- Compliance and inspection records and data
- Enforcement information
- Analytical data
- Investigation or assessment reports

Non-Direct Measurements

Non-direct measurements refer to data or information that are obtained from existing sources or prior activities, rather than being collected firsthand specifically for the project in question. This may include data from computer models, literature files, or databases. DNREC personnel may use non-direct measurements to gather information related to a site. Many tools that are not related to sampling are available to assist in making site related decisions.

DNREC Databases

DNRECtory and SSD are databases that Project Officers may use to search for existing sampling or analytical data from previous efforts. Since the information that may be gathered from DNRECtory or SSD is state produced, it has already been verified for accuracy and quality.

- DNRECtory: All internal and external site documents are maintained on the DNRECtory electronic content management system. This includes all work plans, reports, correspondence, memorandums, EPA documents and Office of the Secretary correspondence.
- DNREC SSD: The information included in this database is site/field visits, meeting reports, work plans, draft and final report(s), permits, weekly notes, public inquiries/notices, correspondences including emails, the Project Officer identification, and the site status.
- Hazardous Waste DE (HazWasteDE): This internal database for the State is used to manage hazardous waste program data. It serves as a supplemental system to RCRAInfo and may include additional state-specific information such as generator notifications, annual reporting data, compliance documentation, and programmatic tracking details. Data is entered into and maintained by DNREC staff and is routinely reviewed for completeness and consistency.
- UST DE: This database is maintained by the State to manage information related to the UST program. It contains information on tank system registration, installation and closure details, inspection results, compliance status, releases, and corrective actions. Data in UST DE is generated from facility submissions, field inspections, and program activities conducted by DNREC staff.

Secondary Data Sources

- Geographical Information System (GIS): Allows the end data user to plot data points on the property by electronically surveying the investigation area. The survey points are plotted on a scaled map area, and this information is submitted as a sample location map in the report.
- United States Geological Survey (USGS): The USGS have pre-prepared maps available that can be utilized as site location maps. These maps may be found online. Additional maps are available at USGS office in Dover, Delaware.
- RCRAInfo: This is a national database maintained by the EPA and used by Division staff to track hazardous waste handlers, regulated activities, permitting, and compliance/enforcement actions under RCRA. Division staff use RCRAInfo to access facility identification data, handler status, waste codes, inspection

results, and enforcement history. These data are entered by regulatory personnel and are subject to EPA data standards and validation rules.

USGS maps, utility markings, environmental justice issues, and GIS coordinates, are potential data used on sites with no acceptance criteria. Project Officers are responsible for reviewing all data from non-direct measurements to identify any limitations on their use. The suitability of data derived from non-direct measurements must be assessed for each specific project. The use of such data will be documented in a site-specific plan. Site-specific plans will outline the purpose and intended application of each type of data or information collected, the approach for identifying or obtaining the data and its anticipated sources, the methods used to evaluate data quality, and the criteria used to determine whether the data quality is sufficient for use in support of the project. Project Officers must clearly document criteria and reasons for including and excluding certain data from use.

GROUP C: ASSESSMENT, RESPONSE ACTIONS, AND OVERSIGHT

Assessments and Response Actions

HSCA, CERCLA, Pre-Remedial

Table 10 summarizes the types of assessments that will be performed under the quality system, while Table 10 outlines the types of nonconformances and their corresponding corrective actions. More information can be found in the subsequent sections.

Table 10 Assessments

Assessment Type	Responsible Party & Organization	Number/ Frequency	Assessment Deliverable	Person Responsible for Responding to Assessment Findings	Person Responsible for Identifying and Implementing CA	Deliverable Due Date
Initial Laboratory Audit	DNREC RS QAM	Once for HSCA Approval	Audit Report	Laboratory QAM	Laboratory QAM	30 days following assessment audit
Ongoing laboratory audit	DNREC RS QAM	Biennial	Audit Report	Laboratory QAM	Laboratory QAM	30 days following assessment audit
Quality System Audit	DNREC RS QAM	Biennial	Quality System Memorandum	Program Administrator and DWHS Director	Program Administrator and QAM	30 days following assessment audit

Laboratory Assessments

Before laboratories can perform work for HSCA sites, they must receive HSCA approval. The laboratory approval process starts with a documentation review conducted by the QAM. The purpose of this review is to assess current physical operations, staff experience, quality systems, and past performance on performance evaluation studies relevant to the analyses included in the proposed project. Specifically, DNREC requires that a prospective laboratory submit:

1. A copy of any relevant QA Manuals applicable to proposed project specific analytical protocol; and
2. Proof of current NELAC TNI certification; and
3. A copy of a Statement of Qualifications (SOQ) or similar facsimile document covering the information outlined in Section 2.3.1.2; and
4. Copies of the results (including corrective actions, as appropriate) from Performance Evaluation conducted and/or required by federal/state agencies during the last two years.

If the contents of the QA Manual and SOQ meet the criteria as outlined in *SOPCAP* Sections 2.3.1.1 and 2.3.1.2, DNREC will then evaluate the results of the laboratory's PE samples. If the laboratory participates in a regular monitoring of performance program, DNREC will review the results of the most recent PE. Otherwise, DNREC may procure and submit its own PE samples (field blind or known) to the lab. PE samples must be analyzed using the same methods and procedures to be used to perform work for DNREC. If the results of the PE samples are acceptable, DNREC will perform an onsite laboratory audit. The audit will verify the laboratory's facility, analytical instruments, QA/QC policies, operational practices, and technical documentation. When the audit is complete, DNREC will issue a report detailing any deficiencies. The laboratory will have the opportunity to respond with a corrective action plan that will allow it to meet the DNREC program requirements. Once HSCA approved, laboratories may perform work for DNREC projects that that fall under the HSCA program.

DNREC **does not have a formal accreditation laboratory process**, therefore, all laboratories under HSCA must have NELAC certification. As part of NELAC certification, laboratory must follow the data quality objectives provided by the end data user as part of the TNI standards. An approved HSCA laboratory must follow the data quality objectives, or the laboratory could subject themselves to disciplinary action under a state approved NELAC participant (i.e. State of New Jersey). A HSCA laboratory can be audited at the discretion of DNREC. All laboratory audit documentation must be maintained at the approved HSCA laboratory. Any laboratory corrective action report

must be submitted to the QAM for review and placed in DNREC RS corrective action/audit folder.

The QAM will perform ongoing evaluations of HSCA approved laboratories. This evaluation will consist of reviewing the laboratory's most recent PE results and conducting a laboratory audit. Ongoing evaluations will take place on a biennial basis and will be performed by the QAM. The process for conducting an ongoing laboratory audit will be the same as the initial audit and is described in further detail in *SOPCAP* Section 2.3.1.4.

Internal Assessments

A quality system audit is conducted by the QAM approximately every two years. The quality system audit evaluates the extent to which work conducted within or on behalf of the Division complies with this *QAPrP*, the DNREC *QMP*, and *SOPCAP*. The audit includes a thorough review of the following:

- Documents (Chain of Custodies, SOPs, Guidances, etc.)
- Sampling and analysis procedures
- Data management policies and procedures
- Training procedures

The quality system report/memorandum outlines major and/or minor issues that may require corrective action. Minor issue corrective action is at the discretion of DNREC Program Administrators. Major issue quality system failures should be discussed with DNREC staff. Corrective action(s) should be documented via email, memorandum, and/or correspondence.

Corrective Action

Corrective action is required when a non-conforming situation occurs in laboratory and or in the field. A nonconformance can be described as any deviation, discrepancy, or failure to meet the established requirements, procedures, standards, or specifications. Nonconformances may include, but are not limited to, procedural errors, data quality issues, equipment malfunctions, documentation errors, or any action that compromises the accuracy, reliability, or integrity of the data or DNREC activities. Anyone involved in a project is required to follow DNREC SOPs and/or *SOPCAP*, except for laboratory personnel, who adhere to laboratory SOPs. If a nonconformance is discovered at any point in the project, DNREC personnel will be notified, and an appropriate corrective action will be implemented. Project Officers will be present on sites during sampling activities, or the implementation of remedial actions, etc. to observe and provide oversight. If the nonconformance causes a deviation from the site-specific sampling plan, it will be discussed in the final report.

Corrective actions for sites will be tracked and maintained by the Project Officer. Laboratory corrective actions will be in a separate folder maintained by the QAM. Corrective action reports, summary, or correspondence can be in any form as long as the procedure can be documented and tracked. An email/letter can be an acceptable form of documenting a corrective action.

The Corrective Action Request Form can be found in Figure 5. Corrective action may be initiated by any project individual who observes a major problem, but the form will be submitted to the laboratory or contractor Project Manager by the Project Officer or QAM. A major problem is defined as any nonconformance that causes a deviation from the site-specific sampling plan, or any nonconformance that influences the site decision. Generally, Corrective Action Request Forms are required to be submitted to DNREC within 30 days of receipt. All corrective actions require the approval signatures of the Project Manager and the QAM.

Nonconformances and their appropriate corrective action are summarized in Table 11 below.

Table 11 Nonconformances

Nonconformance type	Corrective Action Responsible Party	CA documentation	Timeframe for response	Responsibility for implementing CA	Responsibility for monitoring CA implementation
Laboratory nonconformance (e.g. spike recoveries are outside of acceptance criteria)	Laboratory staff	Must be recorded in the case narrative and discussed in the final report, data must be flagged	No response is required	Laboratory staff	Laboratory staff
Field Procedural Nonconformance (e.g. protocols defined by the sampling SOPs are not followed)	Field crew must notify DNREC Project Officer	Email correspondence between the HSCA contractor Project Manager and DNREC Project Officer	Within 14 days of DNREC RS notification	HSCA Contractor Project Manager	DNREC Project Officer
Questionable field data, i.e. suspected field contamination	QAM and Project Officers	Email correspondence to HSCA contractor	Within 14 days of HSCA contractor notification	DNREC RS Project Officers and HSCA contractor	DNREC Project Officers and QAM
Non representative data	QAM and Project Officers	Email correspondence to HSCA contractor	Within 14 days of HSCA contractor notification	HSCA contractor	DNREC Project Officers and QAM
Hold time violation	The laboratory must notify the QAM and Project Officer	Must be included in the case narrative and discussed in the final report,	No response required	Laboratory staff and/or HSCA contractor performing the work if the hold	Laboratory staff or the QAM if the hold time violation was

		data must be flagged		time violation occurred due to a delay in sample receipt or activation	found to be caused by the contractor

RCRA C and UST Prevention

Internal and external performance and systems audits will be undertaken to evaluate the capability and performance of the total measurement system. Audits will be utilized to ensure that inspections and/or field and laboratory activities will provide data that adequately reflects facility conditions. Field performance audits, field systems audits, and laboratory audits will be performed within the RCRA C and UST Prevention programs.

A performance audit evaluates the accuracy of the total measurement system or any component thereof. A systems audit focuses on evaluating the principal components of a measurement system to determine proper selection and use of equipment. Regarding inspections and/or field sampling operations, this oversight activity is performed to critique the quality control procedures which are to be employed. An external laboratory audit may be a compliance audit ensuring that the laboratory is performing according to explicit contract requirements. The laboratory is responsible for performing internal systems and performance audits examining overall laboratory performance.

Field Performance Audit

These audits may be conducted when necessary to evaluate compliance with requirements of a site-specific QAPjP or SAP. Performance audits will determine adherence of operators to written procedures and guidance. These audits are conducted by Project Officers

Field Systems Audit

These audits may be conducted when necessary to evaluate if the project plan system complies with requirements of a site-specific QAPjP. Field systems audits may include, but are not limited to, an examination of the following items: acceptable procedures available to the operators at the point of use (SAPs, SOPs and/or Guidance Documents); training records; logbooks; instrument records; sample collection records; and sample handling, preservation, packaging, shipping, and custody records. These audits will be conducted by Project Officers

Laboratory Audit

These audits may be performed when necessary to assess and evaluate the laboratory adherence to QA criteria. Laboratory systems evaluations may include the following: sample log-in, identification, storage, tracking, and custody procedures, sample and

standards preparation procedures, capacity and availability of instrumentation and equipment, analytical instrument/equipment operation, maintenance and calibration, laboratory security procedures, training and certification of analysts and managers, data quality control procedures.

LUST

Field Safety Audit

Field safety audits will be performed by Project Officers on an annual basis. The results will include the findings of the visit, any discrepancies, corrective action measures taken, and if any follow-up visits are needed. Corrective actions for audit deficiencies must be corrected by the contractor in the field before activities commence again. A Field Safety Audit form will be filled out appropriately by the Project Officer in the field. The form will be documented and stored with the project file.

Performance Audit (Performance Plan)

Performance audits will be performed on a semiannual basis at minimum.

Oversight and Reports to Management

HSCA, CERCLA, Pre-Remedial

Laboratory Audit Reports

Laboratory audits will be conducted by the QAM. Audit reports will include audit results, any corrective action that was implemented, impacts on data quality, and overall assessment of the laboratory. Audit reports will be made available to EPA R3 upon request.

Quality System Audit Reports

Quality system audit reports/memoranda are prepared by the QAM and submitted to the DNREC RS Environmental Program Administrator and DWHS Director. The quality system report/memorandum outlines major and/or minor issues that may require corrective action. Minor issue corrective action is at the discretion of DNREC RS Environmental Program Administrator. Major quality system failures should be discussed with DNREC staff. Corrective action(s) should be documented via email, memorandum, and/or correspondence. The Environmental Program Administrator must file corrective actions in an administrative file. The audit report/memorandum will include suggested corrective actions to address any findings.

Final Reports

Final reports may include RI reports, CBFI reports, SSA reports, etc. but the information contained is generally the same. Once all sampling and analysis activities are completed for an investigation, a draft report is prepared by the contractor or the Project Officer. DNREC staff will review the contents of the report and request changes as needed. Quality assurance review will be included in the report. The QA review will include the following:

- Summary of data quality assessment for the PARCCS parameters
- Discussion of whether DQOs were met
- All nonconformances that occurred during laboratory operations and how the nonconformances may or may not affect data usability
- Nonconformances that may have occurred during sampling or before the samples arrived at the laboratory and any corrective action that may have been implemented
- Discussion of field performance audits that may have been performed

HSCA final reports, CBFI reports, final plans of remedial action, and/or final documents produced by DNREC RS personnel and/or HSCA environmental consultants must be reviewed by the RS Project Officer and other RS staff for completeness and accuracy. If a DNREC RS Project Officer prepares a report, it will be reviewed by the applicable Program Manager, an additional Project Officer, and the QAM. Reporting of laboratory data will conform to the requirements in the current revision of *SOPCAP*. Level 4 data deliverables are required for all HSCA sites. The QA/QC results will be compiled per laboratory data report guidelines in *SOPCAP*. An email and/or correspondence must be submitted detailing any deficiencies and the corrective action taken. The email or correspondence must state that any QA/QC deficiencies have been approved by the QAM and should not adversely affect data quality or the evaluation of the site. Based upon the information in the report, the DNREC RS Program Manager will then evaluate the need for resampling and reanalyzing the questionable data. The DNREC RS Program Managers will review the final corrected document and will require more changes as needed. The final document is electronically scanned and filed in the site file. The final document must be filed for a period of ten years.

Reports to EPA

As stated in the DNREC EPA R3 VCP MOA, DNREC will report the following on an annual basis to EPA R3:

- The identification of sites being addressed under all categories of the HSCA program

- The identification of sites having received Certificates of Completion of Remedy by DNREC
- The identification of sites with full or partial completion in the previous year
- The identification of sites for which DNREC has issued no action determinations

On a semiannual basis for DNREC-lead, EPA-Designated High Risk Sites, DNREC will provide a description of the work accomplished at these sites during the reporting period, delays or other problems, if any, planned corrective measures and where appropriate, a list of the specific site events completed or scheduled.

The EPA approved Statement of Work for Site Inspections will specify the timeframe for submitting the final report. DNREC will submit the SI final report to the EPA R3 Site Assessment Manager. The report will be maintained in the DNREC files following EPA approval. SSA reports will be submitted to EPA R3 Brownfields and Land Revitalization Section. Final documents must be filed for a period of ten years.

RCRA C and UST Prevention

Reports will be prepared biannually and distributed to all project managers overseeing the project for review. The reports will include the following:

- Status of program activities
- Results of any Performance Evaluations and System Audits conducted.
- Results of periodic data quality assessments
- Significant quality assurance problems and recommended solutions
- Changes in the *QAPrP* or site-specific sampling plan

The reports will be prepared by the Program Manager for presentation to the highest-level of management of the organization being audited. When the Program Manager is not independent of the organization or activity being audited then independent reviewers will be assigned. If significant quality assurance problems occur, EPA will be notified.

DNREC will prepare a report for EPA R3 twice a year detailing the status of RCRA grant commitments.

Reports from UST Owners/Operators

The UST Regulations require owners and operators of tanks systems to provide notification for tanks related activities. Tanks Registration Notification forms are required for installation, repairs, retrofits, upgrades, change in service (out or return) or closure, and change of ownership. All tanks related forms can be found here.

LUST

Hydrogeologic Investigation Report

The investigation report must include the checklist included in the *HIG*. The report must be signed by a professional geologist or professional engineer registered in the State of Delaware, in accordance with Part E, §4.2.3 of the UST Regulations. In accordance with Part E §4.2.2 Responsible Parties shall submit the results of the hydrogeologic investigation to the Department no later than one hundred twenty (120) days after a release is confirmed or another Department approved schedule. The hydrogeologic investigation report shall include recommendations for further action or a request for a "No Further Action" determination in accordance with Part E, subsection 6.1.

GROUP D: ENVIRONMENTAL INFORMATION REVIEW AND USABILITY DETERMINATION

Data Verification, Validation, and Assessment

Verification

Data verification is a process for evaluating completeness, correctness, consistency, and compliance of data and/or QC data against a standard or contract. Data verification evaluates adherence to data generation protocols, SOPs, analytical methods, and project specific sampling plans. Verification also involves examining the data for errors or omissions.

Validation

Data validation is a systematic review of data against a set of established criteria to provide a specified level of assurance of its validity prior to its intended use, requiring that the techniques utilized be applied to the data in a methodical and uniform manner. The process of data validation must be close to the origin of the data, independent of the data production, and objective in its approach.

Data Quality Assessment

Data Quality Assessment (DQA) refers to the process used to determine whether the quality of a given data set is adequate for its intended use. DQAs may occur on selected projects and/or data generation processes. The purpose of this type of evaluation is to

determine whether the data collected are acceptable to the decision-maker or end user. Assessments generally are performed once all data has been generated and during the reporting stage of a project. Reports for projects that involved sampling and generation of data will include a DQA, which will be reviewed by the QAM.

HSCA, CERCLA, Pre-Remedial

Approaches to Verification, Validation, and Assessment

Laboratory personnel will verify analytical data at the time of analysis and reporting and through subsequent reviews of the raw data for any nonconformances to the requirements of the analytical method. All analytical data generated for Division projects are to be verified by the laboratory for adherence to *SOPCAP*. The data verification process is summarized in Table 12.

Table 12 Data Verification

Verification Input	Description	Internal/External	Responsible for Verification
COC and Shipping Forms	COC forms and shipping documentation will be reviewed by the laboratory upon receipt of samples for verification against the sample coolers they represent. The COC form will be signed by all parties that have custody of the samples, except for commercia carriers.	External	Laboratory Project Manager
COC and Shipping Forms	All COCs and shipping documentation will be emailed to DNREC for verification of accuracy.	Internal	Project Officer, Contractor staff, and DWHS QAM
Field Notes and Sampling Logs	All field notes and sampling logs will be reviewed internally and added to the project file	Internal	Project Officer and Contractor staff
Laboratory data	All laboratory data packages will be verified internally by the laboratory performing the work for completeness and accuracy prior to submittal. Upon analysis completion, the data goes through 3 levels of verification before submittal.	External	Eurofins bench level analysts, data reviewers, and laboratory QAM
Laboratory data	All final data packages will be verified for content upon receipt.	Internal	DWHS QAM

Data generated under DNREC programs are reported according to defined data deliverable levels. There are 4 levels and they represent increasing degrees of analytical documentation. Levels 1 and 2 include summary results suitable for screening, routine monitoring projects, or site characterization. Levels 3 and 4 are more rigorous in their documentation requirements and include comprehensive analytical information such as raw data and calibration data. The selection of the most suitable data deliverable level is based on project-specific DQOs, regulatory requirements, and the intended use of the

data. Level 4 deliverables will be generated for projects that require the highest level of data defensibility, which includes but is not limited to, data generated for NPL sites and data intended for use in risk assessments.

Data is not routinely validated because the laboratories are required to adhere to the strict analytical procedures outlined in *SOPCAP*. However, data validation is required for all NPL related activities and for work conducted by non HSCA approved laboratories. Additionally, data validation is required for all Level 4 deliverables. Data for NPL sites will be validated by a third party. The contractor is responsible for obtaining third party validation of data generated for NPL sites. For all other Level 4 data deliverables, the Division QAM will validate the analytical data to ensure compliance with the DQOs. The Division QAM or third party performing the validation must be independent of the laboratory performing the analysis. A data validator must be selected prior to the data generation. A copy of the data validation report will then be submitted to DNREC Project Officer to be included in the final report for NPL activities. In addition, HSCA approved laboratories are required to submit a letter that stipulates that the lab will report any alleged scientific misconduct under HSCA to DNREC immediately. Table 13 summarizes validation tasks for all DNREC projects receiving Level 4 deliverables, except those involving NPL sites. Validation of the data by the QAM includes a review of the following:

- Completeness of the data
- Adherence to proper sample preservation, transport, or handling protocols
- Examination of QC data for completeness and adherence to the site specific requirements
- Documentation of all data
- Appropriateness of the data as related to site specific DQOs
- Completeness and accuracy of the chain of custody
- The sample temperature upon receipt
- All required analytes were analyzed according to the site specific requirements
- Comparison of screening and confirmatory data

The site Project Officer will validate the project field information by reviewing the following:

- Confirmation of proper use of sample collection procedures
- Determine whether all the locations described in the sampling plan were sampled or that a reason for not sampling the location is provided and properly documented.

Table 13 Data Validation

Item	Activity	Responsible for Validation
Sampling Plan	Determine whether the sampling plan was executed as specified (i.e., the number, location, and type of field samples were collected and analyzed as specified in the sampling plan).	Project Officer
Sampling Procedures	Evaluate whether sampling procedures were followed with respect to equipment and proper sampling support (e.g., techniques, equipment, decontamination, volume, temperature, preservatives, etc.).	Project Officer
Data Deliverables	Ensure that all required information on analysis was provided	QAM
Analytes	Ensure that required lists of analytes were reported as specified.	Project Officer and QAM
Holding Times	Identify holding time criteria, and either confirm that they were met or document any deviations. Ensure that samples were analyzed within holding times specified in method, procedure, or contract requirements. If holding times were not met, confirm that deviations were documented, that appropriate notifications were made (consistent with procedural requirements), and that approval to proceed was received prior to analysis.	QAM
Sample Handling	Ensure that required sample handling, receipt, and storage procedures were followed, and that any deviations were documented.	Project Officer and QAM
Analytical Methods and Procedures	Establish that required analytical methods were used and that any deviations were noted. Ensure that the QC samples met performance criteria and that any deviations were documented.	QAM
Data Qualifiers	Determine that the laboratory data qualifiers were defined and applied as specified in methods, procedures, or contracts.	QAM
Deviations	Determine the impacts of any deviations from analytical methods and SOPs. Consider the effectiveness and appropriateness of any corrective action	QAM
Field Duplicates	Compare results of field duplicates with criteria established in the sampling plan. Should be submitted to laboratory without information identifying sample location or collection time.	Project Officer and QAM
Project Quantitation Limits	Determine that quantitation limits were achieved, as outlined in the sampling plan and that the laboratory successfully analyzed a standard at the QL.	QAM
Confirmatory Analyses	Evaluate agreement with screening results.	QAM

The final project report generated by the HSCA contractor will include a data quality assessment (DQA). A data quality assessment determines the usability of the data generated using the nonconformances provided in the analytical report case narrative. Contractors will follow the DNREC RS *Guidance for Analytical Data Usability* in Appendix F when performing the DQA. Conducting a DQA will consist of the following steps:

1. Review the project's DQOs and sampling design.

2. Review the laboratory analytical report to ensure data deliverable completeness. All required data deliverables described in Table 7-2 of *SOPCAP* must be present in the data package to proceed.
3. Review the nonconformances listed in the case narrative included in the laboratory analytical data report and determine their impact on data usability using the *Guidance for Analytical Data Usability Assessment.*
4. Document the findings of the DUA and include in the report in the form of text and/or a table, describing the bias on the data created by the nonconformances, if applicable. Include a discussion of the PARCCS parameters and how the nonconformances may deviate from them.

Upon receipt of draft report, the Division QAM will conduct a review of the DQA. The QAM will review the DQA, laboratory case narrative, and the full laboratory data package. The DQA is evaluated to determine if the DQOs were met. Each nonconformance listed in the laboratory case narrative will be evaluated to determine its effect on data usability, using the DNREC RS *Guidance for Analytical Data Usability Assessment* and the USEPA *National Functional Guidelines*. The QAM will also review the full data package to verify that there are no additional nonconformances other than those listed in the laboratory case narrative. When the usability evaluation is complete, the QAM will notify the Project Officer of the findings.

RCRA C, UST Prevention, and LUST

Approaches to Verification, Validation, and Assessment

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

Contractors and DNREC staff will verify field data through reviews of data sets to identify inconsistencies or anomalous values. Any inconsistencies discovered will be resolved as soon as possible by seeking clarification from field personnel responsible for data collection. To obtain defensible and justifiable data, all field personnel will be responsible for following the data collection and documentation procedures described in the site specific plan. Project Officers and contractors evaluate data submitted to them for completeness, correctness, conformance to acceptable practices, errors, omissions of data,

and procedural or contractual requirements, as appropriate. Furthermore, they evaluate the data and field practices for adherence to SOPs, analytical methods, and project specific planning documents, as appropriate. The laboratory is responsible for verifying that their measurement process was "in control" for each batch of samples before proceeding with analysis of a subsequent batch.

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

Data validation is not required for activities under the UST Prevention Program. Validation of data for the RCRA C or LUST programs will be conducted by the Project Officer and the contractor staff. Validation is performed in accordance with the Stage 1 level of EPA's *Guidance for Labelling Externally Validated Laboratory Analytical Data for Superfund Use*.

Finally, data obtained must be compared to the DQOs established in the site specific plan. This assessment will include a review of the sampling design, sampling procedures, sample handling, analytical procedures, and QC procedures. This review will be performed by the contractor as well as the site Project Officer.

Review of Field Data

Field data that are not supported by documentation of validated procedures and quality criteria cannot be used for enforcement purposes but may be useful for preliminary analysis and assessment. An in-house review of field data is generally completed by the Project Officer. Review includes examining logbook narrative, inspection checklists, maps, sample locations, photographs and other data collected during an inspection or sampling event. Sample locations and expected results must be consistent with actual sample analyses results. The review of results must ensure a complete list of sample information is available, proper sampling technique/extraction method/analytical method was followed, ability to validate precision of location data, pH values, and blank contaminations, etc. If review demonstrates that data does not meet project objectives or are of poor quality, an investigation or sampling event may need to be repeated, or the data may be usable with qualifying statements.

Review of Inspection Reports

Some projects require the review of existing data, such as operator-submitted databases or spreadsheets, historical data from Section files or from other DNREC divisions, data from other government' agencies and literature files. The source and quality of the data, along with potential problems affecting its applicability or limitations, will be

documented. Such data will be reviewed for quality and supporting documentation. If supporting documentation does not accompany the data, an attempt will be made to obtain the supporting documentation. Supporting documentation will be used in part to evaluate the quality and usefulness of the data. If such information is not available, the value and use of the data will be limited. Inspection reports should include the following components:

- Detailed data review and reduction procedures for all phases of sample preparation and analysis,
- Field and laboratory personnel responsible for performing each phase of data review and reduction,
- All formulas and equations used for data reduction and analysis,
- The definition of all terms and parameters,
- The measurement units for all parameters and results,
- Instructions on how results from QC samples (such as blanks, spike and duplicate samples) will be treated and used in calculating the final results,
- Procedures for flagging, qualifying, or marking the data with labels,
- Corrective action procedures for instances when data reduction procedures are not followed exactly or correctly, and
- Corrective action procedures for instances when errors are found during data review

Reconciliation with Data Quality Objectives

DQOs are established to ensure that environmental data collected and used by DNREC are of sufficient type, quantity, and quality to support programmatic and regulatory decision-making. Data must be reviewed and reconciled against established DQOs to confirm that the resulting data is fit for its intended use. After the data have been reviewed, verified, and validated, the data are evaluated against project DQOs and the PARCCS parameters, which were described in Section A. Limitations of data, including uncertainty of validated data, are reported to the DNREC using qualifiers such as those in Table 7. If the aforementioned criteria are met and the data are found to be usable according to the process described in the previous section, the Project Officer will determine if the data addresses the objective of the project. Decisions regarding data usability made by the consultant will be subject to DNREC approval. If data is deemed to be unusable, the DNREC Program Manager will recommend resampling of the affected data points.

Professional judgment is a key component of the decision making process. Technical staff will provide recommendations in writing to the Site Project Officer and will forward those recommendations to Program Manager. The Environmental Program Administrator has the final decision as to whether the Division will provide “No Further Action” or recommend further investigation on a site. Recommendations for further action at the site may include additional investigation, a Feasibility Study, or a Proposed Plan of Remedial Action.

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FIGURE 1. ORGANIZATION CHART

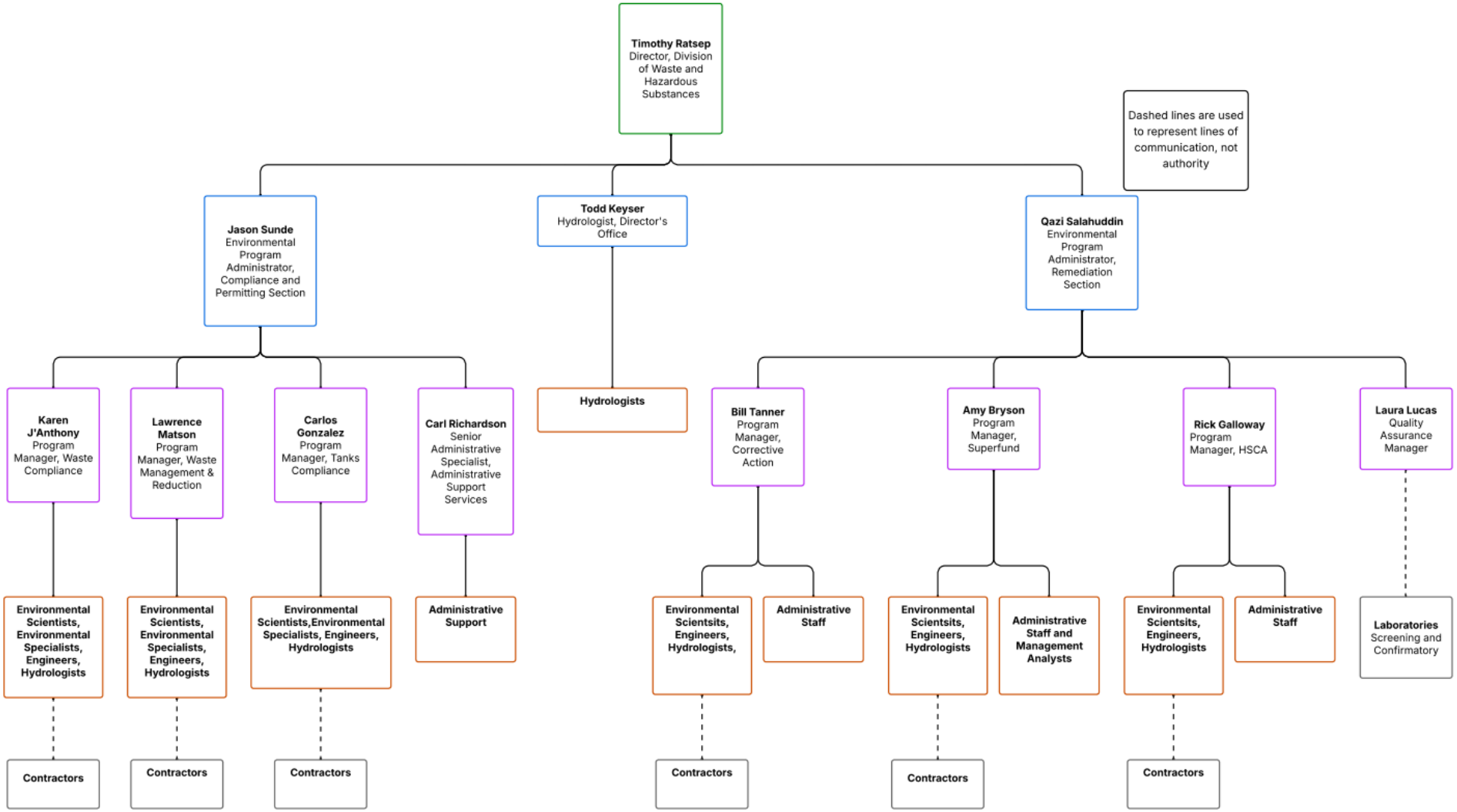


FIGURE 2. DERBCAP TIERED PROCESS

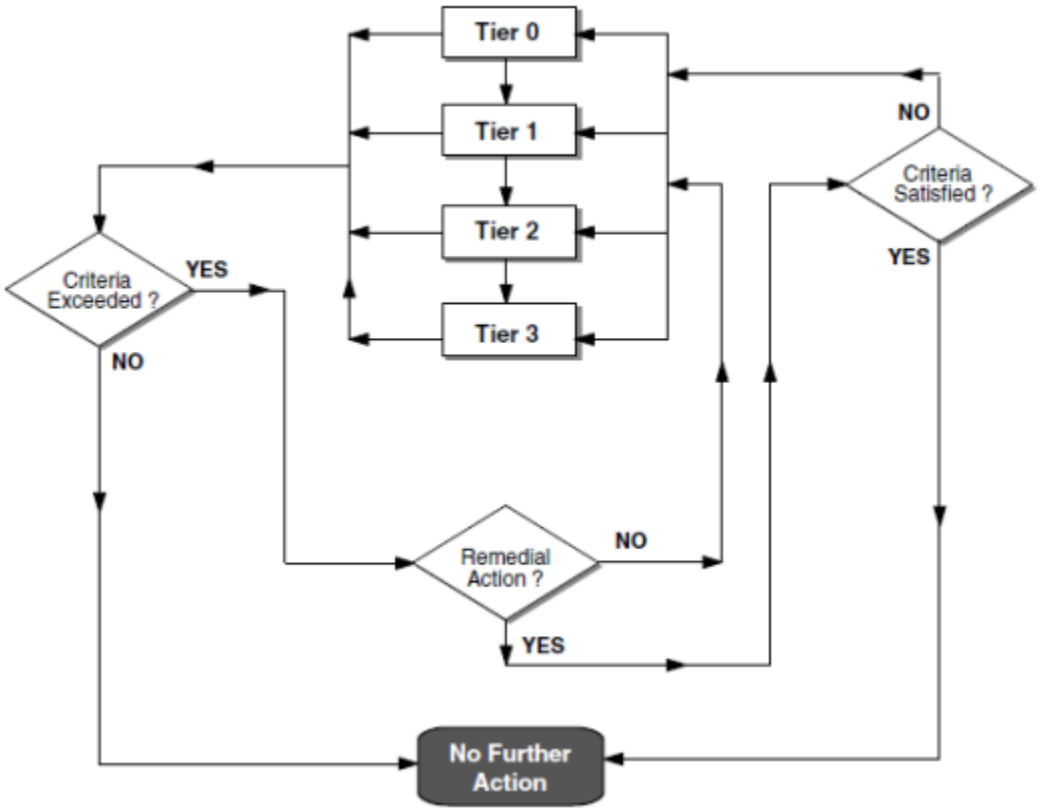
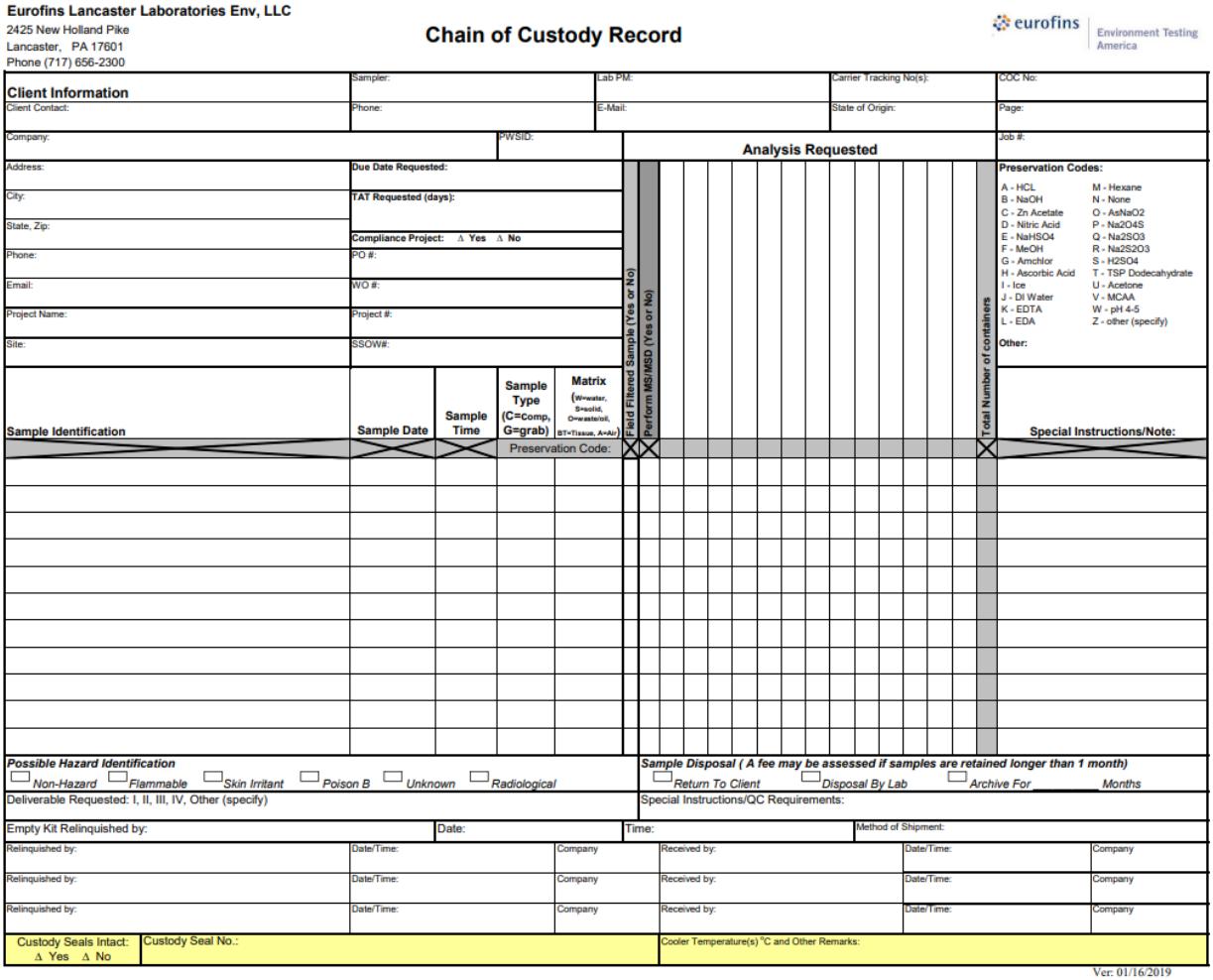


FIGURE 3. EXAMPLE CHAIN OF CUSTODY



Eurofins Lancaster Laboratories Env, LLC
2425 New Holland Pike
Lancaster, PA 17601
Phone (717) 656-2300

Chain of Custody Record

eurofins | Environment Testing America

Client Information	Sampler:	Lab PM:	Carrier Tracking No(s):	COC No:
Client Contact:	Phone:	E-Mail:	State of Origin:	Page:
Company:	PWSID:	**Analysis Requested**		Job #:
Address:	**Due Date Requested:**			**Preservation Codes:**
City:	**TAT Requested (days):**			A - HCL M - Hexane B - NaOH N - None C - Zn Acetate O - AsNaO2 D - Nitric Acid P - Na2O4S E - NaHSO4 Q - Na2SO3 F - MeOH R - Na2S2O3 G - Amchlor S - H2SO4 H - Ascorbic Acid T - TSP Dodecahydrate I - Ice U - Acetone J - DI Water V - MCAA K - EDTA W - pH 4-5 L - EDA Z - other (specify)
State, Zip:	**Compliance Project:** Δ Yes Δ No			
Phone:	PO #:			**Other:**
Email:	WO #:			
Project Name:	Project #:			
Site:	SSOW#:			

Sample Identification	**Sample Date**	**Sample Time**	**Sample Type (C=comp, G=grab)**	**Matrix** (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	Total Number of containers	**Special Instructions/Note:**
			Preservation Code:					

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown* ☐ *Radiological*

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For _____ Months*

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

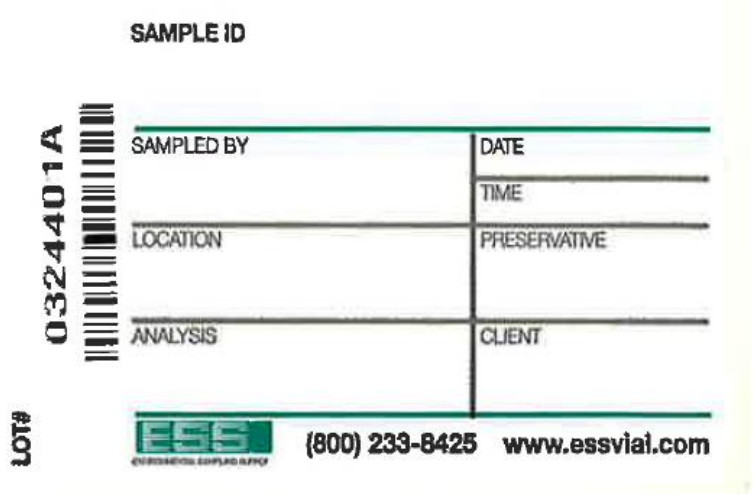
Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks:

Ver: 01/16/2019

FIGURE 4. EXAMPLE SAMPLE LABEL AND CUSTODY SEAL



Sample Label

Custody Seal

FIGURE 5. CORRECTIVE ACTION REQUEST FORM

QUALITY ASSURANCE
CORRECTIVE ACTION REQUEST FORM

Originator _____ Date: _____

Nature of Problem: _____

_____

_____

_____

Recommended Corrective Action: _____

_____

_____

_____

Review By: _____ Date:_____

Action Assigned to: _____ Date Due: _____

Action Completed: _____ Date: _____
(Attach Description of Solution) Signed

Reviewed by: _____ Date: _____

Project Manager Signature: _____

Reviewed by:_____ Date: _____

QA Manager Signature: _____

TABLE 4. SAMPLE CONTAINER REQUIREMENTS

*Table 4 Sample Container Requirements**

Parameter	Matrix	Container Specifications	Minimum Sample Volume	Preservation	Maximum Holding Time
Volatile Organics	Water	Amber glass, 40 mL vial with teflon faced silicon septum and open screw top	40 mL	4 drops concentrated HCl, Zero Headspace, Cool to 4ºC	14 days (7 days if pH is >2)
	Soil	Amber glass, 40 mL vial with teflon-faced silicon septum	5-10 g	10-25 mL CH_3OH, Cool to 4ºC	14 days
Semivolatile Organics	Soil	Amber glass, 8 oz	20 g	Cool to 4ºC	14 days
	Water	Amber glass, 1 liter narrow mouth bottle with teflon lined cap	100-1000 mL	Cool to 4ºC	Extractions within 7 days; Analyses within 40 days of extraction.
Pesticides/PCBs	Soil	Amber glass, 8 oz	8 oz	Cool to 4ºC	Extractions within 14 days; Analyses within 40 days of extraction
	Water	Amber glass, 1 liter narrow mouth bottle with teflon lined cap	1000 mL	Cool to 4ºC	Extractions within 7 days; Analyses within 40 days of extraction
PCBs only	Soil	Amber glass, 8 oz	8 oz	Cool to 4ºC	Extractions within 6 months
Metals	Water	Plastic 1000 mL	1000 mL	HNO_3 to pH<2 Cool to 4ºC	6 months, except Hg 28 days
Metals	Soil	Plastic or glass	8 oz	Cool to 4ºC	6 months, except Hg 28 days; and Cr VI extractions within 30 days, analysis within 7 days of extraction

Parameter	Matrix	Container Specifications	Minimum Sample Volume	Preservation	Maximum Holding Time
Chromium VI	Water	Plastic or glass	200 mL	Cool to 4ºC	24 hours
Acidity	Water	Plastic or glass	100 mL	Cool to 4ºC	14 days
Alkalinity	Water	Plastic or glass	100 mL	Cool to 4ºC	14 days
Biochemical Oxygen Demand	Water	Plastic or glass	1000 mL	Cool to 4ºC	48 hours
Biochemical Oxygen Demand, Carbonaceous	Water	Plastic or glass	1000 mL	Cool to 4ºC	48 hours
Bromide	Water	Plastic or glass	100 mL	None required	28 days
Chemical Oxygen Demand	Water	Plastic or glass	50 mL	H_2SO_4 to pH<2 Cool to 4ºC	28 days
Chloride	Water	Plastic or glass	50 mL	None required	28 days
Chlorine, total residual	Water	Plastic or glass	200 mL	None required	analyze immediately
Color	Water	Plastic or glass	50 mL	Cool to 4ºC	48 hours
Cyanide, total	Water	Plastic or glass	500 mL	Cool to 4ºC NaOH to pH>12 0.6g ascorbic acid	14 days
Fluoride	Water	Plastic or glass	300 mL	None required	28 days
Hardness	Water	Plastic or glass	100 mL	HNO_3 to pH<2 or H_2SO_4 to pH<2	6 months
Hydrogen ion (pH)	Water	Plastic or glass	25 mL	None required	analyze immediately
Kjeldahl and organic nitrogen	Water	Plastic or glass	500 mL	Cool to 4ºC H_2SO_4 to pH<2	28 days
Nitrate	Water	Plastic or glass	100 mL	Cool to 4ºC	48 hours
Nitrate-Nitrite	Water	Plastic or glass	100 mL	Cool to 4ºC H_2SO_4 to pH<2	28 days
Nitrite	Water	Plastic or glass	50 mL	Cool to 4ºC	48 hours
Oil and Grease	Water	Glass	1000 mL	Cool to 4ºC H_2SO_4 to pH<2	28 days
Organic Carbon	Water	Plastic or glass	25 mL	Cool to 4ºC HC1 to pH<2 or H_2SO_4 to pH<2	28 days
Orthophosphate	Water	Plastic or glass	50 mL	Filter immediately Cool 4ºC	48 hours
Oxygen, Dissolved Probe	Water	Glass bottle and top	300 mL	None required	analyze immediately
Oxygen, Winkler	Water	Glass bottle and top	300 mL	Fix on site Store in dark	8 hours
Phenols	Water	Glass	500 mL	Cool to 4ºC	28 days

Parameter	Matrix	Container Specifications	Minimum Sample Volume	Preservation	Maximum Holding Time
				H_2SO_4 to pH<2	
Phosphorus, elemental	Water	Glass	100 mL	Cool to 4ºC	48 hours
Phosphorus, total	Water	Plastic or glass	50 mL	Cool to 4ºC H_2SO_4 to pH<2	28 days
Residue, total	Water	Plastic or glass	100 mL	Cool to 4ºC	7 days
Residue, filterable	Water	Plastic or glass	100 mL	Cool to 4ºC	48 hours
Residue, nonfilterable (TSS)	Water	Plastic or glass	100 mL	Cool to 4ºC	7 days
Residue, settleable	Water	Plastic or glass	1000 mL	Cool to 4ºC	48 hours
Residue, volatile	Water	Plastic or glass	100 mL	Cool to 4ºC	7 days
Silica	Water	Plastic	50 mL	Cool to 4ºC	28 days
Specific conductance	Water	Plastic or glass	100 mL	Cool to 4ºC	28 days
Sulfate	Water	Plastic or glass	50 mL	Cool to 4ºC	28 days
Sulfide	Water	Plastic or glass	500 mL	Cool to 4ºC Zinc acetate NaOH to pH>9	7 days
Sulfite	Water	Plastic or glass	50 mL	None required	analyze immediately
Surfactants	Water	Plastic or glass	250 mL	Cool to 4ºC	48 hours
Temperature	Water	Plastic or glass	1000 mL	None required	analyze immediately
Turbidity	Water	Plastic or glass	100 mL	Cool to 4ºC	48 hours
Gross alpha Gross beta Radium	Water	Plastic or glass	4000 mL	HNO_3 to pH<2	6 months
PFAS	Water	HDPE/PTFE	250mL	Cool to 0 – 6ºC, Trizma 5ng/L if necessary	28 Days
PFAS	Soil/Sed	HDPE/PTFE	4oz	Cool to 0 – 6ºC	28 Days
PFAS	Tissue	HDPE/PTFE	4oz	Cool to ≤ -20ºC	365 Days

*Some analysis parameters may be analyzed via multiple methods that may have different requirements than those listed in this table.

LIST OF APPENDICES

Appendices may be found in the attached zip folder.

Appendix A: Standard Operating Procedures for Chemical Analysis Programs

Appendix B: Delaware Risk Based Corrective Action Protocol

Appendix C: Hydrogeologic Investigation Guidance

Appendix D: Guidance for Human Health Risk Assessments under HSCA

Appendix E: DNREC DWHS Health and Safety Manual

Appendix F: Guidance for Analytical Data Usability

Appendix G: HSCA Screening Level Table Guidance

Appendix H: RS Sampling SOPs

Appendix I: Guidance for Project Officers Performing Investigations

Appendix J: Laboratory Quality Assurance Manuals

Appendix K: DNREC Administrative SOPs

Appendix L: FOIA SOP

Appendix M: Field Inspection Checklist Example