

Uniform Federal Policy
Quality Assurance Project Plan
For
Soils Assessment of Dioxin Sites

*[Insert **SITE NAME**]*

*[Insert Site **LOCATION and STATE**]*

*[Insert **DATE**]*

DRAFT Quality Assurance Project Plan for Soils Assessment

INSERT Site Name/Project Name:

INSERT Site Location

Revision Number:

Revision Date:

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NOTICE AND DISCLAIMER

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For further information, please contact Stephen Dymont of EPA's Office of Superfund Remediation and Technology Innovation (OSRTI), at 703-603-9903 or by e-mail at dymont.stephen@epa.gov

INSTRUCTIONS TO TEMPLATE USERS

This document template was created for the benefit of EPA Regional Remedial Project Managers (RPMs) and related Superfund technical support personnel to use as the basis for developing project-specific Uniform Federal Policy – Quality Assurance Project Plans (UFP-QAPP) for assessment of soils at sites impacted by dioxins / furans and dioxin-like polychlorinated biphenyl (PCB) congeners. The document is supported by a User Guide (User Guide: Uniform Federal Policy - Quality Assurance Project Plan Template for Soils Assessment of Dioxin Sites) also produced by EPA that provides explanations and instructions for the development of project-specific UFP-QAPPs.

This document template provides the following specific benefits to users:

- Comprehensive platform for developing a project-specific UFP-QAPP in accordance with applicable federal policies.
- Technical information on project approaches, field methods, analytical methods and other related procedures specific to dioxin soils assessment.
- Generic text (phrased as if the text were written from the perspective of the User) contains embedded information that prompts the user and provides an efficient method of developing and customizing a project-specific UFP-QAPP.

Users are advised that Regions have the discretion to assess dioxin sites in the manner they determine best addresses site-specific situations and concerns. The goal of the UFP-QAPP template and User Guide is to provide a consistent approach to assessments using incremental composite sampling (ICS) methods with a primary goal of protecting human health and the environment, and doing so in the context of managing site uncertainties and resources to accomplish assessment efforts. Accordingly, Users can use their discretion in regard to use of template text and information prompts based on site specific needs. Specifically, Users can perform any needed modifications, additions and/or deletions to the template to tailor their sampling strategy to respond to the specific needs of the project(s) of concern.

Technical support is available to EPA Regional staff from the OSRTI Technology Integration and Information Branch (TIIB) by contacting Dan Powell, the Branch Chief for TIIB, via email at powell.dan@epa.gov or via phone at 703-603-7196.

NOTE:

USERS SHOULD DELETE THIS PAGE WHEN A QAPP IS PREPARED.

THE ABOVE INFORMATION IS ADVISORY ONLY AND IS NOT INTENDED FOR USE IN FINAL PROJECT-SPECIFIC UFP-QAPPs.

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ACRONYMS

%RSD	percent relative standard deviation
AMU	atomic mass unit
ARAR	Applicable or Relevant and Appropriate Requirement
AutoCAD	Automated Computer Aided Design/Drafting
bgs	below ground surface
CA	Corrective Action
CERCLA	Comprehensive Environmental Restoration, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
COB	close of business
COC	chain of custody (based on the context in which the acronym is used)
COC	contaminant of concern (based on the context in which the acronym is used)
CPSM	Column Performance Check Solution
CRQL	Contract Required Quantitation Limits
CRREL	Cold Regions Research and Engineering Laboratory
CSM	conceptual site model
CV	coefficient of variation (also called "relative standard deviation")
D/Fs	dioxins and furans
DCC	daily calibration check (continuing calibration)
DMA	demonstration of method applicability
DNT	dinitrotoluene
DQI	data quality indicator
DQO	data quality objective
DST	decision support tool
DU	decision unit
DWS	Dynamic Work Strategies
EA	exposure area (also call "exposure unit")
EDD	electronic data deliverable
EML	established minimum level
EMDL	established minimum detection limit
EPA	U.S. Environmental Protection Agency
EPA SITE	U.S. Environmental Protection Agency, Superfund Innovative Technology Evaluation Program
EPC	exposure point concentration
ERT	Environmental Response Team
ESTCP	Environmental Security Technology Certification Program
EU	exposure unit (also called "exposure area")
EVS/MVS	environmental visualization system/mining visualization system software
FIELDS	Field Environmental Decision Support
FORMS	Field Operations and Records Management System software
GC/MS	gas chromatography/mass spectrometry
GIS	geographic information system
GPS	global positioning system
H&S	health and safety
HAZWOPER	Hazardous Waste Operations and Emergency Response
HHRA	human health risk assessment
HpCDD	heptachlorodibenzo-p-dioxin
HpCDF	heptachlorodibenzofuran
HQ	headquarters
HRGC	high resolution gas chromatography
HRMS	high resolution mass spectrometry
HxCDD	hexachlorodibenzo-p-dioxin

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HxCDF	hexachlorodibenzofuran
ICAL	Initial Calibration
ICS	incremental composite sampling
ID	identification number
IDW	Investigation-Derived Waste
IMS	information management system
ISM	Incremental Sampling Methodology
ITRC	Interstate Technology and Regulatory Council
KM	Kaplan-Meier
LCS/LCSD	laboratory control sample/laboratory control sample duplicate
LIMS	laboratory information management system
m/z	mass-to-charge ratio
MDL	method detection limit
mg/kg	milligrams per kilogram
MIS®	Multi-Increment Sampling®
mm	millimeter
MPC	measurement performance criteria
MS/MSD	matrix spike/matrix spike duplicate
MSDS	Material Safety Data Sheets
NA	not applicable
ND	non-detect
NFA	no further action
ng/Kg	nanograms per kilogram
NS	not specified
OCDD	octachlorodibenzo-p-dioxin
OCDF	octachlorodibenzofuran
ORD	Office of Research and Development
OSRTI	Office of Superfund Remediation and Technology Innovation
PCB	polychlorinated biphenyl
PCDD	polychlorinated dibenzo-p-dioxin
PCDF	polychlorinated dibenzofuran
PDA	personal digital assistant (handheld electronic device)
PeCDD	pentachlorodibenzo-p-dioxin
PeCDF	pentachlorodibenzofuran
PFK	perfluorokerosene
ppb	parts per billion
ppm	parts per million
ppt	parts per trillion
PQL	practical quantitation limit
PQO	project quality objectives
PRG	preliminary remediation goal
ProUCL	an U.S. Environmental Protection Agency-supported statistical software that provides statistical analysis of data results
QA	quality assurance
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Project Plan
QC	quality control
QL	quantitation limit
RAGS	Risk Assessment Guidance for Superfund
RPM	Remedial Project Manager
RRT	relative retention time
RSD	relative standard deviation
S/N	signal-to-noise ratio
SADA	Spatial Analysis and Decision Assistance software
SAP	Sampling and Analysis Plan
SCRIBE	USEPA's software tool used to assist in the process of managing environmental data

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Scriblets	USEPA's database program used to capture and import field-generated data into SCRIBE
SD	standard deviation
SDL	sample detection limit
SEDD	Staged Electronic Data Deliverable
SOP	standard operating procedure
SOW	scope of work (depending on context)
SOW	statement of work (depending on context)
SPP	Systematic Planning Process
SSG	Soil Screening Guidance
SSL	soil screening level
SU	sampling unit
TAT	Technical Assistance Team (depending on context)
TAT	turn around times (depending on context)
TBD	to-be-determined
TCDD	tetrachlorodibenzo-p-dioxin
TCDF	tetrachlorodibenzofuran
TEC	toxic equivalence concentration (equals a congener's concentration times its TEF)
TEF	toxicity equivalency factor
TEQ	TCDD toxic equivalent
TIFSD	Technology Innovation and Field Services Division
TNT	trinitrotoluene
TO	Toxic Organics (a designator abbreviation for air methods, such as TO-9)
TOC	total organic carbon
UCL	upper confidence limit
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plans
UFP	Uniform Federal Policy
UNEP	United Nations Environment Programme
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
VSP	Visual Sampling Plan USEPA-supported software that helps determine the number of samples or increments)
WebEOC	Emergency Operations Center
WHO	World Health Organization
XRF	x-ray fluorescence

INTRODUCTION

This Quality Assurance Project Plan (QAPP) was prepared by (Insert **CONTRACTOR NAME**) under contract [Insert **CONTRACT #**] to the United States Environmental Protection Agency (US EPA) Region [Insert **REGION #**] to support the assessment of soils at properties in the vicinity of the [Insert **SITE NAME**] located in [Insert **LOCATION, STATE NAME**]. Soils will be assessed for the potential presence of dioxins, furans and/or dioxin-like compounds associated with the Site. The purpose of the assessment is to determine whether soils confirmed to be impacted by these contaminants of concern (COC) are contaminated at concentrations and distributions which may pose an acute or chronic risk to human health for [Insert **DESCRIPTOR FOR HUMAN RECEPTORS**, e.g., residents, workers, recreational users] associated with the occupancy and/or use of the properties.

Site Description, History & Background

[Insert **SUMMARY OF SITE AND FEATURES, GENERAL HISTORY AND BACKGROUND**. Refer to UFP QAPP Worksheet #10 that addresses results of historical documentation and data review].

Unique Site Considerations

[Insert **SUMMARY OF ANY UNIQUE CONDITIONS** (e.g., historical, physical, geologic legal, community) **THAT HAD A DRIVING AFFECT ON THE WAY THE PROJECT WAS DESIGNED AND/OR WILL BE CONDUCTED.**]

Project Approach Overview

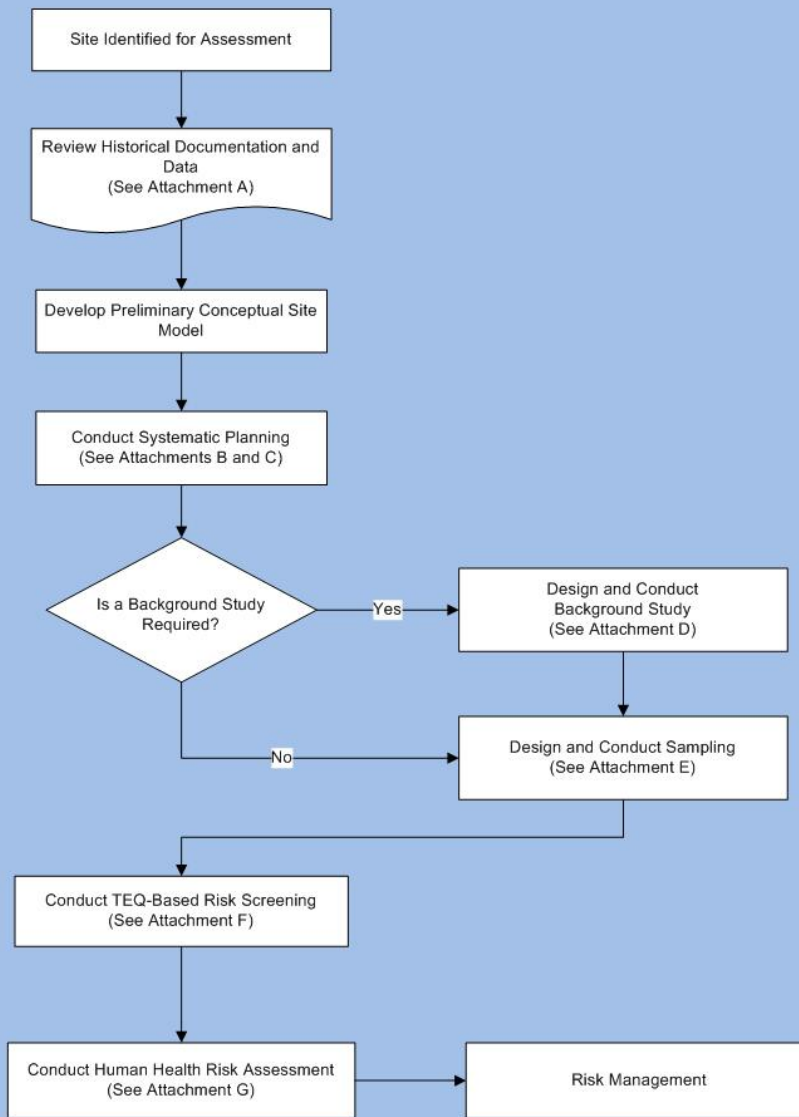
The project approach framework was developed by EPA's Office of Superfund Remediation & Technology Innovation (OSRTI) and has been customized by [Insert **CONTRACTOR NAME**] in coordination with Region [Insert **REGION #**] to address site-specific conditions and issues.

Figure 1 is a summary flowchart that outlines the site assessment process. The figure is supported by a series of attachments that provide additional detail on the project activities to be performed at key milestones of the project. Sequential application of these activities is described in UFP QAPP Worksheet # 16 – Project Schedule / Timeline.

The following brief descriptions describe the nature and purpose of each of the project milestones.

Review Historical Information and Data – Between **xx/xx/201x** and **yy/yy/201y** [Insert **DATES**], the technical project team reviewed relevant site historical information and data to develop a Preliminary Conceptual Site Model (CSM) for the properties that are to be assessed. The Preliminary CSM is a milestone deliverable developed as a fundamental element of preparation for systematic planning of the assessment effort. The data quality assessment process used for the project is described in Figure 1; Attachment A. The Preliminary CSM and the summary results of the data quality assessment of the historical data are included as attachments to Worksheet #13.

Figure 1: Decision Logic Diagram for Dioxin Site Assessment Process



Diligence in gathering and evaluating key data from previous investigations and other site-related information was required to prepare a thorough and effective Preliminary CSM.

Systematic Planning – Between *xx/xx/201x* and *yy/yy/201y* [Insert DATES], the project team engaged in [Insert NUMBER] systematic planning meetings to comprehensively plan and design the implementation of all stages of the assessment project. It involved planning for known decisions and building in contingencies to accommodate changes in project conditions so that stakeholders are able to facilitate the project through all key decision-making stages. This UFP QAPP is the primary product of the systematic planning effort.

The systematic planning meetings are documented in the following worksheets (a series of Worksheet #9s to record participants) and attachments to the Worksheet #9s (for the meeting notes):

- [INSERT LOCATIONS AND TITLES OF MEETING SUMMARIES AND ATTACHMENTS CREATED]
- [INSERT THE LIST OF MEETINGS AS SEQUENTIAL BULLETS OVER THE COURSE OF THE PROJECT]

The agenda[s] used for the systematic planning effort [is / are] provided as Figure 1; Attachment B.

A key component of systematic planning was the performance of a data quality assessment as part of US EPA's Data Quality Objectives (DQO) process to develop data acceptance and other project performance criteria for incorporation in this UFP QAPP. In addition, a thorough analysis of historical data was performed to determine whether and how previous data could be used to guide assessment planning, or in some cases provide data of adequate quantity and acceptable quality to offset some of the assessment requirements. Specifically, data were reviewed to determine their usefulness in directly supporting the establishment of constituent background concentrations, substituting or augmenting data collection needs, performing Toxic Equivalent (TEQ)-based risk screening, performing human health risk assessment (HHRA) and providing information for remediation / mitigation planning and engineering.

Specific DQO guidance used to support this effort included:

- EPA Quality Manual for Environmental Programs. (EPA 2000, May).
- Guidance on Systematic Planning Using the Data Quality Objectives Process. (EPA 2006, February).
- Guidance for Developing Quality Assurance Project Plans. (EPA 2002a, December).
- Uniform Federal Policy for Quality Assurance Project Plans (Manual) (EPA 2005a, March).
- Workbook for Uniform Federal Policy for Quality Assurance Project Plans (Workbook). (EPA 2005b, March).

A strong emphasis was placed on updating the Preliminary CSM to Baseline CSM status. The Baseline CSM is the version that was agreed upon by the stakeholders during systematic planning and subsequently served as the basis for the detailed planning of all phases of this project. The Baseline CSM was specifically used to identify data needs, develop the site-specific sampling plan design, and confirm the selection of appropriate data collection, analysis, and use methodologies. Inherent to the sampling design is an explicit recognition that spatial heterogeneity and analytical method variance are likely to be the primary sources of uncertainty affecting confident site decision-making.

In addition to addressing scientific issues, systematic planning also considered financial, contractual, stakeholder, legal, and regulatory issues; such as budgets, contracts, stakeholder concerns, site reuse, legal and regulatory issues, and relevant social and economic factors.

Design and Conduct Background Study – Based on the results of historical data quality assessment and evaluation of other relevant information, a study to establish background concentration for this particular site [is / is not] needed to support the assessment effort. [Insert REASONS WHY OR WHY NOT.] The data quality assessment process used for the project is described in Attachment A. [The approach to designing the background study is included as Figure 1; Attachment D.]

Design and Conduct Sampling – As indicated above, the assessment design presented in this UFP QAPP is based on a project approach framework developed by OSRTI, and was customized by Region [Insert REGION #] for site-specific application based on the results of the systematic planning efforts. This UFP QAPP provides comprehensive details of the assessment plan and strategy for the site.

Based on the results of systematic planning, the site was determined to be assessed in the context of a [Insert TYPE of EXPOSURE SCENARIO] exposure scenario. Accordingly, the assessment strategy is based on (Insert TYPE of ASSESSMENT STRATEGY).

A review of the available historical data found that it was [usable / not usable] for the following purposes [List PURPOSES] as documented in Worksheet #13.

Conduct TEQ-Based Risk Screening – The analytical results from sampling and analytical efforts will be subjected to screening for risks to human health via toxic equivalent (TEQ) screening process, as outlined in Figure 1; Attachment F.

Human Health Risk Assessment – An HHRA, if required based on the TEQ-based risk screening, may be performed to determine whether detected site contaminants pose an unacceptable human health risk as related to the [Insert EXPOSURE SCENARIO]. The process used to conduct the HHRA is presented in Figure 1; Attachment G.

**Attachment A to Figure 1
Site Assessment Sampling Design and Strategy
Uniform Federal Policy (UFP) Quality Assurance Project Plan (QAPP)**

HISTORICAL DOCUMENTATION AND DATA REVIEW

Historical site documentation and data were compiled and reviewed to inform the systematic planning effort and serve as the basis for developing the Preliminary CSM. Systematic planning included the evaluation of historical site data sets for applicability to data needs for dioxin Toxicity Equivalents (TEQs). As it was compiled, the quality of historical data was assessed from a sampling, as well as analytical perspective. Data quality assessment addressed the following items.

Evaluation of Historical Sampling Approach

- General sampling strategy
 - Statistical/probabilistic
 - Judgmental

- Sample representativeness and comparability relative to new data needs
 - Soil media sampled (sites and sub-sites, soil/waste types, background vs. site)
 - Sampling density
 - Depth intervals
 - Grab or composite
 - Sample processing (sizing, homogenization)

- Data end uses
 - Site delineation or screening
 - Risk assessment
 - Remedial design/remedial action (engineering evaluations, characterization of treated or removed wastes, confirmation of soil/waste removal)

- Decision uncertainty management approach
 - Qualitative/professional judgment
 - Analytical Quality Assurance (QA) program only
 - Classical statistics
 - Other (e.g., geostatistics, modeling)
 - Unknown

Data Quality Assessment via Evaluation of Analytical Methods and Quality Assurance Program

- Is the data of known and documented quality of data; i.e., were samples analyzed and data reported and validated under an EPA QA program or equivalent?
- What was level of review and the SOP for review at the time?
- Were data qualified and was the review narrative available?
- Status of analytical data in terms of whether it was collected for all COCs for use in TEQ evaluations (dioxins, furans, and dioxin-like polychlorinated biphenyls (PCBs)).

- Were quantitation/detection limits sufficient for use in TEQ evaluations?
- Did data quality indicators (DQIs) meet method performance requirements and did they indicate sufficient data quality for use in TEQ evaluations (e.g., precision, bias, completeness, comparability)?
- Were there any applications of field-based or screening methods (e.g., CALUX or immunoassay methods)?
- If non-traditional methods were used, was there a demonstration of method applicability (DMA) or other type of pilot study, or subsequent data analysis to establish the comparability between conventional and alternative methods?
- Is data from non-traditional methods sufficiently usable to estimate the variability in concentration over both short and long spatial scales? Also, can the data provide indications of hotspots or source areas?
- Did any of the historical analytical methods find matrix interferences that should be considered when selecting extract cleanup methods for future analyses?
- Are there QC or validation records available for any applications of non-traditional methods?

Documentation of Historical Documents and Data Review

[Insert [REVIEW DOCUMENTATION](#)]

This section provides a summary of the conclusions and CSM information based on evaluation of historical information and data review.

To aid the review, the Best Management Practices Inventory checklist (Appendix 1 of the User Guide) was used to evaluate historical Site reports. [Insert [COMPLETED CHECKLIST](#)]

**Attachment B to Figure 1
Site Assessment Sampling Design and Strategy
Uniform Federal Policy (UFP) Quality Assurance Project Plan (QAPP)**

SYSTEMATIC PLANNING MEETING AGENDA[S]

The following [is the agenda / are the agendas] that [was / were] used to support systematic planning efforts:

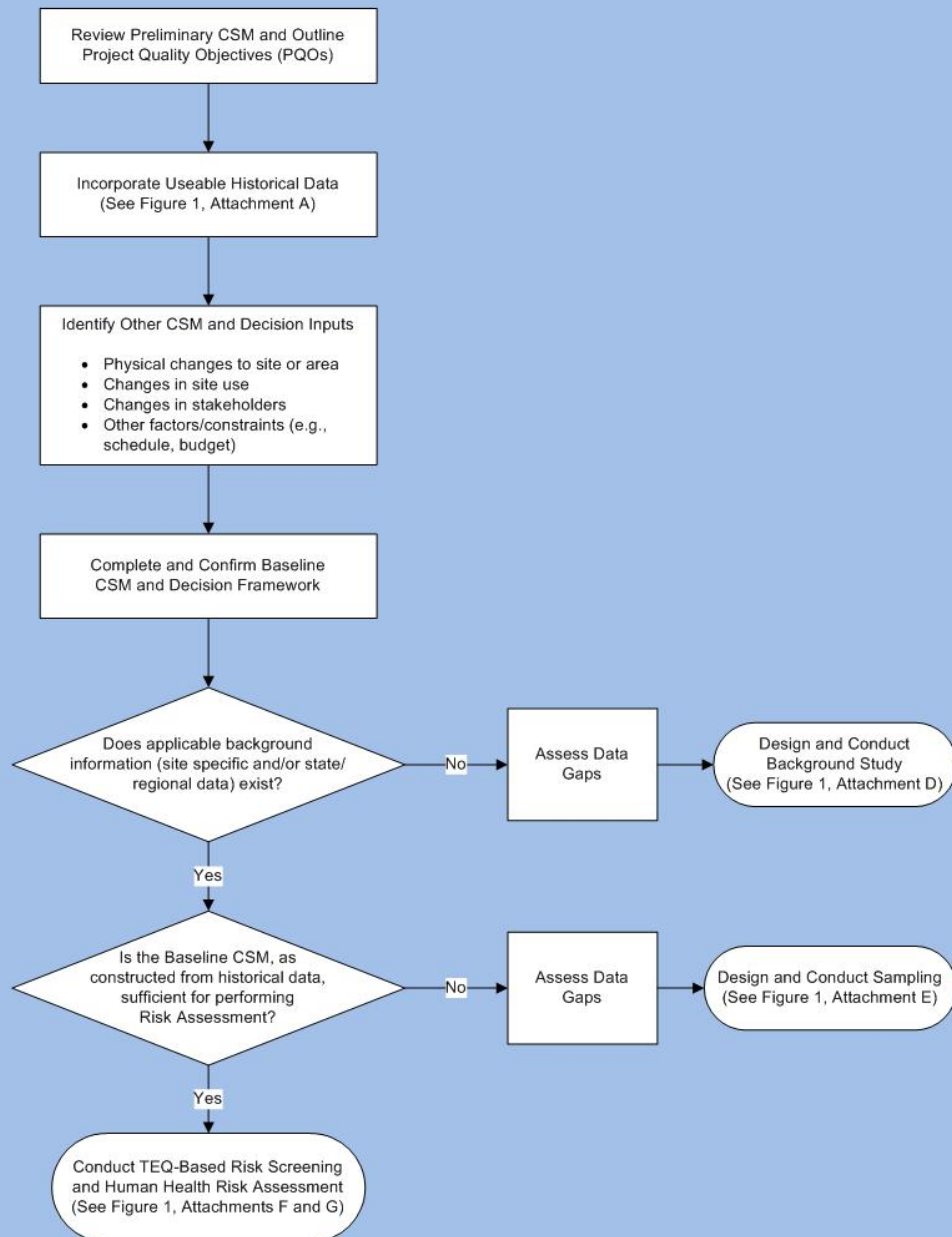
[Insert ACTUAL AGENDA(S) FROM PROJECT SYSTEMATIC PLANNING MEETING(S)]

Post-Meeting Activities

The following [is the list / are the lists] of post-meeting activities undertaken in support of systematic planning efforts:

[Insert ACTUAL LIST(S) OF POST-MEETING ACTIVITIES(S) UNDERTAKEN TO SUPPORT SYSTEMATIC PLANNING MEETING(S)]

Attachment C to Figure 1: CSM and Data Gap Assessments During Systematic Planning



**Attachment D to Figure 1
Site Assessment Sampling Design and Strategy
Uniform Federal Policy (UFP) Quality Assurance Project Plan (QAPP)**

BACKGROUND STUDY DESIGN AND PERFORMANCE

The determination for use of existing background information or the need for designing a site-specific background evaluation should be made by the project team during systematic planning. The rationale for whether or not a background study is required and an explanation of how background data are expected to be collected and subsequently evaluated should be provided in the project-specific UFP-QAPP Worksheets #10 and 11.

Technical teams may choose among the options provided or design background studies based on project specific requirements. Existing text may be leveraged or augmented to assist teams with project specific UFP-QAPP development. Examples provided may be sufficient to meet project objectives for some dioxin assessment projects, however site and/or decision complexity may warrant a more rigorous statistical evaluation of background. In these cases, project teams are encouraged to refer to EPA staff or technical team members with sufficient knowledge of statistics to design and implement an appropriate strategy.

OBJECTIVES AND MAIN COMPONENTS OF ATTACHMENT D TO FIGURE 1

Provide brief introduction, including:

- a) role of background evaluations in environmental risk assessment studies, and
- b) provide an operational definition for background chemicals/locations (EPA 2002d)

Provide guidelines/recommendations for:

- a) selecting candidate background area(s)
- b) development of background sampling designs
- c) technical approaches for conducting site data versus background comparisons

NOTE: In a site-specific UFP-QAPP developed by a Region, Attachment D would be a summary description with key details of the actual background study plan to be implemented in support of the site.

CONSIDERATION FOR SELECTED STUDY COMPONENTS

A. Overall Scope and Implementation of Attachment D

In the project flow-diagram (Figure 1), a trigger for Attachment D (i.e. necessity of a background study) is the absence of an existing site-specific or regional background data set (or threshold values, in the case of regional data), or a determination during review of historical documentation and data (UFP QAPP Figure 1, Attachment A) that an existing background data set is inadequate to support site decision-making.

Example 1. A site-specific background evaluation is recommended in cases where an existing capability for assessing background is absent.

Example 2. A tiered approach is used including an initial comparison to regional background values during systematic planning efforts (See UFP QAPP Figure 1, Attachment C). That is, an initial screen would identify cases where site concentrations are clearly above (or below) an estimated background level. Screening against regional values (use highest values, if data are available from multiple studies) would reduce the frequency of Type I (false positive) decision errors, but at the expense of inflating the Type II (false negative) error rate. This would, however expedite the assessment process for sites where decisions are less complex, and where lengthy/costly delays imposed by development of site-specific evaluations may not be warranted. This would not, however, obviate the possible need for site-specific background values further along in the process for project entering the remediation/mitigation phase (e.g., site-specific background values would be needed if site > background > risk-based cleanup level).

B. Selection of Candidate Background/Reference Areas

Candidate background areas should be located within or proximate to assessment sites. Unlike background studies for metals, which can be ubiquitous as naturally occurring minerals, the soil type(s) and underlying geology do not have to mirror conditions present at the site (notwithstanding any issues connected with the matrix, etc. that could bias laboratory analysis) but should be matched to the extent possible to site geologic conditions. The background areas should include locations that capture local (regional) background influences, but that are not believed to have received dioxin inputs from site activities.

Failure to include locations/areas that represent the range of potential background influences can result in biased estimates and could undermine the utility of investing in a background evaluation.

In an effort to capture the full range of potential background conditions, multiple or discontinuous background areas should be considered. Inclusion of multiple background areas may involve some form of stratified sampling (e.g., proportional allocation of sampling effort based on aerial extent of individual background areas or possibly allocation based on contaminant patterns and expected variability within individual areas).

C. Background Sampling Design

It is recommended that elements of the ICS sampling design for the planned assessment be leveraged to create a companion sampling approach for collection of the background data. As recommended for the site designs, software tools, such as Visual Sampling Plan (VSP) (Matzke et al. 2007), can be used to generate systematic random grids for the background sampling.

Background Sampling Design Considerations:

Establishing the Minimum Sample Size.

The sampling design options for assessment sites outlined in this User Guide yield a minimum of one ICS sample per decision unit (DU). There are also provisions for Regions and site-specific technical teams to collect ICS replicates for a minimum number of DUs (10% or as determined during systematic planning), another frequency of DUs, or all DUs as project data needs are determined. In cases where ICS replicates are only collected at the frequency described in the site-specific UFP-QAPP, some nominal level of replication is typically needed for the background sampling to bound the uncertainty on the background side of the site-to-background comparison. Several examples are provided below for consideration.

Example 1. Require a minimum of three independent ICS samples (1 primary and two field replicates) from one or more background areas. Use of more than one area is suggested if background is expected to vary significantly across a site, however if more than one reference area is used, then the design should be stratified to ensure background sample numbers allocated to individual areas correspond to appropriate area fractions. Individual sites would need to develop an appropriate scheme for allocation sampling effort in cases where multiple background areas are available, and there is potential for significant among-area heterogeneity in dioxin concentrations, or compositional differences in the mixture of dioxin constituents. Existing soil sampling guidance (EPA 1990, 1992, 1994, and 2002e) adequately covers this topic and can aid project technical teams in making this decision.

Example 2. A more rigorous statistical approach is used to estimate minimum sampling parameters based on estimation or specification of desired Type I and II decision errors. Modules for treating multi-increment designs in VSP (e.g., comparing site average to a fixed threshold, comparing site average to a reference average, constructing confidence limits on a mean) allow for estimation of the number of increments per composite, as well as the number of composites, and account for blending variance and other uncertainty components. This is an option for sites with sufficient resources and technical staff, where the benefits (improved power and control of decision errors) of additional investment in the sampling design are needed to improve decision-making and can be technically justified.

D. Technical Approach for Conducting Site versus Background Comparisons

The preferred (and generally accepted standard) approach for discrete designs is comparison of the site and background distributions using two-population tests of location (typically, measures of central tendency and upper quartiles). In situations where only a small number of site results are available, an alternative is to compare individual site results to a fixed background threshold value (BTV) (See EPA [2009c]). BTVs typically represent an upper plausible limit for the unknown background population, and are estimated using simple upper percentiles of the sample distribution, or probabilistic estimators, such as upper tolerance limits (UTL) or upper prediction limits (UPL). UPLs are the preferred estimators in EPA's ProUCL software (EPA 2009c) as well as the unified RCRA groundwater statistical guidance (EPA 2009d).

The sample size for the site data is a constraining factor for selecting the most appropriate background screening option. Potential approaches are provided for cases where there are fewer than three, or three or more, ICS samples per site.

1. Fewer than three samples per site. This approach would compare individual ICS sample TEQ values from a site to a BTV developed for the background data set.

Options for the BTV: Some additional study and consultation with statisticians may be warranted to select either a single BTV method, or to identify criteria for selection of site-specific methods. Both the UTL and UPL should be considered as possible candidates for the BTV.

Documentation of recommendations from the team statistician or statistical support personnel is suggested regarding proposed individual methods (e.g. specifying coverage and confidence level in the case of UTLs), based on the relative performance of tests conducted using these estimators for background.

2. Three or more samples per site. For cases where there is a minimum of three independent ICS samples (1 primary and two field replicates) results for both the site and background data sets, then two-population comparisons using Students t-test are recommended. This would be ill-

advised for discrete designs with $n=3$, but for 30-60 increment composite samples, for both the distribution of increments within composites and the distribution of means (composites), the assumption of normality can be justified. Further, compositing dampens the variance, thus yielding relatively low estimates for the standard error. The standard error impacts the effect size or minimum difference between the two means that are declared statistically significant by the test.

A two-population test for comparing the site and background means requires selection of an appropriate form for conducting one-sided hypothesis tests. EPA (2002d) discusses two background tests forms. Selection of an appropriate test form has important implications in terms of pre-defining or achieving targets for Type I and II decision errors. EPA (2002d) provides additional discussion and recommendations for making this determination.

Option 1. Test Form 1 (presumption of innocence):

H0: Site < Background
HA: Site > Background

Option 2. Test Form 2 (requires a preponderance of evidence to demonstrate that the site is below background):

H0: Site > Background
HA: Site < Background

Note: Test Form 2 recommends specification of “S”, or some magnitude of difference between the site and background data that is considered to be significant in terms of ecological or human health effects. Project technical teams should make this determination or run the risk of flagging a problem based on a statistically detectable difference that is not significant from a practical perspective.

E. Selection of an optimal testing approach among competing alternatives

The selection of an optimal screening approach for conducting site versus background comparisons should be based on the relative performance of different statistical testing methods, considering constraints (e.g., sample size) imposed by the site and background data. Relevant performance criteria include:

a) the Type I or false positive error rate (probability of erroneously concluding that site concentrations exceed background for Option 1 described above), and

b) the power of the test (the probability of correctly identifying sites that exceed background for Option 1 described above, where $\text{power} = 1 - \text{Type II error rate}$). The power of the test depends on the “effect size”, or magnitude of difference between the site and background data (averages in the case of composites) declared statistically significantly different.

**Attachment E to Figure 1
Site Assessment Sampling Design and Strategy
Uniform Federal Policy (UFP) Quality Assurance Project Plan (QAPP)**

{Note: See User Guide for information on completing this Attachment}

SUMMARY OF ASSESSMENT SAMPLING APPROACH, OBJECTIVES AND ASSUMPTIONS

[Insert **GENERAL SUMMARY INFORMATION**]

Site Type(s) [INDICATE ALL THAT APPLY AND DESCRIBE UNIQUE ATTRIBUTES]

1. 0.25 Acre Residential
2. Large Area or Multiple Sub-Sites
3. Industrial
4. Other Non-Residential
5. Constrained Site Conditions
6. Other: _____

Sampling Strategy Elements [INDICATE ALL THAT APPLY]

1. Contaminant Types to be Assessed
 - a. Dioxins and furans: 135 polychlorinated dibenzo furans (PCDD/Fs)
 - b. Dioxins and furans: 17 congeners (PCDD/Fs) with TEFs
 - c. Dioxin-like compounds with TEFs: 12 polychlorinated biphenyls congeners(PCBs)
 - d. Other analyte species, list: _____

2. Exposure Scenario
 - a. Residential, industrial, recreational, other specific scenarios (e.g., construction and utility worker exposure)

 - b. Direct contact with surficial soil [within the 0–2 feet below ground surface (bgs) interval]

 - c. Other: _____

3. DUs should be delineated as consistent with site type and exposure scenario. A site may have one or more DUs. DUs can be divided into SUs if required to complete data gaps in the CSM or to streamline cleanup as needed.

4. Incremental sample distribution and locations are:

- a. Determined via Random Start Systematic Grid method (e.g., determined manually or generated by Visual Sampling Plan (VSP)) for each DU.
- b. Modified based on evaluation of Conceptual Site Model (CSM) during systematic planning
- c. Modified by collection of additional ICS samples in areas of sites with unique shapes, physiographic features, asymmetrical boundaries, etc. to provide data for qualitative evaluation to support remediation / mitigation planning.

5. Replicate quantities

- a. Minimum of three (primary + two additional) field replicate samples should be collected per DU, except where the sampling design provides for only a single ICS. A mechanism for controlling decision error should be developed if only a single ICS is to be collected in a DU. *{See Implementation Example 2 in User Guide for more information}*
- b. A “variability source” QC procedure should be conducted at least once during the soils assessment effort. *{See item #19 (Pilot Studies) of the “Concepts and Definitions” section of the User Guide for more information.}*

Attachment F to Figure 1
Site Assessment Sampling Design and Strategy
Uniform Federal Policy (UFP) Quality Assurance Project Plan (QAPP)

TEQ-BASED RISK SCREENING

[AUGMENT THIS ATTACHMENT WITH RELEVANT NOTES AND/OR SITE-SPECIFIC CONSIDERATIONS]

Historical data review [did / did not] allow the site investigation and risk screening program to focus on selected constituents and support streamlining of the sampling and analytical program.

In accordance with Figure 1, the analytical results from soil samples collected at sites are used to conduct a 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) TEQ-based risk screening. The TEQ-based risk screening represents a first step in risk management and Regions have the discretion to conduct human health risk assessments and determine the necessity of remedial actions in accordance with EPA and Regional policies and procedures. The following is a summary of the TEQ-based risk screening process.

Depending on historical information and the contaminants of concern, dioxin TEQ ICS soil samples collected at the Site may be analyzed for three classes of contaminants:

- Polychlorinated dibenzo dioxins (PCDDs); TCDD is a member of this class,
- Polychlorinated dibenzo furans (PCDFs), and
- Dioxin-like polychlorinated biphenyls (PCBs) (USEPA, 1996c).

It is well-established that some of the individual contaminants in these three classes cause toxicity to humans via similar mechanisms as those causing TCDD toxicity (van den Berg and others, 2006). Historical data review [did / did not] allow the site investigation and risk screening program to focus on selected constituents within these three classes and support streamlining of the sampling and analytical program. Concentrations of each of these individual contaminants will be converted to a TCDD TEQ using contaminant-specific toxicity equivalency factors (TEF). TEFs represent the relative toxicity of each contaminant to TCDD. For example, a TEF of 0.1 for Chemical A means that Chemical A is approximately one-tenth as toxic as TCDD. EPA (2009) "recommends the use of the TEFs developed by the World Health Organization (WHO)" (van den Berg and others, 1998, 2006). For the purposes of conducting the TEQ-based risk screening, the 2005 WHO TEFs are used (UNEP, 2007).

DU-specific TEQs for the Site are calculated as follows:

- For each detected contaminant/congener with a TEF, the reported concentration (C) of the contaminant/congener are multiplied by its congener-specific TEF to generate a congener-specific toxic equivalence concentration (TEC). Then all the TECs are summed to get a sample-specific total TEQ. For DUs with replicate ICS samples, the three (or more) replicate samples' total TEQs are used to calculate the TEQ UCL for the DU.
 - $C \times \text{TEF} = \text{TEC}$
 - $\sum \text{TEC} = \text{Total TEQ}$
- As the primary basis for decisions, the sample TEQ is calculated based on detected, nondetected, and congener results with "J" qualifiers. Nondetected congeners are included

in the calculations using a Kaplan-Meier (KM) approach. Results with a “R” qualifier [representing rejected results] will not be used in the calculation of the TEQ as such, but should be used in a sensitivity analysis that evaluates the importance of the rejected data [see UFP-QAPP template Worksheet #15]. These two types of calculated TEQ-based risk screening results (with and without accounting for rejected results) will be compared and contrasted for the purpose of providing risk managers with the ability to compare to decision criteria. If the congener that is rejected is important, there are various options to pursue, including reanalysis (perhaps with improved cleanup of the sample extract). *{See the detailed discussion of handling nondetect and rejected data that is presented in Appendix 4 of the User Guide. A Microsoft Excel spreadsheet that is programmed to perform these calculations is available upon request.}*

- Because of the possibility of reanalysis, holding times for archived samples will be tracked to ensure documentation of recommendations from the team statistician or statistical support personnel is suggested regarding proposed holding times are not exceeded. Holding times up to one year have been specified by EPA methods [See UFP-QAPP template Worksheet #19].
- The total TEQ or TEQ UCL will be compared to the residential or industrial, as appropriate, threshold value for TEQ.

If the sensitivity analysis shows that sample reporting limits impede TEQ screening evaluations for one or more sample analyses, the affected samples may be reanalyzed to assess whether the elevated reporting limits are due to laboratory or matrix issues. If reanalysis confirms matrix interferences, the laboratory will be consulted to identify and undertake corrective actions. If matrix problems cannot be corrected, the original analytical results may be subjected to statistical evaluation to assess data usability and application.

**Attachment G to Figure 1
Site Assessment Sampling Design and Strategy
Uniform Federal Policy (UFP) Quality Assurance Project Plan (QAPP)**

HUMAN HEALTH RISK ASSESSMENT

As presented in Attachment F, if the 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) TEQ calculated for a DU exceeds the threshold value, several additional steps will be required, as follows:

Step 1 Compare TEQ Results to Background

If the DU-specific TEQ results exceed background (See Figure 1, Attachment F) a human health risk assessment (HHRA) [will / may] be prepared based on Regional risk management evaluation and decision (See Figure 1).

Step 2 Conduct Human Health Risk Assessment

Should an HHRA be prepared, it will be done so assuming reasonable maximum exposure (RME) and residential land use at the DU (see Attachment E to Figure 1) unless confirmed by Region [Insert REGION #] and [Insert State Regulatory Agency] to evaluate an alternate future land use, such as industrial/commercial. The exposure unit for the HHRA is the DU. The exposure point concentration (EPC) used in the HHRA is the final overall TEQ calculated for EUs/DUs in accordance with EPA guidance based on the overall TEQ values (EPA 2002c, 2009c). The HHRA can also be prepared using the exposure assumptions and TEFs identified by EPA (2009b). It should be noted that the PRG is based on only two exposure routes: incidental ingestion of and dermal contact with soil. If it is determined based on discussions with regulatory agencies that the HHRA should evaluate additional exposure pathways such as inhalation of particulates, and ingestion of foodstuffs (e.g., homegrown produce or aquatic life), exposure parameters for these exposure pathways will be discussed with and approved by Region [Insert REGION #] and [Insert STATE REGULATORY AGENCY].

Consideration of exposure pathways beyond incidental ingestion of soil, including identification of appropriate exposure/dose equations and exposure parameter values will be conducted consistent with relevant EPA and [Insert STATE REGULATORY AGENCY] risk assessment guidance (see reference list for example EPA risk assessment guidance).

Cancer risks are summed across all exposure pathways. The cumulative cancer risk is compared to EPA's acceptable cancer risk range of 1 in 1 million (1E-06) to 1 in 10,000 (1E-04). Similarly, non-cancer hazards are also summed across all exposure pathways. The cumulative non-cancer hazard (referred to as a hazard index [HI]) is compared to the EPA benchmark of 1.

The risk assessment will include a discussion of the major sources of uncertainty in the risk assessment process, such as available analytical results, selection of land use, and exposure and toxicity assumptions.

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QAPP WORKSHEET #1 (UFP-QAPP MANUAL SECTION 2.1) -- TITLE AND APPROVAL PAGE

Uniform Federal Policy Quality Assurance Project Plan for Soils Assessment; [Insert SITE NAME]; [Insert SITE LOCATION and STATE]; [Insert DATE]

Document Title

United States Environmental Protection Agency; Region [Insert REGION #]

Lead Organization

[Insert NAME and ORGANIZATIONAL AFFILIATION]

Preparer's Name and Organizational Affiliation

[Insert CONTACT INFORMATION]

Preparer's Address, Telephone Number, and E-mail Address

[Insert DATE]

Preparation Date (Day/Month/Year)

Investigative Organization's Project Manager: _____

Signature

Printed Name/Organization/Date

Investigative Organization's Project QA Officer: _____

Signature

Printed Name/Organization/Date

Lead Organization's Project Manager: _____

Signature

Printed Name/Organization/Date

Approval Signatures: _____

Signature

Printed Name/Title/Date

DRAFT Quality Assurance Project Plan for Soils Assessment

INSERT Site Name/Project Name:

Revision Number:

INSERT Site Location

Revision Date:

Approval Authority

Signature

Printed Name/Title/Date

Approval Authority

Other Approval Signatures:

Signature

Printed Name/Title/Organization/Date

INSERT Site Name/Project Name:

Revision Number:

INSERT Site Location

Revision Date:

QAPP WORKSHEET #2 (UFP-QAPP MANUAL SECTION 2.2.4) -- QAPP IDENTIFYING INFORMATION

Site Number/Code: [Insert [SITE NUMBER/CODE](#)]
Operable Unit: [Insert [OPERABLE UNIT](#)]
Contractor Name: [Insert [CONTRACTOR NAME](#)]
Contractor Number: [Insert [CONTRACTOR NUMBER](#)]
Contract Title: [Insert [CONTRACT TITLE](#)]
Work Assignment Number: [Insert [WORK ASSIGNMENT NUMBER](#)]

1. Identify guidance used to prepare QAPP: Uniform Federal Policy for Quality Assurance Project Plans (UFP QAPP) ACTIONABLE TEMPLATE, US EPA, Office of Superfund Remediation and Innovative Technology (OSRTI), Technology Innovation and Field Services Division (TIFSD), [Insert [DATE](#)]

2. Identify regulatory program: Comprehensive Environmental Restoration, Compensation and Liability Act (CERCLA); [Insert [STATE REGULATORY PROGRAM IF APPLICABLE](#)]

3. Identify approval entity: [Insert [AGENCY NAME\(S\)](#)]

4. Indicate whether the QAPP is a generic or a project-specific QAPP. ([UNDERLINE ONE](#))

5. List dates of systematic planning sessions that were held: [Insert [DATE\(S\)](#)]

6. List dates and titles of QAPP documents from previous site work, if applicable:

Title	Received Date
[Insert TITLE]	[Insert DATE]
[Insert TITLE]	[Insert DATE]
[Insert TITLE]	[Insert DATE]
[Insert TITLE]	[Insert DATE]

7. List organizational partners (stakeholders) and connection with lead organization: [Insert [NAME\(S\)](#)]

8. List data users: [Insert [NAME\(S\)](#)]

DRAFT Quality Assurance Project Plan for Soils Assessment

INSERT Site Name/Project Name:

Revision Number:

INSERT Site Location

Revision Date:

- 9. If any required QAPP elements and required information are not applicable to the project, then circle the omitted QAPP elements and required information on the attached table. Provide an explanation for their exclusion below:**

[Insert [UFP QAPP DEVIATIONS](#)]

[Insert [EXPLANATION FOR UFP QAPP EXCLUSIONS](#)]

Identify where each required UFP-QAPP element is located in the UFP-QAPP (provide section, worksheet, table, or figure number) or other related project planning documents (provide complete document title, date, section number, and page numbers of the information in the document. Circle QAPP elements and required information that are not applicable to this project. Provide an explanation in the document section following the table.

Note: this table is completed when QAPP is finalized.

Required QAPP Element(s) and Corresponding QAPP Section(s)	Crosswalk to Related Documents	QAPP Worksheet # in QAPP Workbook	Required Information
Project Management and Objectives			
2.1 Title and Approval Page		1	- Title and Approval Page
2.2 Document Format and Table of Contents 2.2.1 Document Control Format 2.2.2 Document Control Numbering System 2.2.3 Table of Contents 2.2.4 QAPP Identifying Information		2	- Table of Contents - QAPP Identifying Information
2.3 Distribution List and Project Personnel Sign-Off Sheet 2.3.1 Distribution List 2.3.2 Project Personnel Sign-Off Sheet		3 4	- Distribution List - Project Personnel Sign-Off Sheet
2.4 Project Organization 2.4.1 Project Organizational Chart 2.4.2 Communication Pathways 2.4.3 Personnel Responsibilities and Qualifications 2.4.4 Special Training Requirements and Certification		5 6 7 8	- Project Organizational Chart - Communication Pathways - Personnel Responsibilities and Qualifications Table - Special Personnel Training Requirements Table
2.5 Project Planning/Problem Definition 2.5.1 Systematic Planning Meeting 2.5.2 Problem Definition, Site History, and Background		9 10	- Project Planning Session Documentation (including Data Needs tables) - Systematic Planning Participants Sheet - Problem Definition, Site History, and Background - Site Maps (historical and present)

Required QAPP Element(s) and Corresponding QAPP Section(s)	Crosswalk to Related Documents	QAPP Worksheet # in QAPP Workbook	Required Information
2.6 Project Quality Objectives and Measurement Performance Criteria 2.6.1 Development of Project Quality Objectives Using the Systematic Planning Process 2.6.2 Measurement Performance Criteria		11 12	- Site-Specific PQOs - Measurement Performance Criteria Table
2.7 Secondary Data Evaluation		13	- Sources of Secondary Data and Information - Secondary Data Criteria and Limitations Table
2.8 Project Overview and Schedule 2.8.1 Project Overview 2.8.2 Project Schedule		14 15A and 15B 16	- Summary of Project Tasks - Reference Limits and Evaluation Table - Project Schedule/Timeline Table
Measurement/Data Acquisition			
3.1 Sampling Tasks 3.1.1 Sampling Process Design and Rationale 3.1.2 Sampling Procedures and Requirements 3.1.2.1 Sampling Collection Procedures 3.1.2.2 Sample Containers, Volume, and Preservation 3.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures 3.1.2.4 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures 3.1.2.5 Supply Inspection and Acceptance Procedures 3.1.2.6 Field Documentation Procedures		17 18 19 20 21 22	- Sampling Design and Rationale - Sample Location Map - Sampling Locations and Methods/ SOP Requirements Table - Analytical Methods/SOP Requirements Table - Field Quality Control Sample Summary Table - Sampling SOPs - Project Sampling SOP References Table - Field Equipment Calibration, Maintenance, Testing, and Inspection Table

DRAFT Quality Assurance Project Plan for Soils Assessment

INSERT Site Name/Project Name:

Revision Number:

INSERT Site Location

Revision Date:

Required QAPP Element(s) and Corresponding QAPP Section(s)	Crosswalk to Related Documents	QAPP Worksheet # in QAPP Workbook	Required Information
3.2 Analytical Tasks 3.2.1 Analytical SOPs 3.2.2 Analytical Instrument Calibration Procedures 3.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures 3.2.4 Analytical Supply Inspection and Acceptance Procedures		23 24 25	<ul style="list-style-type: none"> - Analytical SOPs - Analytical SOP References Table - Analytical Instrument Calibration Table - Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table
3.3 Sample Collection Documentation, Handling, Tracking, and Custody Procedures 3.3.1 Sample Collection Documentation 3.3.2 Sample Handling and Tracking System 3.3.3 Sample Custody		26 and 27	<ul style="list-style-type: none"> - Sample Collection Documentation Handling, Tracking, and Custody SOPs - Sample Container Identification - Sample Handling Flow Diagram - Example Chain-of-Custody Form and Seal
3.4 Quality Control Samples 3.4.1 Sampling Quality Control Samples 3.4.2 Analytical Quality Control Samples		28A and 28B	<ul style="list-style-type: none"> - QC Samples Table - Screening/Confirmatory Analysis Decision Tree
3.5 Data Management Tasks 3.5.1 Project Documentation and Records 3.5.2 Data Package Deliverables 3.5.3 Data Reporting Formats 3.5.4 Data Handling and Management 3.5.5 Data Tracking and Control		29 30	<ul style="list-style-type: none"> - Project Documents and Records Table - Analytical Services Table - Data Management SOPs
Assessment/Oversight			
4.1 Assessments and Response Actions 4.1.1 Planned Assessments 4.1.2 Assessment Findings and Corrective Action Responses		31 32	<ul style="list-style-type: none"> - Assessments and Response Actions - Planned Project Assessments Table - Audit Checklists - Assessment Findings and Corrective Action

DRAFT Quality Assurance Project Plan for Soils Assessment

INSERT Site Name/Project Name:

Revision Number:

INSERT Site Location

Revision Date:

Required QAPP Element(s) and Corresponding QAPP Section(s)	Crosswalk to Related Documents	QAPP Worksheet # in QAPP Workbook	Required Information
			Responses Table
4.2 QA Management Reports		33	- QA Management Reports Table
4.3 Final Project Report			
Data Review			
5.1 Overview			
5.2 Data Review Steps 5.2.1 Step I: Verification 5.2.2 Step II: Validation 5.2.2.1 Step IIa Validation Activities 5.2.2.2 Step IIb Validation Activities 5.2.3 Step III: Usability Assessment 5.2.3.1 Data Limitations and Actions from Usability Assessment 5.2.3.2 Activities		34 35 36 37	- Verification (Step I) Process Table - Validation (Steps IIa and IIb) Process Table - Validation (Steps IIa and IIb) Summary Table - Usability Assessment
5.3 Streamlining Data Review 5.3.1 Data Review Steps To Be Streamlined 5.3.2 Criteria for Streamlining Data Review 5.3.3 Amounts and Types of Data Appropriate for Streamlining			

Explanations of Deviations from UFP-QAPP Contents: [Insert **EXPLANATIONS OF DEVIATIONS INDICATED IN ABOVE TABLE**]

Project-Specific OR Generic QAPP -

Site Name/Project Name:

Site Location

Title:

Revision Number:

Revision Date:

QAPP WORKSHEET #3 (UFP-QAPP MANUAL SECTION 2.3.1) -- DISTRIBUTION LIST

List those entities to which copies should be provided of the approved QAPP, subsequent QAPP revisions, addenda, and amendments.

QAPP Recipients	Title	Organization	Telephone Number	Fax Number	E-mail Address	Document Control Number
[Insert NAME]	[Insert TITLE]	[Insert ORGANIZATION]	[Insert TELEPHONE NUMBER(s) and TYPE (Cell, direct)]	[Insert FAX NUMBER]	[Insert EMAIL ADDRESS]	[Insert DOCUMENT CONTROL NUMBER]

Project-Specific OR Generic QAPP -

Site Name/Project Name:

Site Location

Title:

Revision Number:

Revision Date:

QAPP WORKSHEET #4 (UFP-QAPP MANUAL SECTION 2.3.2) -- PROJECT PERSONNEL SIGN-OFF SHEET

Have copies of this form signed by key project personnel from each organization to indicate that they have read the applicable QAPP sections and expect to perform the tasks as described. Each organization should complete their own form and forward the signed sheet(s) to the designated central project file.

Organization: Insert ORGANIZATION NAME

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read Email Receipt
[Insert NAME]	[Insert TITLE]	[Insert TELEPHONE NUMBER(s) and TYPE (Cell, direct)]	[Apply SIGNATURE or INSERT e-SIGNATURE]	[Insert DATE]

Project-Specific OR Generic QAPP -

Site Name/Project Name:

Site Location

Title:

Revision Number:

Revision Date:

QAPP WORKSHEET #5 (UFP-QAPP MANUAL SECTION 2.4.1) -- PROJECT ORGANIZATIONAL CHART

Identify reporting relationships between all organizations involved in the project, including the lead organization and all contractors and subcontractor organizations. Identify the organizations providing field sampling, on-site and off-site analysis, and data review services, including the names and telephone numbers of all project managers, project team members, and/or project contacts for each organization.

Approval Authority:
United States Environmental Protection Agency
Region [Insert REGION #]

Lead Organization:
[Insert NAME of ORGANIZATION]

Lead Organization Project Manager:
[Insert NAME]

Regulatory Approval:
[Insert NAME of APPROVING ENTITY]

Investigative Organization:
[Insert CONTRACTOR NAME]

Role: [Insert ROLE(s)]
Project Manager: [Insert NAME]

Overall QA Project Officer:
[Insert NAME]

QA Officer:
[Insert NAME]

Health & Safety Officer:
[Insert NAME]

Subcontractors: [Insert SERVICE AREA]

Organization: [Insert ORGANIZATION NAME]
Role: [Insert ROLE(s)]
Project Contact: [Insert NAME]

Organization: [Insert ORGANIZATION NAME]
Role: [Insert ROLE(s)]
Project Contact: [Insert NAME]

[Insert ADDITIONAL SUBCONTRACTORS as necessary]

Contractor Project Team:

<u>Name</u>	<u>Title</u>	<u>Project Role</u>
[Insert NAME]	[Insert TITLE]	Field Team Leader
[Insert NAME]	[Insert TITLE]	Field Sampling Team
[Insert NAME]	[Insert TITLE]	Onsite Health and Safety Officer
[Insert NAME]	[Insert TITLE]	Geologist / Hydrogeologist
[Insert NAME]	[Insert TITLE]	Chemist
[Insert NAME]	[Insert TITLE]	Risk Assessor / Toxicologist
[Insert NAME]	[Insert TITLE]	Statistical Support /Data Analyst
[Insert NAME]	[Insert TITLE]	[Insert PROJECT ROLE]
[Insert NAME]	[Insert TITLE]	[Insert PROJECT ROLE]
[Insert NAME]	[Insert TITLE]	[Insert PROJECT ROLE]

Subcontractors: [Insert SERVICE AREA]

Organization: [Insert ORGANIZATION NAME]
Role: [Insert ROLE(s)]
Project Contact: [Insert NAME]

Organization: [Insert ORGANIZATION NAME]
Role: [Insert ROLE(s)]
Project Contact: [Insert NAME]

[Insert ADDITIONAL SUBCONTRACTORS as necessary]

QAPP WORKSHEET #6 (UFP-QAPP MANUAL SECTION 2.4.2) -- COMMUNICATION PATHWAYS

Describe the communication pathways and modes of communication to be used during the project, after the QAPP has been approved. Describe the procedures for soliciting and/or obtaining approval between project personnel, between different contractors, and between samplers and laboratory staff. Describe the procedure to be followed when any project activity originally documented in an approved QAPP requires real-time modification to achieve project goals or a QAPP amendment is required. Describe the procedures for stopping work and identify who is responsible.

Communication Drivers	Responsible Entity	Name	Telephone Number	Procedure (timing, pathways, etc.)
Project Communications	[Insert RESPONSIBLE ENTITY]	[Insert NAME]	[Insert TELEPHONE NUMBER(s)]	[Insert DESCRIPTION of PROCEDURE]
Contractual Communications (including STOP WORK Notification)	[Insert RESPONSIBLE ENTITY]	[Insert NAME]	[Insert TELEPHONE NUMBER(s)]	[Insert DESCRIPTION of PROCEDURE]
Field Planning Meeting	[Insert RESPONSIBLE ENTITY]	[Insert NAME]	[Insert TELEPHONE NUMBER(s)]	[Insert DESCRIPTION of PROCEDURE]
Field-based Decision Making	[Insert RESPONSIBLE ENTITY]	[Insert NAME]	[Insert TELEPHONE NUMBER(s)]	[Insert DESCRIPTION of PROCEDURE]
Site Decision Making	[Insert RESPONSIBLE ENTITY]	[Insert NAME]	[Insert TELEPHONE NUMBER(s)]	[Insert DESCRIPTION of PROCEDURE]
Conceptual Site Model (CSM)	[Insert RESPONSIBLE ENTITY]	[Insert NAME]	[Insert TELEPHONE NUMBER(s)]	[Insert DESCRIPTION of PROCEDURE]

QAPP WORKSHEET #7 (UFP-QAPP MANUAL SECTION 2.4.3) -- PERSONNEL RESPONSIBILITIES AND QUALIFICATIONS TABLE

Identify project personnel associated with each organization, contractor, and subcontractor participating in responsible roles. Include data users, decision-makers, project managers, QA officers, project contacts for organizations involved in the project, project health and safety officers, geotechnical engineers and hydrogeologists, field operation personnel, analytical services, and data reviewers. Identify project team members with an asterisk (*). Attach resumes to this worksheet or note the location of the resumes.

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
NOTE: This table can be customized as necessary to reflect project-specific team membership.				
[Insert NAME]	Regional Administrator	[Insert ORGANIZATION]	Regional authority for project and site decisions.	[Insert UFP QAPP APPENDIX NUMBER]
[Insert NAME]	Regional Project Manager	[Insert ORGANIZATION]	Management of assessment project.	[Insert UFP QAPP APPENDIX NUMBER]
[Insert NAME]	Quality Assurance Officer	[Insert ORGANIZATION]	Ensure technical quality of work efforts. Perform field audits.	[Insert UFP QAPP APPENDIX NUMBER]
[Insert NAME]	Health & Safety Officer	[Insert ORGANIZATION]	Ensure protection of worker health and safety. Approve site-specific health and safety plans. Perform field audits.	[Insert UFP QAPP APPENDIX NUMBER]
[Insert NAME]	Regional Technical Staff*	[Insert ORGANIZATION]	Support RPM, assist with systematic planning, and with technical oversight	[Insert UFP QAPP APPENDIX NUMBER]
[Insert NAME]	Contractor Project Manager*	[Insert ORGANIZATION]	Technical management of Assessment project.	[Insert UFP QAPP APPENDIX NUMBER]
[Insert NAME]	Field Team Leader*	[Insert ORGANIZATION]	Manage field data collection efforts.	[Insert UFP QAPP APPENDIX NUMBER]
[Insert NAME]	[Hydrogeologist, Chemist, Statistician, Risk Assessor, Toxicologist, Engineer, etc.]*	[Insert ORGANIZATION]	[Insert RESPONSIBILITIES as applicable to each discipline]	[Insert UFP QAPP APPENDIX NUMBER]
[Insert NAME]	Analytical Laboratory*	[Insert ORGANIZATION]	Analytical services	[Insert UFP QAPP APPENDIX NUMBER]
[Insert NAME]	Field Sampling Services Subcontractor(s)*	[Insert ORGANIZATION]	[Insert TYPE of SERVICE(s)]	[Insert UFP QAPP APPENDIX NUMBER]

QAPP WORKSHEET #8 (UFP-QAPP MANUAL SECTION 2.4.4) -- SPECIAL PERSONNEL TRAINING REQUIREMENTS TABLE

Provide the following information for those projects requiring personnel with specialized training. Attach training records and/or certificates to the QAPP or note their location.

Project Function	Specialized Training By Title or Description of Course	Training Provider	Training Date	Personnel / Groups Receiving Training	Personnel Titles / Organizational Affiliation	Location of Training Records / Certificates ¹
Sample Analysis	Analyst certification for analytical methods	[Insert SOURCE of TRAINING]	[Insert DATE]	[Insert NAMES of PERSONNEL or GROUP(s)]	[Insert TITLE and ORGANIZATION]	[Insert UFP QAPP APPENDIX NUMBER]
Laboratory	Primary Waste Sample Certification	[Insert SOURCE of TRAINING]	[Insert DATE]	[Insert NAMES of PERSONNEL or GROUP(s)]	[Insert TITLE and ORGANIZATION]	[Insert UFP QAPP APPENDIX NUMBER]
Field Team	HAZWOPER 40 Hour 8 Hour Refresher 8 Hour Supervisor	[Insert SOURCE of TRAINING]	[Insert DATE]	[Insert NAMES of PERSONNEL or GROUP(s)]	[Insert TITLE and ORGANIZATION]	[Insert UFP QAPP APPENDIX NUMBER]
Regional Project Manager	Incremental or Compositing Sampling Strategy	[Insert SOURCE of TRAINING]	[Insert DATE]	[Insert NAMES of PERSONNEL or GROUP(s)]	[Insert TITLE and ORGANIZATION]	[Insert UFP QAPP APPENDIX NUMBER]
Regional Technical Support	Incremental or Compositing Sampling Strategy	[Insert SOURCE of TRAINING]	[Insert DATE]	[Insert NAMES of PERSONNEL or GROUP(s)]	[Insert TITLE and ORGANIZATION]	[Insert UFP QAPP APPENDIX NUMBER]
Field Team	ICS Sampling Techniques Sieving / Subsampling	[Insert SOURCE of TRAINING]	[Insert DATE]	[Insert NAMES of PERSONNEL or GROUP(s)]	[Insert TITLE and ORGANIZATION]	[Insert UFP QAPP APPENDIX NUMBER]
Field Team	Sample Shipment / Transportation	[Insert SOURCE of TRAINING]	[Insert DATE]	[Insert NAMES of PERSONNEL or GROUP(s)]	[Insert TITLE and ORGANIZATION]	[Insert UFP QAPP APPENDIX NUMBER]
Field Team	SCRIBE / Scriblets	[Insert SOURCE of TRAINING]	[Insert DATE]	[Insert NAMES of PERSONNEL or GROUP(s)]	[Insert TITLE and ORGANIZATION]	[Insert UFP QAPP APPENDIX NUMBER]
QA/QC	[Insert TYPE of TRAINING]	[Insert SOURCE of TRAINING]	[Insert DATE]	[Insert NAMES of PERSONNEL or GROUP(s)]	[Insert TITLE and ORGANIZATION]	[Insert UFP QAPP APPENDIX NUMBER]

¹ If training records and/or certificates are on file elsewhere, document their location in this column. If training records and/or certificates do not exist or are not available, then this should be noted.

QAPP WORKSHEET #9 (UFP-QAPP MANUAL SECTION 2.5.1) – SYSTEMATIC PLANNING MEETING PARTICIPANTS SHEET

Complete this worksheet for each systematic planning meeting held. Identify project team members who are responsible for planning the project. The following is the generic form used for scoping meetings.

<p>Project Name: [Insert PROJECT NAME]</p> <p>Projected Date(s) of Sampling: [Insert DATE(s)]</p> <p>Project Manager: [Insert NAME]</p>	<p>Site Name: [Insert SITE NAME]</p> <p>Site Location: [Insert LOCATION, STATE]</p>				
<p>Date of Session: [Insert DATE]</p> <p>Systematic Planning Meeting Purpose: Develop site-specific plan for site soils assessment effort.</p>					
Name	Title	Affiliation	Phone #	E-mail Address	Project Role
[Insert NAME]	[Insert TITLE]	[Insert AFFILIATION]	[Insert PHONE #]	[Insert EMAIL ADDRESS]	[Insert PROJECT ROLE]

Comments/Decisions:

[Insert [COMMENTS / DECISIONS](#) or [REFERENCE TO SEPARATE DOCUMENT](#)]

Action Items:

[Insert [ACTION ITEMS](#) or [REFERENCE TO SEPARATE DOCUMENT](#)]

Consensus Decisions:

[Insert [CONSENSUS DECISIONS](#) or [REFERENCE TO SEPARATE DOCUMENT](#)]

QAPP WORKSHEET #10 (UFP-QAPP MANUAL SECTION 2.5.2) – SITE BACKGROUND AND BASELINE CONCEPTUAL SITE MODEL (CSM)

The problem to be addressed by the project: [Insert SUMMARY OF SITE-SPECIFIC ISSUES TO BE ADDRESSED]

The environmental questions being asked: [Insert SUMMARY OF SITE-SPECIFIC ISSUES TO BE ADDRESSED]

Observations from any site reconnaissance reports: See Attachment A - Historical Documentation and Data Review

A synopsis of secondary data or information from site reports: See Attachment A - Historical Documentation and Data Review

The classes of contaminants and the affected matrices: Dioxins, furans, dioxin-like congeners of polychlorinated biphenyls (PCBs), [INSERT OTHER ANALYTE SPECIES]. Matrices = soil. Depth [Insert DEPTH OF SURFICIAL EXPOSURE BASED ON REGIONAL DEFINITION OR SITE-SPECIFIC DETERMINATION]

The rationale for inclusion of chemical and nonchemical analyses: [Insert RATIONALE]

Information concerning various environmental indicators: [Insert SUMMARY OF SITE-SPECIFIC ISSUES TO BE ADDRESSED]

Project decision conditions (If..., then...@ statements): See Figure 1 and Attachments

QAPP WORKSHEET #11 (UFP-QAPP MANUAL SECTION 2.6.1) -- PROJECT QUALITY OBJECTIVES/SYSTEMATIC PLANNING PROCESS STATEMENTS

Use this worksheet to develop project quality objectives (PQOs) in terms of type, quantity, and quality of data determined using a systematic planning process. Provide a detailed discussion of PQOs in the QAPP. List the PQOs in the form of qualitative and quantitative statements. These statements should answer questions such as those listed below. These questions are examples only, however; they are neither inclusive nor appropriate for all projects.

Who will use the data? EPA Region [Insert REGION #] and [Insert COMPANY NAME], EPA's mission support contractor. [Insert OTHERS, as applicable]

What will the data be used for? The analytical results for soils will be used to determine whether the site(s) pose a risk to human health based on comparison to applicable threshold criteria and/or background concentration range. As applicable, the data may also be used to determine a remediation design and/or provide forensic information.

What type of data are needed (matrix, target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques)? Data will consist of analytical results for surface soil media, analyzed for dioxins and furans (D/Fs) and dioxin-like PCBs. D/Fs may be analyzed via EPA Method SW-846 8290, EPA Method 1613, the CLP D/F congener method (non-routine analytical services), or an equivalent method able to provide congener data for the 17 D/Fs with TEFs. The 12 dioxin-like PCBs with TEF values may be analyzed by EPA Method 1668, the CLP PCB congener method (non-routine analytical services), or equivalent. Unless getting data on the whole suite of D/F and PCB compounds has value as a forensic or other tool, costs might be reduced by requesting that the laboratory provide data ONLY for the toxic congeners. Confer with the laboratory. Analyses will be conducted by laboratories certified in the methods of concern. If data for the toxic congeners only is obtained, all other raw data information should be retained in the project file in case a need for its use arises. In particular, all analytical quality control checks should be retained.

Sampling will be performed using an incremental-composite sampling (ICS) approach. Some soil sample archiving for future analysis may be necessary.

Matrix: Surface soil.

How “good” do the data need to be in order to support the environmental decision? Data results will be calculated to be expressed as a total TEQ that can be confidently compared to a soil “action level” [Insert **THRESHOLD VALUE IF APPLICABLE**] “background level” at [Insert **VALUE**] ppt. Soil data need to have provided with it with measures of its sampling and analytical variability (i.e., definitive data). Overall statistical variability in the data needs to be small enough so that the confidence interval width between the mean and UCL does not bracket the action level. Or if it does bracket the action level, the width needs to be narrow enough that the chance of decision error is acceptable to the risk manager. Detection limits need to be low enough to statistically compare on-site with background concentrations. See Worksheets # 12, 15 and 37.

How much data are needed (number of samples for each analytical group, matrix, and concentration)?

See Figure 1, Attachment E.

Where, when, and how should the data be collected/generated? Samples will be collected and prepared on site. See Attachment E, Worksheets 17 and 18

Who will collect and generate the data? [Insert **COMPANY NAME**]; the Region [Insert **REGION #**] mission support contractor.

How will the data be reported? [Insert **DATA REPORTING PLAN DESCRIPTION**]

How will the data be archived? [Insert **DATA ARCHIVING DESCRIPTION**]

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QAPP WORKSHEET #12 (UFP-QAPP MANUAL SECTION 2.6.2) -- MEASUREMENT PERFORMANCE CRITERIA TABLE

Complete this worksheet for each matrix, analytical group, and concentration level. Identify the data quality indicators (DQIs), measurement performance criteria (MPC), and QC sample and/or activity used to assess the measurement performance for both the sampling and analytical measurement systems. Use additional worksheets if necessary. If MPC for a specific DQI vary within an analytical parameter, i.e., MPC are analyte-specific, then provide analyte-specific MPC on an additional worksheet.

Matrix	Soil				
Analytical Group ^{1,4}	Dioxins/Furans Dioxin-like PCBs				
Concentration Level	Low Level ¹⁰				
Sampling Procedure ²	Analytical Method/SOP ³	Data Quality Indicators (DQIs)	Measurement Performance Criteria ⁹	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Incremental-Composite Surface Sampling SOP (see Worksheet 17)	EPA Method 8290A/1613B, or CLP SOW Method DLM02.2 See [Insert TITLE of LABORATORY SOP , Revision DATE ; [Insert APPENDIX NUMBER]	Analytical (Laboratory) Precision	%RSD or RPD < 25% %RSD < 35%	Laboratory sub-sampling replicates and LCS/LCSD	A (laboratory processing & analysis)
		Sampling Precision	Standard deviation low enough for statistical TEQ decision-making at desired level of confidence (depends on how close the mean is to the action level)	Field replicates at the DU level; and field/laboratory sample preparation replicates. {See <i>User Guide Concept #19</i> }	S & A
		Accuracy (bias)	%Recovery 70-130% Dioxins/furans < PQL ⁵ %Recovery 70-130% Dioxins/furans < PQL ⁵	LCS Method blank MS/MSD Field blank ⁷	A A S&A ⁶ S&A ⁶
		Sensitivity	SDL ≤ PQL ⁸	SDL determined per method	S&A
		98	100% (depends on number of DUs in sampling design)	Data review and validation	S&A
Representativeness	Sampling and sample processing in accordance with	Field notes review and/or field audits; laboratory	S		

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			SOP (See Worksheet 17)	narrative review for sub-sampling	
		Comparability	Sampling and sample processing in accordance with SOP (See Worksheet 17) Analytical precision and bias within acceptable limits	Field notes review and/or field audits; laboratory narrative review for sub-sampling Data review	S&A A

¹ If information varies within an analytical group, separate by individual analyte.

² Reference number from QAPP Worksheet #21 (see Section 3.1.2).

³ Reference number from QAPP Worksheet #23 (see Section 3.2).

⁴ Co-planar and some other PCB congeners can also contribute to toxic equivalents (TEQs) as dioxin-like compounds. With the exception of two congeners (#126 and #169), however, toxicity equivalency factors (TEF) for these PCBs are 0.0003 or less, meaning their contribution to TEQ is less than one thousandth of TCDD or PeCDD congeners. Thus, co-planar PCBs may not require assessment or Assessment at many sites. Consult historical information to determine if there could be high concentrations of PCBs present.

⁵ Detected blank contaminants must be less than the Project Quantitation Limit (PQL) Goal listed in Worksheet #15. For samples analyzed according to CLP SOW DLM02.2, blank concentrations up to 3 times the PQL are allowable for OCDD/OCDF.

⁶ MS/MSD samples are considered optional for dioxin/furan analyses, and many laboratories do not run MS/MSDs as part of their normal QA program. This is because concentration results for dioxins/furans are recovery-corrected based on isotopically-labeled internal standards that are spiked into every sample.

⁷ Field blanks will include equipment blanks and source water blanks (see Worksheet #17).

⁸ The sample detection limit (SDL) must be less than the PQL Goal (see Worksheet #15).

⁹ These criteria apply to each individual target analyte reported by the analytical methods.

¹⁰ A maximum RSD criteria of 35% is specified for all samples including low concentration samples. If this criterion can not be met, the ability to assess uncertainty at low levels may be technology limited.

CLP Contract Laboratory Program
 LCS Laboratory control sample
 LCSD Laboratory control sample duplicate
 MS Matrix spike
 MSD Matrix spike duplicate

OCDD Octachlorodibenzodioxin
 OCDF Octachlorodibenzofuran
 PCB Polychlorinated biphenyl
 PeCDD Pentachlorodibenzodioxin
 SOP Standard operating procedure

SOW Statement of Work
 TCDD Tetrachlorodibenzodioxin
 TEQ Toxic equivalent

QAPP WORKSHEET #13 (UFP-QAPP MANUAL SECTION 2.7) -- SECONDARY DATA CRITERIA AND LIMITATIONS TABLE

Identify all secondary data and information that will be used for the project and their originating sources. Specify how the secondary data is expected to be used and the limitations on their use. Each project specific area should include any limitations on use of the data in the final report. Data from each project specific area is accumulated in the final site report and the limits on data use presented.

Secondary Data	Data Source (originating organization, report title and date)	Data Generator(s) (originating organization, data types, data generation / collection dates)	How Data Will Be Used	Limitations on Data Use
D/F congeners or total homologues; dioxin-like PCB congeners or homologues; or total PCBs/Aroclor data Calculated TEQ results from previous investigation and remediation activities PAHs (indicators of combustion or oil contamination) Any other contaminants of concern	[Insert DATA SOURCE]	[Insert DATA GENERATOR]	Evaluate whether existing data can be used for risk screening and risk assessment. Can data be used to estimate contaminant variability to statistically determine # of increments? Attachment A to Figure 1 presents review topics and considerations for historical data sets. Can data be used to support CSM development? Attachment C to Figure 1 illustrates the incorporation of historical data into the Baseline CSM and the assessment of data gaps.	An uncertainty range (based on total measurement variability) will be used to assess whether the data are below the action level when uncertainty is taken into account.

QAPP WORKSHEET #14 (UFP-QAPP MANUAL SECTION 2.8.1) -- SUMMARY OF PROJECT TASKS

Provide a brief overview of the listed project activities. The following table is to be completed for each project area.

Sampling Tasks: Sample collection per Attachment E, Worksheets 17 and 18

Analysis Tasks: Off-site laboratory analysis using high resolution GC/MS via EPA Method 1613B/8290A or CLP-SOW Method DLM02.2 (HRGC/HRMS) or other methods as indicated in Worksheets 12, 15, and 19.

Quality Control Tasks: Full EPA QA program including field and laboratory QC checks, auditing/oversight, and data review/validation. Additionally includes sampling quality assurance ("variability sources QC procedure"). *{See User Guide Concept #19}*

Secondary Data: Compilation and review of historical site data for development of preliminary and baseline CSM per Figure 1, Attachment A, Worksheet 13. *{See Section 2.7 of original UFP-QAPP Manual.}*

Other Data: [Insert **OTHER DATA** as needed]

Data Management Tasks: Sample tracking and documentation, field data entry, data mapping, statistical analyses, data verification, data qualifier entry, and database upload. *{See Section 3.5 of original UFP-QAPP Manual.}*

Documentation and Records: Per EPA QA and CLP requirements (per CLP SOW and SEDD requirements).

Assessment / Audit Tasks: Field and laboratory audits as determined by project chemist and QA staff. *{See Section 4.0 of original UFP-QAPP Manual.}*

Data Review Tasks: Data verification and completeness checks, data validation in accordance with EPA functional guidelines.

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QAPP WORKSHEET #15A (UFP-QAPP MANUAL SECTION 2.8.1) -- REFERENCE LIMITS AND EVALUATION TABLE – DIOXIN / FURANS

Complete this worksheet for each matrix, analytical group, and concentration level. Identify the target analytes/contaminants of concern and project-required action limits. Next, determine the quantitation limits (QLs) necessary to achieve the project quality objectives. Finally, list the published and achievable detection and quantitation limits for each analyte.

Matrix: Soil

Analytical Group: Dioxins/Furans

Concentration Level: Low-level definitive analysis by EPA Method 1613B/8290A or CLP-SOW Method DLM02.2 (HRGC/HRMS)

Analyte	CAS Number	Project Action Limit (i.e. Decision Criteria) (applicable units)	Project Quantitation Limit Goal ⁵ (applicable units)	Analytical Method ¹		Achievable Laboratory Limits ²	
				MDLs	Method QLs ⁶	MDLs ⁷	QLs ⁸
2,3,7,8-TCDD	1746-01-6	1 ^{3,4}	1	NS	1	NA ⁷	1
1,2,3,7,8-PeCDD	40321-76-4	1 ^{3,4}	1	NS	5 ⁹	NA	1 ⁹
1,2,3,4,7,8-HxCDD	39227-28-6	1 ^{3,4}	10	NS	5	NA	5
1,2,3,6,7,8-HxCDD	57563-85-7	1 ^{3,4}	10	NS	5	NA	5
1,2,3,7,8,9-HxCDD	19408-74-3	1 ^{3,4}	10	NS	5	NA	5
1,2,3,4,6,7,8-HpCDD	35822-39-4	1 ^{3,4}	100	NS	5	NA	5
OCDD	3268-87-9	1 ^{3,4}	30,000	NS	10	NA	10
2,3,7,8-TCDF	51207-31-9	1 ^{3,4}	10	NS	1	NA	1
1,2,3,7,8-PeCDF	57117-41-6	1 ^{3,4}	300	NS	5	NA	5
2,3,4,7,8-PeCDF	57117-31-4	1 ^{3,4}	30	NS	5	NA	5

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1,2,3,4,7,8-HxCDF	70648-26-9	1 ^{3,4}	10	NS	5	NA	5
1,2,3,6,7,8-HxCDF	57117-44-9	1 ^{3,4}	10	NS	5	NA	5
1,2,3,7,8,9-HxCDF	72918-21-9	1 ^{3,4}	10	NS	5	NA	5
2,3,4,6,7,8-HxCDF	60851-34-5	1 ^{3,4}	10	NS	5	NA	5
1,2,3,4,6,7,8-HpCDF	67562-39-4	1 ^{3,4}	100	NS	5	NA	5
1,2,3,4,7,8,9-HpCDF	55673-89-7	1 ^{3,4}	100	NS	5	NA	5
OCDF	39001-02-0	1 ^{3,4}	30,000	NS	10	NA	10
Total TCDD	41903-57-5	1 ^{3,4}	--				
Total PeCDD	36088-22-9	1 ^{3,4}	--				
Total HxCDD	34465-46-8	1 ^{3,4}	--				
Total HpCDD	37871-00-4	1 ^{3,4}	--				
Total TCDF	55722-27-5	1 ^{3,4}	--				
Total PeCDF	30402-15-4	1 ^{3,4}	--				
Total HxCDF	55684-94-1	1 ^{3,4}	--				
Total HpCDF	38998-75-3	1 ^{3,4}	--				

¹ Analytical MDLs and QLs are those listed in the EPA reference methods.

² Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing the analytical method for a specific application (project and matrix). Achievable MDLs and QLs are to be completed by the project team in cooperation with the project laboratory.

³ Project Action Limit is below the lowest applicable threshold value. Action levels should not be adjusted for sample compositing factors (see Attachment E, Worksheet 17).

⁴ Additional state action levels, background levels, or other decision criteria may need to be considered during finalization of Project Action Limits.

⁵ This column presents Project Action Limit (ppt TEQ) adjusted by the analyte's Toxicity Equivalency Factor (TEF), as adopted in 2005 by the World Health Organization (WHO; see also Van Den Berg et. al. 2006, <http://epa-prgs.ornl.gov/chemicals/help/documents/vandenberg2006.pdf>) . This

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adjustment serves to increase the allowable PQL Goal for congeners that are less toxic than the most toxic dioxin/furan congeners (2,3,7,8-TCDD and 1,2,3,7,8-PeCDD).

⁶ This column presents concentrations corresponding to the “minimum levels” listed in methods 1613B/8290A, which are also consistent with the Contract Required Quantitation Limits (CRQLs) specified in CLP-SOW method DLM02.2.

⁷ Generalized method detection limit (MDL) studies are not applicable for dioxins/furans. Rather, current high resolution methods for these compounds specify the determination of a sample-specific reporting limit that is based on signal-to-noise level (note 8). Nevertheless, some laboratories may provide MDL studies for dioxins in standard matrixes upon request. MDLs for dioxins/furans in standard matrixes can typically range from 0.2 to 0.5 ppt for TCDD/Fs and TeCDD/Fs, 0.4 to 1.0 ppt for HxCDD/Fs and HpCDD/Fs, and 1.0 to 1.5 ppt for OCDD/F.

⁸ Most laboratories report standard QLs consistent with the referenced EPA methods, and are based on method calibration levels. Standard QLs should be confirmed upon laboratory selection and used as “upper bound” sensitivity goals for the specific site and project. All dioxin and furan analyses performed for EPA since 1982 have used a technique for calculating the sample specific estimated detection limit (or “sample detection limit” [SDL]) for each of the chlorination levels and each congener by using the noise level present in the elution window and the height of the chromatographic peak of the appropriate internal standard. Both the signal to noise and peak height are determined by the GC/MS data system and the result of the calculation is a detection limit that is specific to the homologous series and sample. If the compound is non-detect in a sample, this value is used as the reporting limit. As this value is sample specific, it can be lower or higher than the value generated from a generic MDL study (in accordance with 40 CFR 136) on a standard matrix.

⁹ EPA method QL is higher than Project Action Limit or Project QL Goal. Thus, a project “upper bound” QL of 1 ppt is recommended for the laboratory that is lower than the standard method QL of 5 ppt.

In addition to definitive HRGC/HRMS methods, some screening technologies are available for consideration by project teams as follows:

- Immunoassay or receptor gene tests, available from Xenobiotic Detection Systems (the CALUX test) and CAPE Technologies. These tests have been assessed by the EPA SITE program, and are the basis of EPA Methods 4435 and 4025, respectively. They have detection limits in the low ppt TEQ range, but can exhibit high biases or variability. Moreover, they require equipment and training, with sample turnaround times of 1-3 days.
- Fast TAT laboratory screening methods are available from some full service laboratories. These methods have TATs of less than 1 week, with reduced costs relative to HRGC/HRMS methods, but have elevated reporting limits (in the high ppt to ppb range).

TEFs for dioxin congeners and co-planar PCBs are also summarized at: http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/usersguide.htm

HpCDD	Heptachlorodibenzo-p-dioxin	NS	Not specified	TCDD	Tetrachlorodibenzo-p-dioxin
HpCDF	Heptachlorodibenzofuran	PeCDD	Pentachlorodibenzo-p-dioxin	TCDF	Tetrachlorodibenzofuran
HxCDD	Hexachlorodibenzo-p-dioxin	PeCDF	Pentachlorodibenzofuran	TEQ	TCDD Toxic Equivalent
HxCDF	Hexachlorodibenzofuran	ppt	Parts per trillion		
NA	Not applicable	PRG	Preliminary Remedial Goal		

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QAPP WORKSHEET #15B (UFP-QAPP MANUAL SECTION 2.8.1) -- REFERENCE LIMITS AND EVALUATION TABLE – DIOXIN-LIKE PCBs

Complete this worksheet for each matrix, analytical group, and concentration level. Identify the target analytes/contaminants of concern and project-required action limits. Next, determine the quantitation limits (QLs) necessary to achieve the project quality objectives. Finally, list the published and achievable detection and quantitation limits for each analyte.

Matrix: Soil

Analytical Group: Dioxin-like PCB Congeners

Concentration Level: Low-level definitive analysis by EPA Method 1668A/B or CLP-SOW Method CBC01.2 (HRGC/HRMS)

Analyte	Congener Number	CAS Number	Project Action Limit (i.e. Decision Criteria) (ng/Kg)	Project Quantitation Limit Goal ⁵ (ng/Kg)	Analytical Method ¹		Achievable Laboratory Limits ²	
					MDLs	Method QLs	MDLs ⁶	QLs ⁷
3,3',4,4'-TetraCB	77	32598-13-3	1 ^{3,4}	10,000	17	50	TBD	50
3,4,4'5-TetraCB	81	70362-50-4	1 ^{3,4}	3,000	18	50	TBD	50
2,3,3',4,4'-PeCB	105	32598-14-4	1 ^{3,4}	30,000	11	20	TBD	50
2,3,4,4',5-PeCB	114	74472-37-0	1 ^{3,4}	30,000	12	50	TBD	50
2,3,4,4',5-PeCB	118	31508-00-6	1 ^{3,4}	30,000	19	50	TBD	50
2',3,4,4',5-PeCB	123	65510-44-3	1 ^{3,4}	30,000	15	50	TBD	50
3,3',4,4',5-PeCB	126	57465-28-8	1 ^{3,4}	10	14	50	TBD	10 ⁸
2,3,3',4,4',5-HxCB	156	38380-08-4	1 ^{3,4}	30,000	14	50	TBD	50

Project-Specific OR Generic QAPP -

Site Name/Project Name:

Site Location

Title:

Revision Number:

Revision Date:

2,3,3',4,4',5'-HxCB	157	69782-90-7	1 ^{3,4}	30,000	13	50	TBD	50
2,3',4,4',5,5'-HxCB	167	52663-72-6	1 ^{3,4}	30,000	11	50	TBD	50
3,3',4,4',5,5'-HxCB	169	32774-16-6	1 ^{3,4}	30	16	50	TBD	50
2,3,3',4,4',5,5'-HpCB	189	39635-31-9	1 ^{3,4}	30,000	18	50	TBD	50

¹Analytical MDLs and QLs are the estimated minimum detection limits (EMDLs) and estimated minimum levels (EMLs) listed in EPA Method 1668B.

²Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing the analytical method for a specific application (project and matrix). Achievable MDLs and QLs are to be completed by the project team in cooperation with the project laboratory. Recommendations for target QLs have been provided below.

³Project Action Limit is the lowest applicable residential threshold value total TEQ. Action levels should not be adjusted for sample compositing factors (see Figure 1, Attachment E, Worksheet 17).

⁴Additional state action levels, background levels, or other decision criteria may need to be considered during finalization of Project Action Limits.

⁵This column presents Project Action Limit (ppt TEQ) adjusted by the analyte's Toxicity Equivalency Factor (TEF), as adopted in 2005 by the World Health Organization (WHO; see also Van Den Berg et. al. 2006, <http://epa-prgs.ornl.gov/chemicals/help/documents/vandenberg2006.pdf>). This adjustment serves to increase the allowable PQL Goal for congeners that are less toxic than the most toxic dioxin/furan congeners (2,3,7,8-TCDD and 1,2,3,7,8-PeCDD). TEFs for dioxin congeners and co-planar PCBs are also summarized at: http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/usersguide.htm.

⁶Project- and matrix-specific method detection limit (MDL) studies should be performed in accordance with 40 CFR 136.

⁷Most laboratories report standard QLs consistent with the referenced EPA methods, and are based on method calibration levels. Standard QLs should be confirmed upon laboratory selection and used as "upper bound" sensitivity goals for the specific site and project. For EPA CLP method CBC01.2, the lowest method calibration levels are set at 2 ng/Kg (ppt).

⁸EPA method QL is higher than Project Action Limit or Project QL Goal. Thus, a project "upper bound" QL of 10 ng/Kg (ppt) is recommended for the laboratory that is lower than the standard method QL of 50 ng/Kg.

HpCDD	Heptachlorodibenzo-p-dioxin	ng/Kg	nanograms per kilogram	PRG	Preliminary Remedial Goal
HpCDF	Heptachlorodibenzofuran	NS	Not specified	TBD	To be determined (by project team)
HxCDD	Hexachlorodibenzo-p-dioxin	PeCDD	Pentachlorodibenzo-p-dioxin	TCDD	Tetrachlorodibenzo-p-dioxin
HxCDF	Hexachlorodibenzofuran	PeCDF	Pentachlorodibenzofuran	TCDF	Tetrachlorodibenzofuran
NA	Not applicable	ppt	Parts per trillion	TEQ	TCDD Toxic Equivalent

QAPP WORKSHEET #16 (UFP-QAPP MANUAL SECTION 2.8.2) -- PROJECT SCHEDULE / TIMELINE TABLE

List all project activities as well as the QA assessments that are expected to be performed during the course of the project. Include the anticipated start and completion dates.

Activities	Organization	Anticipated Date(s) of Initiation	Anticipated Date of Completion	Deliverable	Deliverable Due Date
Review Historical Documentation and Data (see Figure 1, Attachment)	[Insert CONTRACTOR NAME]	[Insert DATE]	[Insert DATE]	Preliminary CSM and Supporting Information	[Insert DATE]
Systematic Planning Meeting (See Figure 1, Attachments B and C)	[Attach STAKEHOLDER LIST]	[Insert DATE]	[Insert DATE]	Baseline CSM and Final Assessment Design and Strategy	[Insert DATE]
Background Study (as needed) (See Figure 1, Attachment D)	[Insert CONTRACTOR NAME]	[Insert DATE]	[Insert DATE]	Background Values for use as Decision Criteria	[Insert DATE]
Assessment Sampling Effort(s) (See Figure 1, Attachment E)	[Insert CONTRACTOR NAME]	[Insert DATE(s)]	[Insert DATE(s)]	Site Assessment Data and Reporting	[Insert DATE(s)]
TEQ-Based Risk Screening (See Figure 1, Attachment F)	[Insert CONTRACTOR NAME]	[Insert DATE]	[Insert DATE]	Determination of whether site contamination exceeds decision criteria	[Insert DATE]
Human Health Risk Assessment (See Figure 1, Attachment G)	[Insert CONTRACTOR NAME]	[Insert DATE]	[Insert DATE]	Determination of whether site poses risk to human health	[Insert DATE]
Remediation / Mitigation (as warranted).	[Insert CONTRACTOR NAME]	[Insert DATE]	[Insert DATE]	Remediation / Mitigation Report	[Insert DATE]
Site Closure / Reuse	[Insert AGENCY NAME]	[Insert DATE]	[Insert DATE]	Clearance for closure or reuse	[Insert DATE]

QAPP WORKSHEET #17 (UFP-QAPP MANUAL SECTION 3.1.1) -- SAMPLING DESIGN AND RATIONALE

Describe the project sampling approach. Provide the rationale for selecting sample locations and matrices for each analytical group and concentration level.

17.1 Describe and provide a rationale for choosing the sampling approach (e.g., grid system, biased statistical approach):

Incremental Composite Sampling (ICS) was selected as the sampling strategy to assess the Site because it improves the accuracy of mean estimates for areas of interest by reducing the variability of the sample data as compared to discrete sampling strategies. The objective of a composite sample is to collect data which represents a mean analyte concentration for a designated area. Composite sample data have much lower variability than discrete sample data and a higher reproducibility (Hawaii DOH 2009). Their higher accuracy supports greater confidence for decision-making.

The composite samples for this project will consist of [Insert [METHOD OF SELECTING NUMBER OF INCREMENTS: A DEFAULT OF 30 - 60 INCREMENTS OF SOIL OR THE NUMBER OF INCREMENTS IS DETERMINED STATISTICALLY FROM SITE VARIABILITY.](#)] from each Decision Unit (DU) and combined into a single DU-ICS sample. [If more than one DU, insert [A LIST OR TABLE TO INDICATE THE NUMBER OF INCREMENTS PER DU.](#)]

The number and size of DUs at the Site was evaluated during systematic planning as part of the data quality objectives (DQO) process, and is site-specific based on the Site's conceptual site model (CSM) (See Worksheet #10) and sampling objectives (See Figure 1, Attachment B, and Worksheet #11).

A DU is defined as the smallest area about which a risk-based decision can be made [Insert [APPLICABLE ACTION LEVEL AND/OR RISK AND/OR REMEDIATION AND/OR OTHER DECISION](#)]. For residential [[use / reuse](#)] of the site, in the absence of site-specific information, the default DU will be a 0.25-acre area. A 0.25-acre residential DU also defines an exposure unit (EU) which is the size of a DU for which residential risk-based decisions will be made. Determining appropriately sized DUs is a critical function of systematic planning, and DU areas or volumes should be developed in consultation with risk assessors and other key technical team members to ensure DUs match EUs and exposure assumptions.

A larger DU size depends upon [Insert [LEAD REGULATORY AGENCY](#)] guidance for clearance of larger areas. For DUs where the contaminant distribution is especially heterogeneous (based on review of the CSM, or other historical or current measures of site contaminant variability) it may be prudent to increase the number of increments collected to between 30 and 60, or an alternate quantity that best ensures adequate increment density (Hathaway et al 2008). {[See also discussion in the User Guide, Concept #17, page 28 and Concepts #19-21, page 30 – 35](#)}.

In especially heterogeneous areas, collecting a greater number of increments in each DU [[will / may be](#)] performed to reduce field sampling error and minimize the variation from the mean among replicate samples used to evaluate representativeness of the data collected. The number of

increments selected for the composite samples in the Site Assessment was evaluated during systematic planning as part of the DQO process (Hathaway et al 2008).

Individual soil increments (that make up a composite sample) are expected to typically weigh between 5 and 50 grams each. When choosing the mass per increment, keep in mind that the field composite sample should typically weigh between 300 and 2,500 g after sieving soil samples to the target particle size. The “300 to 2,500 g” suggestion is based on the mass sufficient to minimize Gy’s Fundamental Error for sample collection (USEPA 1999). Note that sieving of “raw” incremental-composite samples to a particle size less than 2 mm (the definition of “soil”), will be [\[completed in the field / performed as part of the laboratory-based sample preparation process\]](#) and will reduce the amount of soil mass available for analysis. This was taken into consideration during DQO development when the target increment mass and target soil particle size was determined. The mass of the composite sample is a function of the number of increments collected, the depth at which samples were collected, the size of the sample collection tool utilized, the total number and type of analyses planned, and the laboratory digestion/analysis mass required for each test. Consideration of these factors is recorded in Worksheet #17, section 17.2.2. As discussed below, the mass of the composite sample [\[may / will\]](#) be reduced by sieving (i.e., removal of sticks and stones > 2 mm in size) and sub-sampling in the field, prior to submittal to the laboratory. The < 2-mm sized soil particles are generally considered “soil” and are of most interest for contaminant analysis, while larger particles are considered to be gravel, rocks, or other materials (e.g., sticks and roots). Sieving the soil sample to the < 2-mm size can also help establish the maximum particle size of the sample, which is necessary to determine the minimum sample mass necessary for extraction/analysis in the laboratory. The target particle size selected for this Site is [ENTER PARTICLE SIZE].

17.2 Describe the sampling design and rationale in terms of what matrices will be sampled, what analytical groups will be analyzed and at what concentration levels, the sampling locations (including QC, critical, and background samples), the number of samples to be taken, and the sampling frequency (including seasonal considerations) [May refer to map or Worksheet #18 for details]:

This section describes the sampling method and locations, the number of samples to be collected, and the sampling frequency. The following outlines sample collection for 0.25-acre residential DUs and collection of field replicates in association with primary sample collection. The smallest routine DU size for this project will be 0.25-acre (which defines a residential EU). The DU size [\[was / was not\]](#) uniquely determined by the CSM. The DQO process determined that DUs larger or smaller than 0.25 acres [\[are / are not\]](#) appropriate. *{See User Guide for options on how to scale DUs to larger size and for strategies that the project team can select to address large areas which need to be sampled.}*

17.2.1 Sample Collection Procedure for a 0.25-acre DU

To collect ICS samples from a 0.25-acre DU, a systematic random transect walk or a systematic random grid with grid blocks, is the general approach to the increment collection scheme. The incremental layout scheme was [\[determined manually / assisted using Visual Sampling Plan \(VSP\)\]](#). This design strategy should result in generally equal distribution of increment collection points across the DU. Field samplers may also walk the DU, collecting increments as they pace the area in a systematic way. For example, a square-shaped DU may be divided into five rows, with six increments collected from each row in a systematic random fashion, with an initial random starting point. For more rectangular-shaped

DUs, fewer rows might be used, with more increments per row collected. Row lengths and increments per row may be modified as needed to accommodate a variety of DU shapes and orientations.

The ends of each row [will / may] may be marked with flags to help establish approximate lines for the collection of increments. Flags [will / may] also be placed along the edges of the DU parallel to the rows to help ensure approximate spacing. Flags [will / will not] be placed at every increment collection point. Global Positioning System (GPS) technology will be used to document the DU location and to create maps for the soil investigation report. With the exception of cases where a modified mapping need is identified, only the four corners of the DU (or enough points to delineate a DU's irregular shape) will be located via GPS. As GPS location information can be several meters off, depending on the specific GPS device used; this factor was considered in establishing DQOs for the investigation.

For a systematic random walk collection, [Insert NUMBER BETWEEN 30 AND 60] individual soil increments are determined by “pacing” a set distance along the rows of the DU, and not individually measured.

For a systematic random with grid blocks increment collection, 30 to 60 equal-sized blocks are first established (e.g., a grid established across the DU), then a random location would be selected in each grid block to collect a single increment.

Increments will be collected in a manner that produces a [ENTER cylindrical or core-shaped sample OR OTHER SHAPE]. This will be accomplished using a [ENTER soil coring sampler OR OTHER SAMPLE COLLECTION TOOL] to collect a [Insert “core-shaped” OR OTHER SAMPLE SUPPORT DESCRIPTION (see User Guide, Concept # 7)] sample over the entire depth of interest. Inappropriate tools will not be used, nor will collecting a sample (or sub-sample) that contains more soil particles from the top of the sample than the bottom (or vice versa) as these could lead to biased sample results due to the heterogeneous distribution of contaminated particles in the soil.

For composite samples collected from within the 0-2 feet interval below ground surface (bgs) only, hand tools will be used to collect the increments. The type of sampling device used will be dependent in part on the hardness of the soil, or the degree to which larger grain sizes (coarse gravels; cobbles) are present. For soft soils, an approximately [Insert SPATIAL DIMENSIONS OF THE SAMPLER DEVICE, such as 1-inch-diameter soil core barrel] that can be advanced by hand or foot will be used. Battery-operated drills with large bits may also be utilized to increase efficiency and reduce sampler fatigue. For harder or rocky soils, a coring device with slide hammer, a mattock (large pick), hydraulic, or electric-assisted device, may be needed to advance the [Insert SAMPLER TYPE, such as core barrel] or access the soil column for sampling. If a hand augur is used, care will be taken to lay the contents of the augur barrel out on plastic marked to distinguish surface soil to the at-depth end. The objective in using each type of tool will be to focus on collecting [Insert SAMPLE SUPPORT, such as core-shaped] sample increments from the [Insert DESIRED DEPTH]. Field conditions will be confirmed [RETAIN OR DELETE THE FOLLOWING TEXT AS APPLICABLE: and proposed sampling tools tested at the Site as a demonstration of method applicability study before final selection of a particular type or combination of tools.

Care will be taken to collect an incremental sample that contains the same amount of soil particles from the top of the sample as the bottom. This is achieved by scraping the length of the core using a decontaminated trowel or disposable scoop. Care will be taken to collect equal volumes of soil from each incremental location for the ICS sample. This soil will be placed in a large bucket along with all the other increments. If the soil cannot be easily homogenized with previously collected increments, it should be disaggregated before adding it to the bucket. This can be achieved by placing it in a heavy plastic bag which is then kneaded or hit with a mallet to break up aggregated materials. This will make subsequent sample handling steps possible. The composite sample will then be thoroughly combined in the collection container. If

disaggregation has already been performed well, this step may consist of simple mixing, making sure the bottom and top layers are mixed as well, and settling of finer particles to the bottom does not occur. Aggregates need to be broken up by pounding, mortar and pestle, or hand kneading before proceeding to the next step. *{Note: All the information on how the ICS sample is to be processed should be identified in Worksheet #11 with attachments included as appropriate. SOPs specific to sample processing are provided as attachments to QAPP worksheet #21.}*

The ICS sample may be sieved to the < 2 mm particle size in the field to remove large particles (stones, twigs, etc.) and reduce sample mass. *{NOTE: This is NOT the same as the sieving step that isolates a specific soil size fraction, if that is called for by Worksheet #10 (“...and affected matrices”) and Worksheet #11, and described in the sampling SOPs which are part of QAPP Worksheet #21} SOP options will be available for soil disaggregation and primary sieving upon request, as will a second SOP for soil sieving to acquire the particle size of interest.}* In some cases, sieving samples in the field could be difficult due to high moisture content of soils or a lack of adequate field facilities, appropriate equipment, or planning. If sieving is not possible in the field, either the entire ICS sample will be sent to the laboratory or it will be sub-sampled in the field following the procedure below to reduce the volume sent to the laboratory. In the laboratory, samples will be dried so that results can be reported in dry weight. *{NOTE: It is important during systematic planning to ensure that the laboratory is prepared to accept and process these large or moderately sized ICS.}*

If the ICS sample volume is to be reduced so that a smaller sample volume is sent to the laboratory, the following process will be performed in the field. Once a composite sample has been collected and disaggregated, the disaggregated composite sample will be sub-sampled to create the final composite sample to be delivered to the laboratory for further processing and analysis. To sub-sample the composite, the entire sample will be spread out to a thin layer (~ 0.25 inch thick “slabcake”) on clean plastic or a decontaminated flat surface, and sub-sampled in a manner similar to how the field composite sample was collected—by taking 30 to 60 [Insert ACTUAL NUMBER] sub-sample increments in systematic random locations across the (spread-out) sample. In this case, sub-sampling will be conducted with a rectangular-shaped scoop. Care will be taken so that all particles in the scoop path and at the full depth of the slabcake are retained on the scoop, so Gy-type sampling errors (USEPA, 1999 in User Guide Reference list) are avoided. The sub-sample increments will be placed into a clean, [Insert SIZE and CONTAINER] to form one ICS sample to be sent to the laboratory. At DUs targeted for collection of analytical replicates, the incremental sub-sampling process will be performed two additional times, producing three identical samples from the same DU-ICS. The two partially prepared sub-sample replicates will be sent to the analytical laboratory for archiving. The two archived laboratory replicates may be analyzed if the original analytical result does not meet data quality acceptance limits, and [will / will not] be used to assess sources of sampling error. The replicate designated for the primary analysis will be dried, disaggregated, and sieved to isolate the particle-size of interest to the project decision (if necessary, as determined in Worksheet #10). The laboratory will also use the same “slabcake” incremental sub-sampling technique to sample the final prepared soil and obtain the required mass (in grams) necessary for sample extraction and analysis.

The sample preparation process of drying, disaggregation, and incremental sub-sampling will be used as the method for mass reduction. The entire sample will be spread out into a thin layer and increments will be collected in a systematic random fashion (with a tool sized to representatively scoop particles to the bottom of the sample). This will provide the best means of collecting a representative sub-sample of all the different sizes and types of soil particles present in the composite sample *{See USEPA, 2003 in User Guide}*. Subsampling processes for mass reduction (in the field or in the laboratory), should follow SOPs provided as attachments to the UFP-QAPP in Worksheet #21. All sample containers will be labeled and stored as described in Worksheet #27.

17.2.2 Sample Collection Procedure for DUs with an area greater than 0.25-acre

A larger DU size depends upon [Insert **LEAD REGULATORY AGENCY**] guidance for clearance of larger areas. The DU-ICS samples will be collected in a manner similar to the process outlined in Section 17.2.1. However, for larger DUs it may be helpful to partition the DU into subunits (i.e. SUs), each of which is sampled with its own ICS. Such a subunit is a SU, because each subunit is represented by a single sample. Each SU sample (abbreviated as SU-ICS) can be separately analyzed as individual samples, or subjected to a another tier of compositing to create a single ICS that represents the entire DU. *{See discussion in the User Guide, Concept #14, page 28 for further explanation of the benefits of SUs}*.

Each SU may consist of an equal number of increments, or of the number of increments that is determined statistically based on the individual SU's variability. These increments will then be homogenized and sub-sampled (using the slabcake method) into two portions. One of these portions will be a SU-ICS sample that [will / will not] be analyzed individually. If analyzed separately, the SU results from the same DU [will / will not] be used to calculate a mean and UCL for the DU. If this approach to calculating a UCL for the DU is used, the number of increments in each SU will be [Insert **NUMBER**] so that the total number of increments representing the DU mean and UCL is [Insert **NUMBER** that is no less than 30]. The remaining portion of the SU-ICS [will / will not] be archived for later analysis in case the DU fails and is determined to require cleanup or further investigation. Archiving SU samples for potential later analysis will reduce the chance that another field mobilization, with its associated work plans, sample acquisition, analysis, data interpretation and reporting, will be required. The soil will be processed (homogenized, sieved, sub-sampled) as outlined above and determined in Worksheet #10.

All sample jars will be labeled and stored as described in Worksheet #27.

17.2.3 Field Replicates

When field sampling is adequately "representative," repeat measurements within the same DU are expected to estimate the average contaminant concentration similarly. Field replicate results will be used as a QC check to evaluate acceptable performance of the sampling and analysis chain, including having an appropriate number of increments and adequate homogenization in sample preparation. This data will be used to determine the amount of variation from the mean that will be considered when comparing average contaminant concentrations in the DU to applicable decision criteria.

Determining whether the estimate of average contaminant concentration(s) will be adequately representative for the area under investigation (per the established DQO criteria for the statistical evaluation of the ICS analytical data) was performed during the DQO development effort. For this project, field replicates will be collected for [Insert **QUANTITY OR PERCENT**] of the total number of DU-ICS samples. The DU[s] chosen for field replicates will be selected by [Insert **randomly / judgmentally** and insert **RATIONALE** for selection if judgmental]. For sites with a small number of DUs, a minimum of one set of field replicates will be collected.

There are a number of options available for determining what measure of data variation from the mean will be used when evaluating the field replicate measurements and comparing the data to applicable criteria. If the increment density, or some other aspect of the sampling and analytical design is not sufficient to support DU decision-making, this will show up mathematically when calculating the TEQ standard deviation (SD) for the DU replicates. The link between variability and decision-making is the UCL. The greater the variability between the replicates, the higher the TEQ UCL on the mean will be. The greater the numerical gap between the TEQ mean of the replicates and the TEQ UCL from the replicates, the greater the amount of uncertainty in the data. If both the TEQ mean and UCL are on the same side of the applicable threshold value (either both below, or both above), a statistically confident decision can be made. The TEQ SD for the replicates is calculated using [Insert a spreadsheet, or other mechanism]. The SD will be used in the equation to calculate the TEQ UCL and to calculate the TEQ relative standard deviation (RSD). The equation for the RSD is the SD of the replicates divided by the average of the replicates times 100%.

[If different statistical data assessment procedures are planned, INSERT EXPLANATION OF OTHER STATISTICAL EVALUATION METHOD]

17.2.3.1 Relative Standard Deviation (RSD)

The RSD (also known as the coefficient of variation or CV) is a measure of the variation among a group of sample results. It will be used to assess the degree of variability between a set of DU replicates. The degree of variability is also related to the shape of the data distribution. A skewed shape (where one side is pulled out, for example, a lognormal distribution) has a higher RSD than a normal distribution. Therefore the RSD can be used as an indicator of the parent distribution from which the replicates came. RSD is the only statistical test that can be applied to determine distribution shape, since all standard statistical techniques require more than 3 data results. Computer simulations have led statisticians to make the following recommendations, which [will / will not (if not, the following can be removed)] be used to aid data assessment:

- If the TEQ RSD is low (i.e., less than 1.5), the Student's t-distribution will be used to calculate the 95% UCL for the TEQ.
- If the TEQ RSD is between 1.5 and 3, the non-parametric Chebyshev 95% UCL will be used.
- If the TEQ RSD is high (greater than 3), the non-parametric Chebyshev 99% UCL will be used. Although this is a 99% UCL by calculation, it is treated as a 95% UCL for the purposes of decision-making when the RSD is high.

Refer to Concept #18 in the User Guide for more discussion.

17.2.3.2 Calculating the 95 Percent Upper Confidence Limit for a DU TEQ

The Student's t distribution 95% UCL = arithmetic TEQ replicate mean + $\frac{95\% \text{ one-sided Student t factor} \times \text{TEQ SD}}{\text{Square root of the number of (replicate) samples}}$

The Chebyshev 95% UCL = arithmetic TEQ replicate mean + $\frac{4.359 \times \text{TEQ SD}}{\text{Square root of the number of (replicate) samples}}$

The Chebyshev 99% UCL = arithmetic TEQ replicate mean + $\frac{9.950 \times \text{TEQ SD}}{\text{Square root of the number of (replicate) samples}}$

If the mean and UCL straddle the applicable threshold value (the mean below the applicable threshold value, but the UCL above it) this means that there is statistical uncertainty about whether the true mean exceeds the applicable threshold value. If there is high variability (i.e., the RSD is greater than 1.5), the need to use the nonparametric Chebyshev UCLs can greatly increase the UCL. If the UCL and the mean will bracket the action level, this is an indication that there is more variability in the data set than can be tolerated in the decision-making process. If there is sufficient control over variability, the mean and the UCL will both fall on the same side of the action level. Note that even high variability in the data (a wide distance between the mean and UCL) might not be important if the field concentrations are far from the action level. If the mean is very low compared to the action level, the UCL may still fall below the action level even if the variability is high.

Unacceptably high data variability (i.e., a high RSD that causes the mean and UCL to straddle the action level) may suggest that the DU's matrix heterogeneity requires denser incremental sampling coverage to ensure an accurate representation of the DU's average, or it may indicate that sample preparation and homogenization procedures were not rigorous enough for this matrix. The source of high variability will be evaluated with a series of field and laboratory replicates (the Variability Source QC Procedure in the User Guide, pp. 37 - 38). This procedure evaluates which steps in the sampling and analytical procedures are contributing most to overall variability. If the source of variability is in sample preparation (which will be revealed through the analysis of the sample preparation replicates), increasing the number of increments will not address the problem.

For this project, if the mean and UCL straddle the action level, [Insert **DECISION-MAKING STRATEGY**]. This refers to a strategy such as: the UCL will be compared directly with the applicable threshold value; or perform additional evaluation of the field data and the "variability source" QC data; and/or take action to reduce decision uncertainty, such as take corrective action to reduce data variability by taking more increments, modifying sample prep procedures, resampling using an SU strategy to isolate hotspots and reduce DU replicate variability, etc.]

[RETAIN ONE OF THE PARAGRAPHS BELOW, AS APPLICABLE]

At DUs without replicate analyses, if needed a TEQ UCL for each will be calculated using the [highest / average / grouped in accordance with the CSM] area-wide variability results. That is, a standard deviation (SD) will be calculated when there are at least three similar adjacent DUs, each having a DU-ICS analytical result. There are strict conditions to be met for this procedure to be used. It is mandatory criteria that all the grouped, adjacent DU-ICS samples are very similar in TEQ results, congener profiles, CSMs, and in physical attributes. The SD calculated on this area-wide set of TEQ DU-ICS sample results will be used to calculate a UCL for those DUs not having a set of DU-ICS replicates.

At DUs without replicate analyses, a statistical uncertainty interval will be calculated around the applicable threshold value using the replicate data collected. This is simply the mirror image of calculating the uncertainty interval around a result and comparing it to the applicable threshold

value. One important difference associated with this technique is that the TEQs of the DUs used to provide a measure of variability (the SD) should be close to the same TEQ value of the applicable threshold value. Then single DU-ICS analytical values will be compared to the confidence interval around the action level. That is, a standard deviation (SD) will be calculated when there are at least three similar adjacent DUs, each having a DU-ICS analytical result. The SD calculated on this area-wide set of DU-ICS analytical results will be used to calculate an uncertainty interval around the applicable threshold value which will be used when evaluating data for those DUs not having a set of DU-ICS replicates. DU-ICS TEQ values for DUs above or below the uncertainty level represent decisions that can be made at the desired level of statistical confidence while those falling within the range of uncertainty may require additional evaluation or be subject to regional risk management decisions.

17.2.3.3 Sample Collection Procedure for Collecting DU Replicates

DU replicates will be collected at the same time that original DU samples are collected. An identical number of increments as used in the original DU-ICS samples will be collected via a new systematic DU grid for each of two DU-ICS field replicates. Field replicates will be given unique sample identification numbers that will not reveal to the laboratory that they are replicates.

The frequency of DU replicates will be [Insert **COLLECTION FREQUENCY INFORMATION**] as was determined during systematic planning. The rationale for selecting which DUs to perform replicates on is as follows [Insert **RATIONALE FOR SELECTION**]:

17.2.4 **Sample Collection for Anomalous Locations**

During the field sampling efforts, if areas are noticeably different than surrounding areas, or have been previously identified by the CSM as a potential anomalous area, a separate DU will be formed specifically for this area. The area will be sampled by collecting 30 incremental samples from the area to form an independent DU-ICS sample. Increments from the newly formed DU will not be mixed into ICS samples for the surrounding DUs. Care will be taken to mark the edges of the new DU for GPS documentation to create maps for the soil investigation reports and potential follow-up activities.

If at any time smaller anomalous areas are encountered, or for investigation of the area for remedial purposes, grab samples may be collected. To minimize non-representative high and low concentration extremes due to short-scale matrix heterogeneity, at least 5 increments will be taken from small areas to form a single composite grab sample. Likewise, to minimize sampling error during laboratory sub-sampling, the same sample preparation and sub-sampling slabcake techniques will be used as for the DU-ICS samples. The increments will be sized such that enough soil will be collected to go through the sample preparation steps. The amount of soil will be calculated to minimize Gy-type errors.

All sample jars will be labeled and stored as described in Worksheet #27. Composite grab samples will be marked as such on the chain of custody (COC) forms.

QAPP WORKSHEET #18 (UFP-QAPP MANUAL SECTION 3.1.1) -- SAMPLING LOCATIONS AND METHODS/SOP REQUIREMENTS TABLE

List all site locations that will be sampled and include sample/ID number, if available. (Provide a range of sampling locations of ID numbers if a site has a large number.) Specify matrix and, if applicable, depth at which samples will be taken. Only a short reference for the sampling location rationale is necessary for the table. The text of the QAPP should clearly identify the detailed rationale associated with each reference. Complete all required information, using additional worksheets if necessary

Sampling Location / ID Number	Matrix	Depth (units)	Analytical Group	Concentration Level	Number of Samples (identify laboratory and field replicates)	Sampling SOP Reference ¹	Rationale for Sampling Location ²
[Insert Sampling Location / ID Number]	Soil	[Insert DEPTH RANGE]	dioxins / furans, PCB congeners	1.0 ppt (dioxins/ furans) 10-50 ppt (PCB congeners)	[Insert NUMBER of SAMPLES]	See Figure 1, Attachment E / Worksheets 17 and 27	[Insert SAMPLING DESIGN and STRATEGY]

¹ Specify the appropriate letter or number from the Project Sampling SOP References table (Worksheet #21).

² Indicate type of sampling design and strategy – 0.25 acre residential; large area site; multiple sites; etc.

QAPP WORKSHEET #19 (UFP-QAPP MANUAL SECTION 3.1.1) -- ANALYTICAL SOP REQUIREMENTS TABLE

For each matrix, analytical group, and concentration level; list the analytical and preparation method/SOP and associated sample volume, container specifications, preservation requirements, and maximum holding time.

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method / SOP Reference ¹	Sample Size	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation / analysis)
Soil	Dioxins/Furans	All	EPA 8290A/1613B or CLP SOW DLM02.2 / Laboratory SOP [Insert APPENDIX NUMBER]	Analytical aliquot volume – 30 grams	Amber glass wide-mouth jar	Cool, 4+/- 2° C, dark	Up to 1 year ²
Soil	PCB Congeners	All	EPA 1668A/B or CLP SOW CBC01.2 / Laboratory SOP [Insert APPENDIX NUMBER]	Analytical aliquot volume – 30 grams	Amber glass wide-mouth jar	Cool, 4+/- 2° C, dark	Up to 1 year ²

¹ Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23).

² Sample extracts can also be stored for 1 year at -10°C

Project-Specific OR Generic QAPP -

Site Name/Project Name:

Site Location

Title:

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QAPP WORKSHEET #20 (UFP-QAPP MANUAL SECTION 3.1.1) -- FIELD QUALITY CONTROL SAMPLE SUMMARY TABLE

Summarize by matrix, analytical group, and concentration level the number of field QC samples that will be collected and sent to the laboratory.

Matrix	Analytical Group	Conc. Level	Analytical and Preparation SOP Reference ¹	No. of Samples ²	No. of Field Replicate Sets	No. of MS/MSD	No. of Source Blanks	No. of Equip. Blanks	No. of Performance Testing Samples	Total No. of Samples to Lab
Soil	Dioxins/ Furans	Low Level	EPA Method 8290A/1613B, or CLP SOW Method DLM02.2 See [Insert TITLE of LABORATORY SOP, Revision DATE; [Insert APPENDIX NUMBER]]	[Insert ESTIMATED NUMBER OF SAMPLES] See Worksheet 17	Minimum 10% of sampling areas ⁴	Minimum 5% of sampling areas ⁵	1 per change in decontamination water supply	1 per sampling day	Not Applicable	[Insert ESTIMATED NUMBER OF SAMPLES] See Worksheet 17
Soil	PCB Congeners	Low Level	EPA Method 1668A/B, or CLP SOW Method CBC01.2 See [Insert TITLE of LABORATORY SOP, Revision DATE; [INSERT APPENDIX NUMBER]]	[Insert ESTIMATED NUMBER OF SAMPLES] See Worksheet 17	Minimum 10% of sampling areas ⁴	Minimum 5% of sampling areas ⁵	1 per change in decontamination water supply	1 per sampling day	Not Applicable	[Insert ESTIMATED NUMBER OF SAMPLES] See Worksheet 17

¹ Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23).

² If samples will be collected at different depths at the same location, count each discrete sampling depth as a separate sampling location or station.

³ Minimum of three replicates per set (triplicates).

⁴ Replicate samples will be collected at all sampling areas for archiving and later analysis as necessary. However, a minimum of 10% of the replicate sets will be analyzed to assess sampling and analytical precision.

⁵ MS/MSDs are advised but not required; see Worksheet #12.

Project-Specific OR Generic QAPP -

Site Name/Project Name:

Site Location

Title:

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QAPP WORKSHEET #21 (UFP-QAPP MANUAL SECTION 3.1.2) -- PROJECT SAMPLING SOP REFERENCES TABLE

List all SOPs associated with project sampling including, but not limited to, sample collection, sample mass reduction/sample preparation, sub-sampling procedures, sample preservation, equipment cleaning and decontamination, equipment testing, inspection and maintenance, supply inspection and acceptance, and sample handling and custody. Include copies of the SOPs as attachments or reference all in the QAPP. Sequentially number sampling SOP references in the Reference Number column. The reference number can be used throughout the QAPP to refer to a specific SOP.

Reference Number	Title, Revision Date and / or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
TBD	[Insert TITLE, REVISION DATA and / or NUMBER]	[Insert EPA CONTRACTOR]	[Insert EQUIPMENT TYPE]	TBD	TBD
TBD	[Insert TITLE, REVISION DATA and / or NUMBER]	[Insert EPA LABORATORY]	[Insert EQUIPMENT TYPE]	TBD	TBD
TBD	[Insert TITLE, REVISION DATA and / or NUMBER]	[Insert FIELD TESTING PROVIDER]	[Insert EQUIPMENT TYPE]	TBD	TBD
TBD	[Insert TITLE, REVISION DATA and / or NUMBER]	[Insert FIELD SERVICES PROVIDER]	[Insert EQUIPMENT TYPE]	TBD	TBD
TBD	[Insert TITLE, REVISION DATA and / or NUMBER]	[Insert SPECIALTY EQUIPMENT PROVIDER]	[Insert EQUIPMENT TYPE]	TBD	TBD

Project-Specific OR Generic QAPP -

Site Name/Project Name:

Site Location

Title:

Revision Number:

Revision Date:

QA/QC Procedures

QA/QC Procedure	Person(s) Responsible for Procedure (title and organizational affiliation)
Sample Collection	See Worksheet 7
Drafting and Approval of Governing Documents	See Worksheets 1 and 2
Field Planning Meetings	See Worksheet 6
Field Team Training Requirements	See Worksheet 8
Field Logbooks	See Worksheet 27
Material Safety Data Sheets (MSDS)	See Worksheet 7
Investigation-Specific Field Forms	See Worksheet 29
Photographic Documentation	See Worksheet 29
Global Positioning System (GPS) Point Collection	See Worksheet 17
Field Equipment Maintenance	See Worksheet 22
Handling Investigation-Derived Waste (IDW)	See Worksheet 17
Field Sample Custody and Documentation	See Worksheet 27
Sample Packaging and Shipping	See Worksheet 27
Modification Forms	See Worksheet 29
Field Audits	See Worksheet 7

QAPP WORKSHEET #22 (UFP-QAPP MANUAL SECTION 3.1.2.4) -- FIELD EQUIPMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION TABLE

Identify all field equipment and instruments (other than analytical instrumentation) that require calibration, maintenance, testing, or inspection and provide the SOP reference number for each type of equipment. In addition, document the frequency of activity, acceptance criteria, and corrective action requirements on the worksheet.

[TO BE COMPLETED AS NEEDED BY THE PROJECT TEAM – THE PARTICULATE DIOXIN AND DUST MEASUREMENT DEVICES BELOW MAY NOT BE NECESSARY AT ALL SITES, PARTICULARLY THOSE WITH LOW SOIL CONCENTRATIONS OR LOW DUST POTENTIAL]

Field Equipment	Calibration Activity	Maint. Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Resp. Person	SOP Reference ¹
High volume air samplers for methods TO-9A and TO-10A (H&S Monitoring for dioxins/furans and PCBs), as needed	High volume sampler calibration	TBD – specific for sampler selected	Flow check per TO-9A, section 11.2.3	NA	Upon receipt, after maintenance, any time flow checks deviate >10% from specified value	Indicated flow rate = true flow rate ±10%	Recalibrate	Site Health and Safety Officer	TBD – specific for sampler selected
Thermo DataRam or other dust monitor	Gravimetric calibration (as needed for specific aerosols)	Filter replacement, cleaning of optical sensor	NA – testing and repair at factory only	NA	Daily or as notified by instrument	NA	NA	Field Team Lead	TBD – specific for sampler selected

¹ Specify the appropriate reference letter or number from the Project Sampling SOP References table (Worksheet #21).

Project-Specific OR Generic QAPP -

Site Name/Project Name:

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Title:

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QAPP WORKSHEET #23 (UFP-QAPP MANUAL SECTION 3.2.1) -- ANALYTICAL SOP REFERENCES TABLE

List all SOPs that will be used to perform on-site or off-site analysis. Indicate whether the procedure produces screening or definitive data. Sequentially number analytical SOP references in the Reference Number column. Include copies of the SOPs as attachments or reference in the QAPP. The reference number can be used throughout the QAPP to refer to a specific SOP.

Reference Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
SOP #XXX [Insert APPENDIX NUMBER]	"PCDDs/PCDFs by HRGC/HRMS," Revision [Insert REVISION # and DATE]	Definitive	Dioxins/Furans	HRGC [Insert MAKE / MODEL] HRMS [Insert MAKE / MODEL]	[Insert LABORATORY NAME]	No
SOP #XXX [Insert APPENDIX NUMBER]	"PCB Congeners by HRGC/HRMS," Revision [Insert REVISION # and DATE]	Definitive	PCB Congeners	HRGC [Insert MAKE / MODEL] HRMS [Insert MAKE / MODEL]	[Insert LABORATORY NAME]	No

HRGC High resolution gas chromatography
 HRMS High resolution mass spectrometry
 PCDD Polychlorinated dibenzo-p-dioxins
 PCDF Polychlorinated dibenzofurans
 SOP Standard operating procedure

QAPP WORKSHEET #24 (UFP-QAPP MANUAL SECTION 3.2.2) -- ANALYTICAL INSTRUMENT CALIBRATION TABLE

Identify all analytical instrumentation that requires calibration and provide the SOP reference number for each. In addition, document the frequency, acceptance criteria, and corrective action requirements on the worksheet.

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference ¹
HRGC/HRMS (Per Method 8290)	Tune (PFK)	Prior to sample analysis and at the end of the analytical sequence.	Resolving power \geq 10,000 at $m/z=304.9842$ & $m/z=380.9760 \pm 5$ ppm of expected mass.	(1) Retune instrument (2) Reanalyze PFK (3) End resolution acceptable "as is" – assess data for impact if resolution is less than 10,000 and narrate or reinject as necessary.	[Insert NAME of LABORATORY ANALYST; Insert NAME of LABORATORY]	See [Insert TITLE of LABORATORY SOP, Revision DATE; [Insert APPENDIX NUMBER]
HRGC/HRMS (Per Method 8290)	Column Performance Check Solution (CPSM). Includes the Window Defining Mix.	Prior to 12 hours of net sample analysis.	Used to set retention times of first and last eluters. CPSM must have \leq 25% valley resolution for 2,3,7,8-TCDD from the closest eluting analytes.	(1) Readjust windows. (2) Evaluate system. (3) Perform maintenance. (4) Reanalyze CPSM. (5) No corrective action is necessary if 2,3,7,8-TCDD is not detected and the % valley is greater than 25%.	[Insert NAME of LABORATORY ANALYST; Insert NAME of LABORATORY]	See [Insert TITLE of LABORATORY SOP, Revision DATE; [Insert APPENDIX NUMBER]
HRGC/HRMS (Per Method 8290)	5 point Initial Calibration (Multipoint ICAL)	Initially as required	(1) Int. Std. = %RSD < 20% (2) Natives = %RSD < 20% (3) Retention times must be within -1 to +3 seconds of the labeled I.S. or 0.005 RRT units. (4) Ion ratios within limits specified in the SOP and $S/N \geq 10:1$.	(1) Evaluate system. (2) Recalibrate. (3) If all criteria are met except #4 (ratio), evaluate impact, narrate and report if no impact is found.	[Insert NAME of LABORATORY ANALYST; Insert NAME of LABORATORY]	See [Insert TITLE of LABORATORY SOP, Revision DATE; [Insert APPENDIX NUMBER]
HRGC/HRMS	Routine calibration	Prior to and after	(1) Int. Std. = %RSD <	(1) Evaluate system.		See [Insert TITLE

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Site Name/Project Name:

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Title:

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Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference ¹
(Per Method 8290)	(continuing calibration check)	every 12 hrs of sample analysis.	30% (2) Natives = %RSD < 20% (3) Ion ratios within limits specified in the SOP.	(2) Recalibrate. (3) If all criteria are met except #3 (ratio), evaluate impact, narrate and report if no impact is found.	[Insert NAME of LABORATORY ANALYST; Insert NAME of LABORATORY]	of LABORATORY SOP, Revision DATE; [Insert APPENDIX NUMBER]
HRGC/HRMS (PCB Congeners)	5 point Initial Calibration (Multipoint ICAL)	Initially as required	(1) Int. Std. RR %RSD < 20% (2) Target cmpd. RR %RSD < 20% (3) RTs within windows established from initial standard. (4) Ion ratios within limits specified in the SOP and S/N ≥ 10:1.	(1) Evaluate system. (2) Recalibrate.	[Insert NAME of LABORATORY ANALYST; Insert NAME of LABORATORY]	See [Insert TITLE of LABORATORY SOP, Revision DATE; [Insert APPENDIX NUMBER]
HRGC/HRMS (PCB Congeners)	Routine calibration (continuing calibration check)	Prior to and between every 12 hr. shift of sample analysis.	(1) Int. Std. RR %RSD < 30% (2) Natives RR %RSD < 50% (3) Int. Std. RTs within 15 sec. of ICAL RTs; RRTs of target cmpds within CLP SOW (or SOP) criteria. (4) Ion ratios and S/N within limits specified in the SOP.	(1) Evaluate system. (2) Recalibrate..	[Insert NAME of LABORATORY ANALYST; Insert NAME of LABORATORY]	See [Insert TITLE of LABORATORY SOP, Revision DATE; [Insert APPENDIX NUMBER]

¹ Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23).

%RSD Percent relative standard deviation
 HRGC High resolution gas chromatography
 HRMS High resolution mass spectrometry

m/z Mass to charge ratio
 PCDF Polychlorinated dibenzofurans.
 PFK Perfluorokerosene
 ppm Parts per million

RRT Relative retention time
 S/N Signal to noise
 SOP Standard operating procedure
 TCDD Tetrachlorodibenzo-p-dioxin

QAPP WORKSHEET #25 (UFP-QAPP MANUAL SECTION 3.2.3) -- ANALYTICAL INSTRUMENT AND EQUIPMENT MAINTENANCE, TESTING, AND INSPECTION TABLE

Identify all analytical instrumentation that requires maintenance, testing, or inspection and provide the SOP reference number for each. In addition, document the frequency, acceptance criteria, and corrective action requirements on the worksheet.

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference ¹
HRGC/HRMS	Parameter Setup	Physical check	Physical check	Initially; prior to DCC	All parameters must match those set in the SOP	If any parameters do not match the SOP, reset them to proper values.	Laboratory Analyst	[Insert APPENDIX NUMBER]
HRGC/HRMS	System Performance Check	PFK tune and resolution check; window defining mix; isomer specificity check	Review check data relative to method criteria	Initially; prior to each 12-hour shift	Per CLP SOW method requirements	Correct the problem and repeat checks	Laboratory Analyst	[Insert APPENDIX NUMBER]

¹ Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23). These requirements apply to HRGC/HRMS instruments to be used for dioxin/furan and PCB congener analysis.

- AMU Atomic mass unit
- DCC Daily calibration check (continuing calibration)
- HRGC High resolution gas chromatography
- HRMS High resolution mass spectrometry
- SOP Standard operating procedure

Project-Specific OR Generic QAPP -

Site Name/Project Name:

Site Location

Title:

Revision Number:

Revision Date:

QAPP WORKSHEET #26 (UFP-QAPP MANUAL APPENDIX A) -- SAMPLE HANDLING SYSTEM

Use this worksheet to identify components of the project-specific sample handling system. Record personnel, and their organizational affiliations, which are primarily responsible for ensuring proper handling, custody, and storage of field samples from the time of collection, to laboratory delivery, to final sample disposal. Indicate the number of days field samples and their extracts/digestates will be archived prior to disposal.

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): [Insert NAME/COMPANY NAME], Field Team, EPA's mission support contractor
Sample Documentation (Personnel/Organization): [Insert NAME/COMPANY NAME], Field Team, EPA's mission support contractor
Sample Packaging (Personnel/Organization): [Insert NAME/COMPANY NAME], Field Team, EPA's mission support contractor
Type of Shipment (Personnel/Organization): [Insert NAME/COMPANY NAME], Field Team Lead, EPA's mission support contractor
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Laboratory sample custodian, [Insert LABORATORY NAME]
Sample Custody and Storage (Personnel/Organization): Laboratory sample custodian, [Insert LABORATORY NAME]
Sample Preparation (Personnel/Organization): Analyst, [Insert ANALYST/LABORATORY NAME]
Sample Determinative Analysis (Personnel/Organization): Analytical Chemist, [Insert LABORATORY NAME]
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): One year from sample collection date, or as notified by contractor
Sample Extract/Digestate Storage (No. of days from extraction/digestion): 45 days after extraction, or 1 year at -10°C
SAMPLE DISPOSAL
Personnel/Organization: Laboratory sample custodian, [Insert COMPANY NAME]
Number of Days from Analysis: When notified by contractor (or after one year)

QAPP WORKSHEET #27 (UFP-QAPP MANUAL SECTION 3.3.3) – SAMPLE CUSTODY REQUIREMENTS TABLE

Describe the procedures that will be used to maintain sample custody and integrity. Include examples of chain-of-custody forms, traffic reports, sample identification, custody seals, laboratory sample receipt forms, and laboratory sample transfer forms. Attach or reference applicable SOPs.

27.1 Sample Handling and Custody

The following sections describe sample handling procedures, including sample ID and labeling, documentation, chain of custody, and shipping.

27.1.1 Sample Identification

Specific sampling identifiers will be assigned to each individual sample which represents either a composite sample representing a DA or, DU, or a discrete sample collected in support of the project. Point names are presented on Worksheet #18. Sample ID schemes are presented in [Insert LOCATION]

27.1.2 Sample Labels

A sample label will be affixed to all sample containers. The label will be completed with the following information written in indelible ink:

- Project name and location
- Decision Unit #
- Sample ID number
- Date and time of sample collection
- Preservative used
- Sample collector's initials
- Analysis required

After it is labeled, each sample will be refrigerated or placed in a cooler that contains ice to maintain the sample temperature at 4 ± 2 °C.

27.1.3 Sample Documentation

Documentation during sampling is essential to ensure proper sample identification. Field personnel will adhere to the following general guidelines for maintaining manual field documentation:

- Documentation will be completed in permanent black ink.
- All entries will be legible.
- Errors will be corrected by crossing out with a single line and then dating and initialing the lineout.
- Unused portions of pages will be crossed out, and each page will be signed and dated.

For projects using hand-held data entry and collection systems, see Worksheet # 29.

27.1.4 Chain of Custody

Field personnel will use standard sample COC procedures to maintain and document sample integrity during collection, transportation, storage, and analysis. A sample will be considered to be in custody if one of the following statements applies:

- It is in a person's physical possession or view.
- It is in a secure area with restricted access.
- It is placed in a container and secured with an official seal such that the sample cannot be reached without breaking the seal.

COC procedures will provide an accurate written record that traces the possession of individual samples from the time they are collected in the field to the time they are accepted at the laboratory. The COB record also will be used to document all samples collected, the analysis requested, and which samples are to be archived to be analyzed at a future time. Information that the field personnel will record on the COC record will include the following:

- Project name and number
- Sampling location
- Name and signature of sampler
- Destination of samples (laboratory name)
- Sample ID number
- Date and time of collection
- Number and type of containers filled

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Title:

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- Analysis requested
- Sample designation (discrete or composite)
- Signatures of individuals involved in custody transfer, including the date and time of transfer
- Airbill number (if applicable)
- Project contact and phone number

Unused lines on the COC record will be crossed out. Field personnel will sign COC records that are initiated in the field, and the airbill number will be recorded. The record will be inserted in a waterproof plastic bag and taped to the inside of the shipping container used to transport the samples. Signed airbills will serve as evidence of custody transfer between field personnel and the courier, and between the courier and the laboratory. Copies of the COC record and the airbill will be retained and filed by field personnel before the containers are shipped.

Laboratory COC will begin when samples are received and continue until samples are discarded. The laboratory will be advised to designate a specific individual as the sample custodian. The custodian will receive all incoming samples, sign the accompanying custody forms, and retain copies of the forms as permanent records. The laboratory sample custodian will record all pertinent information on the samples, including the persons who delivered the samples, the date and time received, sample condition at the time of receipt (sealed, unsealed, or broken container; temperature; or other relevant remarks), the sample ID numbers, and any unique laboratory ID numbers for the samples. This information should be entered into a computerized laboratory information management system (LIMS). When the sample transfer process is complete, the custodian will be responsible for maintaining internal logbooks, tracking reports, and other records necessary to maintain custody throughout sample preparation and analysis.

The laboratory will provide a secure storage area for all samples. Access to this area will be restricted to authorized personnel. The custodian will ensure that samples that require special handling, including non-dioxin-related samples that are heat- or light-sensitive, radioactive, or have other unusual physical characteristics, will be properly stored and maintained prior to analysis.

27.1.5 Sample Shipment

The following procedures will be implemented when samples collected during this project are shipped:

- The cooler will be filled with bubble wrap, sample bottles, and packing material. Sufficient packing material will be used to prevent sample containers from breaking during shipment. Enough ice will be added to maintain the sample temperature of below 4 ± 2 °C.
- The COC records will be placed inside a plastic bag. The bag will be sealed and taped to the inside of the cooler lid. The air bill, if required, will be filled out before the samples are handed over to the carrier. The laboratory will be notified if the sampler suspects that the sample contains any substance that would require laboratory personnel to take safety precautions.
- The cooler will be closed and taped shut with strapping tape around both ends. If the cooler has a drain, it will be taped shut both inside and outside of the cooler.
- Signed and dated custody seals will be affixed on the front and side of each cooler. Wide clear tape will be placed over the seals to prevent accidental breakage.
- The COC record will be transported within the taped sealed cooler. When the cooler is received at the analytical laboratory, laboratory personnel will open the cooler and sign the COC record to document transfer of samples.

Multiple coolers may be sent in one shipment to the laboratory. The outside of the coolers will be marked to indicate the number of coolers in the shipment.

Project-Specific OR Generic QAPP -

Site Name/Project Name:

Site Location

Title:

Revision Number:

Revision Date:

QAPP WORKSHEET #28A (UFP-QAPP MANUAL SECTION 3.4) -- QC SAMPLES TABLE – DIOXINS / FURANS

Complete a separate worksheet for each sampling technique, analytical method/SOP, matrix, analytical group, and concentration level. If method/SOP QC acceptance limits exceed the measurement performance criteria, the data obtained may be unusable for making project decisions.

Matrix	Soil					
Analytical Group	Dioxins/Furans					
Concentration Level	Low Level					
Analytical Method / SOP Reference	EPA 8290A/1613B or CLP SOW method DLM02.2					
Analytical Organization	[Insert LABORATORY NAME]					
QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1/Extraction Batch (20 samples)	See [Insert TITLE of LABORATORY SOP, Revision DATE; [Insert APPENDIX NUMBER]	1) Report results if sample results >10x blank result or sample results ND. (5x for OCDD) 2) If results are <10x blank and if sufficient sample is available, re-extract and reanalyze samples (5x for OCDD). 3) If insufficient sample is available, reanalyze extracts. 4) Qualify data as needed.	[Insert NAME of LABORATORY ANALYST; Insert NAME of LABORATORY]	Accuracy/Bias-Contamination	No Target Compounds>PQL Goal

Project-Specific OR Generic QAPP -

Site Name/Project Name:

Site Location

Title:

Revision Number:

Revision Date:

LCS/LCSD	1/Extraction Batch (20 samples)	See [Insert TITLE of LABORATORY SOP , Revision DATE ; [Insert APPENDIX NUMBER]	1) Check calculations. 2) If sufficient sample is available, re-extract and reanalyze samples. 3) If insufficient sample is available, reanalyze extracts. Qualify data as needed.	[Insert NAME of LABORATORY ANALYST ; Insert NAME of LABORATORY]	Accuracy/Bias	%RSD ≤ 25%, percent recoveries of target analytes 70-130%, or See [Insert TITLE of LABORATORY SOP , Revision DATE ; [Insert APPENDIX NUMBER]
Internal Standards	Spiked into every sample and QC sample	See [Insert TITLE of LABORATORY SOP , Revision DATE ; ([Insert APPENDIX NUMBER)]	1) Check calculations. 2) Check chromatogram for interference. If found, flag data. 3) Check S/N. If < 10:1, re-extract sample. 4) If S/N > 10:1, evaluate data for usability, flag, narrate and report. 5) Check instrument and reanalyze extract if a problem is found and corrected. 6) Re-extract and reanalyze adversely affected samples.	[Insert NAME of LABORATORY ANALYST ; Insert NAME of LABORATORY]	Accuracy/Bias	40-135% Recovery, or See [Insert TITLE of LABORATORY SOP , Revision DATE ; [Insert APPENDIX NUMBER]
MS/MSD	1/20 samples or per request of project team ²	See [Insert TITLE of LABORATORY SOP , Revision DATE ; [Insert APPENDIX NUMBER]	Identify problem; if not related to matrix interference, re-extract and reanalyze MS/MSD and all associated batch samples upon request of project team.	[Insert NAME of LABORATORY ANALYST ; Insert NAME of LABORATORY]	Interferences - Accuracy/Bias - Precision	%RSD ≤ 35%, percent recoveries of target analytes 70-130%, or See [Insert TITLE of LABORATORY SOP , Revision DATE ; [Insert APPENDIX NUMBER]

¹ This worksheet addresses QC checks performed at the laboratory; additional information concerning QC checks, including field QC samples, is presented in Worksheets #12 and #20.

Project-Specific OR Generic QAPP -

Site Name/Project Name:

Site Location

² See discussion of MS/MSD samples for dioxin analyses in Worksheet #12.

Title:

Revision Number:

Revision Date:

%RSD Percent relative standard deviation
HRGC High resolution gas chromatography
HRMS High resolution mass spectrometry
LCS/LCSD Laboratory control sample/laboratory control sample
 duplicate
m/z Mass-to-charge ratio
MS/MSD matrix spike/matrix spike duplicate
OCDD octachlorodibenzo-p-dioxin

PFK Perfluorokerosene
ppm Parts per million
RRT Relative retention time
S/N Signal-to-noise ratio
SOP Standard operating procedure

Project-Specific OR Generic QAPP -

Site Name/Project Name:

Site Location

Title:

Revision Number:

Revision Date:

QAPP WORKSHEET #28B (UFP-QAPP MANUAL SECTION 3.4) -- QC SAMPLES TABLE – DIOXIN-LIKE PCB CONGENERS

Complete a separate worksheet for each sampling technique, analytical method/SOP, matrix, analytical group, and concentration level. If method/SOP QC acceptance limits exceed the measurement performance criteria, the data obtained may be unusable for making project decisions.

Matrix	Soil					
Analytical Group	PCB Congeners					
Concentration Level	Low Level					
Analytical Method / SOP Reference	EPA 1668A/B or CLP SOW method CBC01.2					
Analytical Organization	[Insert LABORATORY NAME]					
QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1/Extraction Batch (20 samples)	See [Insert TITLE of LABORATORY SOP, Revision DATE; [Insert APPENDIX NUMBER];	1) Report results if sample results >10x blank result or sample results ND. 2) If results are <10x blank and if sufficient sample is available, re-extract and reanalyze samples. 3) If insufficient sample is available, reanalyze extracts. 4) Qualify data as needed.	[Insert NAME of LABORATORY ANALYST; Insert NAME of LABORATORY]	Accuracy/Bias-Contamination	No Target Compounds>PQL Goal
LCS/LCSD	1/Extraction Batch (20 samples)	See [Insert TITLE of LABORATORY	1) Check calculations. 2) If sufficient sample is available, re-extract	[Insert NAME of LABORATORY ANALYST;	Accuracy/Bias	%RSD ≤ 25%, percent recoveries of target analytes 70-130%, or

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		SOP, Revision DATE; [Insert APPENDIX NUMBER]	and reanalyze samples. 3) If insufficient sample is available, reanalyze extracts. Qualify data as needed.	Insert NAME of LABORATORY]		See [Insert TITLE of LABORATORY SOP, Revision DATE; [Insert APPENDIX NUMBER]
Internal Standards/ labeled compounds	Spiked into every sample and QC sample	See [Insert TITLE of LABORATORY SOP, Revision DATE; ([Insert APPENDIX NUMBER]	1) Check calculations. 2) Check chromatogram for interference. If found, flag data. 3) Check S/N. If < 10:1, re-extract sample. 4) If S/N > 10:1, evaluate data for usability, flag, narrate and report. 5) Check instrument and reanalyze extract if a problem is found and corrected. 6) Re-extract and reanalyze adversely affected samples.	[Insert NAME of LABORATORY ANALYST; Insert NAME of LABORATORY]	Accuracy/Bias	25-150% Recovery, or See [Insert TITLE of LABORATORY SOP, Revision DATE; [Insert APPENDIX NUMBER]
MS/MSD	1/20 samples or per request of project team ²	See [Insert TITLE of LABORATORY SOP, Revision DATE; [Insert APPENDIX NUMBER]	Identify problem; if not related to matrix interference, re-extract and reanalyze MS/MSD and all associated batch samples upon request of project team.	[Insert NAME of LABORATORY ANALYST; Insert NAME of LABORATORY]	Interferences - Accuracy/Bias - Precision	%RSD ≤ 35%, percent recoveries of target analytes 70-130%, or See [Insert TITLE of LABORATORY SOP, Revision DATE; [Insert APPENDIX NUMBER]

¹ This worksheet addresses QC checks performed at the laboratory; additional information concerning QC checks, including field QC samples, is presented in Worksheets #12 and #20.

² See discussion of MS/MSD samples for dioxin analyses in Worksheet #12.

%RSD Percent relative standard deviation
 HRGC High resolution gas chromatography
 HRMS High resolution mass spectrometry
 LCS/LCSD Laboratory control sample/laboratory control sample duplicate
 m/z Mass-to-charge ratio
 MS/MSD matrix spike/matrix spike duplicate

OCDD octachlorodibenzo-p-dioxin
 PFK Perfluorokerosene
 ppm Parts per million
 RRT Relative retention time
 S/N Signal-to-noise ratio
 SOP Standard operating procedure

QAPP WORKSHEET #29 (UFP-QAPP MANUAL SECTION 3.5.1) -- PROJECT DOCUMENTS AND RECORDS TABLE

Identify the documents and records that will be generated for all aspects of the project including, but not limited to, sample collection and field measurement, on-site and off-site analysis, and data assessment.

Sample Collection Documents and Records	On-Site Analysis Documents and Records	Off-Site Analysis Documents and Records	Data Assessment Documents and Records ¹	Other
Planning Documents	No on-site analyses are anticipated	Sample login and tracking information	Sampling and analytical data in required format (SEDD/Scribe-compatible)	
Field data collection system <ul style="list-style-type: none"> • Sample location data (GPS and PDA) • Sample collection documentation (COC, field logs, or FORMS II Lite) Sample processing records (ICS, homogenization)		Prep and instrument logs	Laboratory full data and documentation packages (including raw data)	
Field audit/assessment records		Calibration and maintenance data	Data entry and upload into project database (Scribe)	
		QA program data (checks, audits, reviews)	Data download from Scribe; data reduction and visualization work-products (e.g., FIELDS, SADA, ProUCL, VSP, ArcView, EVS/MVS, statistical analysis)	
		Analytical raw data and instrument output	External audit records (laboratory, file)	
		Sample storage and disposal	Data validation reports	

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Sample Collection Documents and Records	On-Site Analysis Documents and Records	Off-Site Analysis Documents and Records	Data Assessment Documents and Records ¹	Other
		Electronic data deliverable (SEDD)	Project reports	
		Laboratory QA Plan, SOPs, and certification documentation	Meeting notes and collaborative work products/tools (e.g., project web portals and file sharing sites)	
			Site Administrative Record	

¹ Additional information on data management and flow is presented in Appendix X.

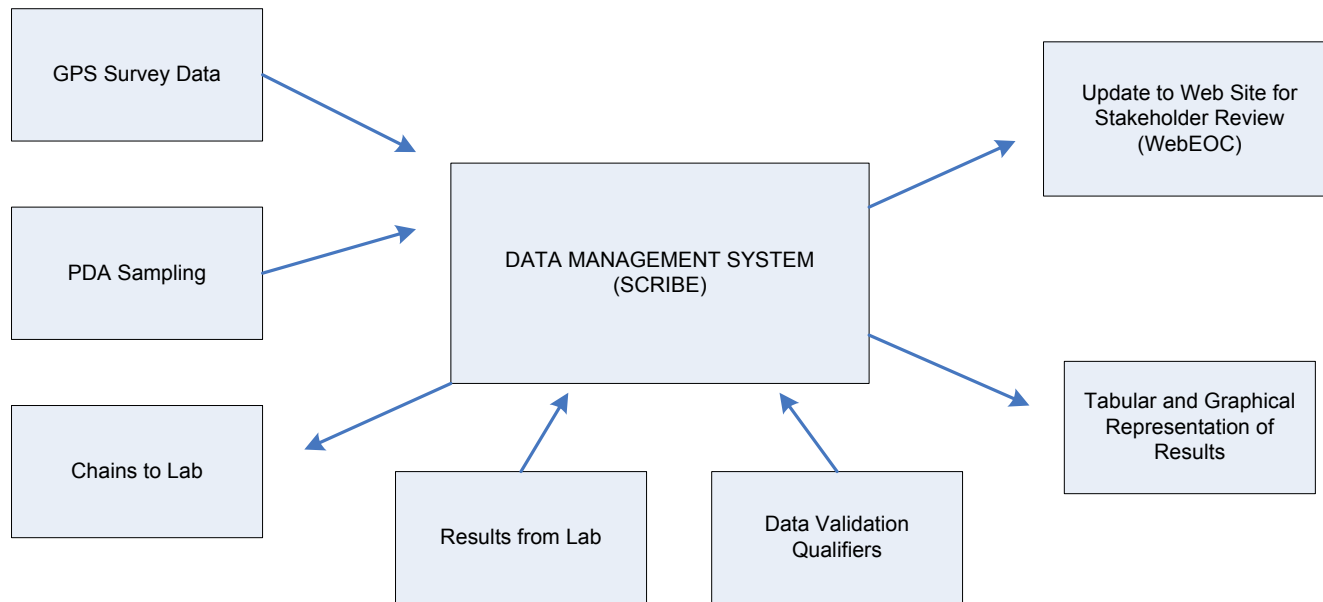
² Records management may be governed by contractual or administrative requirements. For example, analytical data reported from the CLP will be reported and documented in accordance with the current CLP SOW for dioxins/furans (DLM02.2).

COC	Chain of custody	ICS	Incremental composite sampling
EVS/MVS	C-Tech environmental visualization system/mining visualization system software (http://www.ctech.com/index.php?page=evspro)	PDA	Personal digital assistant
		ProUCL	EPA ProUCL statistical software package (http://www.epa.gov/esd/tsc/software.htm)
FIELDS	EPA Region 5 FIELDS software (http://www.epa.gov/region5fields/htm/software.htm)	SADA	Spatial Analysis and Decision Assistance software (http://www.tiem.utk.edu/~sada/applications.shtml)
FORMS II Lite	Field Operations and Records Management System (http://www.epa.gov/superfund/programs/clp/f2lite.htm)	SEDD	Superfund Staged Electronic Data Deliverable (http://www.epa.gov/superfund/programs/clp/sedd.htm)
GPS	Global positioning system	VSP	Visual sampling plan (http://vsp.pnl.gov/index.stm)

DATA MANAGEMENT CONSIDERATIONS

This worksheet describes the use of Scribe as a database-driven, project data management system. Regions have the discretion to utilize the data management system of their choice however this section should sufficiently describe the planned data management system for collection, storage, and processing of field information and laboratory data.

The following diagram illustrates the basic concepts of data flow for the site assessment process based on using Scribe as the project database management system.



The following describes the flow of data to and from Scribe the central Data Management System:

Scribe is a data management decision support tool (DST) developed by EPA's Environmental Response Team (ERT) that allows a greater number of project teams working at sites to realize the benefits of maintaining data in a relational database. Scribe can import electronic data, including analytical laboratory results in electronic data deliverable (EDD) format and sampling location data such as global positioning system (GPS) coordinates. Scribe can print sample labels and chain-of-custody documents. Scribe can be integrated with software packages to capture and import sampling and monitoring data collected using handheld PDA's during field work. An existing software extension called Scriplets is available for simple applications and when field personnel are using PALM® units in the field. Otherwise, a custom PDA application can be developed to integrate with Scribe. One advantage of the custom PDA application is that it can incorporate verification and checks into the application so that bad data is less likely to be generated in the field.

Use of a front-end (pre-Scribe) data management, evaluation and communication system needs to be determined on a Regional basis and/or site-specific basis according to the project needs, available resources and technical capabilities of stakeholders to operate, maintain and utilize the system.

The following describes key elements of a field-based data collection and entry system.

GPS Survey Data – Location coordinate data is taken and recorded. This functionality can be incorporated into a custom PDA application if using PDA units with GPS capability.

PDA Sampling – Sample information is entered into the PDA application using Scriplets/Custom Application as described above. The information captured in the PDA application includes:

- Project name, number and location
- Decision Area #
- Decision Area Name
- Decision Unit #
- Decision Unit Name
- Sample ID number
- Sampling location Description
- Sample Location Coordinates
- Date and time of sample collection
- Preservative used
- Sample collector's initials/Name
- Destination of samples (laboratory name)
- Number and type of containers filled
- Analysis requested
- Sample designation (discrete or composite)

Sample Chain of Custody – COCs are generated in Scribe. The following is an example of the steps to be taken to generate a COC:

- Click on **Chain of Custody** under the Sample Management section of the navigation pane.
- Click the **Add a Chain of Custody** button
- Scribe automatically assigns the next sequential COC #.
- Enter the **Bin Number** the crews reported on the Sample Coordinator Check-List
- Enter the current date as the **date shipped**
- Click the **Assign Samples to COC** button to select which samples are in the bin.
- Select the **Simple Chain** Layout
- **Hi-light the samples to be assigned** to the chain and **click the Assign to button** at the bottom of the screen.

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- Click **Yes** to assign the samples to the chain
- Click the **Print Chain of Custody** button and select **Preview**
- Click the printer icon to send the COC to the printer
- Place the COC in the paperwork box for the crew.
- Repeat the COC process for the remaining samples imported from the PDA

Laboratory Results – Analytical results from the laboratory are loaded into the Scribe database and undergo a QC review before they are made available to end users. Scribe provides a quick turnaround of preliminary sample results.

Data Validation Results – Data qualifiers from the data validation can be input into the database to document data usability for data end users and final work products.

Update Website for Stakeholder Review – Validated and verified results and documents are uploaded to a central location, preferably on the Internet that can be accessed by all the stakeholders regardless of where they are located. WebEOC is an example of an existing web-enabled crisis information management system (IMS) that provides secure real-time information sharing to help managers make sound decisions quickly. The site allows for quick and secure distribution and communication of results and data analysis to stakeholders. This central location also serves as a data archive and repository.

Tabular and Graphical Representation of Results – Scribe’s data querying capabilities allow for flexible data analysis and integration into visual software packages like AutoCAD or geographic information system (GIS).

QAPP WORKSHEET #30 (UFP-QAPP MANUAL SECTION 3.5.2.3) -- ANALYTICAL SERVICES TABLE

Identify all laboratories or organizations that will provide analytical services for the project, including on-site screening, on-site definitive, and off-site laboratory analytical work. Group by matrix, analytical group, concentration, and sample location or ID number. If applicable, identify the subcontractor laboratories and backup laboratory or organization that will be used if the primary laboratory or organization cannot be used or cannot meet DQOs.

Matrix	Analytical Group	Concentration Level	Sample Locations/ID Number	Analytical SOP	Data Package TAT	Laboratory Options (name and address, contact person and telephone number)
Soil	Dioxins/ furans	All	All	EPA 8290A/1613B	35	[Insert NAME of SELECTED PRIMARY LABORATORY]
Soil	Dioxins/ furans	All	All	EPA 8290A/1613B	35	[Insert NAME of SELECTED BACK-UP LABORATORY]
Soil	PCB Congeners	All	All	EPA 1668A/B [or CBC01.2]	35	[Insert NAME of SELECTED PRIMARY LABORATORY]
Soil	PCB Congeners	All	All	EPA 1668A/B [or CBC01.2]	35	[Insert NAME of SELECTED BACK-UP LABORATORY]
The data below is provided for informational purposes only to identify major national laboratories known to be capable of providing the required analytical services. Laboratories are listed in alphabetical order and no inferences are made to indicate the relative capabilities and cost value of any given laboratory.						
Soil	Dioxins/ furans, PCB congeners	All	All	EPA 8290A/1613B and 1668A	35	Columbia Analytical, Houston, TX; 713-266-1599
Soil	Dioxins/ furans, PCB congeners	All	All	EPA 8290A/1613B and 1668A	35	Pace Analytical, Minneapolis, MN; 979-575-9172
Soil	Dioxins/ furans	All	All	EPA 8290A/1613B	35	SGS Environmental, Wilmington, NC; 910-350-1903
Soil	Dioxins/ furans, PCB congeners	All	All	EPA 8290A/1613B and 1668A	35	Test America, Sacramento, CA; 916-374-4308

QAPP WORKSHEET #31 (UFP-QAPP MANUAL SECTION 4.1.1) -- PLANNED PROJECT ASSESSMENTS TABLE

Identify the type, frequency, and responsible parties of planned assessment activities that will be performed for the project.

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (title and organizational affiliation)	Person(s) Responsible for Responding to Assessment Findings (title and organizational affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (title and organizational affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (title and organizational affiliation)
Field Readiness Review	Before mobilization for the project and before major phases of work are initiated	Internal	Project Team	[Insert NAME of PROJECT QA MANAGER], [Insert NAME of EPA CONTRACTOR]	[Insert NAME of PROJECT MANAGER], [Insert NAME of EPA CONTRACTOR]	[Insert NAME of PROJECT MANAGER], [Insert NAME of EPA CONTRACTOR]	[Insert NAME of PROJECT QA MANAGER], [Insert NAME of EPA CONTRACTOR]
Field Sampling Surveillance	Once during the field sampling	Internal	Project Team	[Insert NAME of PROJECT CHEMIST or FIELD QA MANAGER], [Insert NAME of EPA CONTRACTOR]	[Insert NAME of FIELD TEAM LEADER or PROJECT MANAGER], [Insert NAME of EPA CONTRACTOR]	[Insert NAME of PROJECT MANAGER], [Insert NAME of EPA CONTRACTOR]	[Insert NAME of PROJECT QA MANAGER], [Insert NAME of EPA CONTRACTOR]
Laboratory Surveillance	Once during laboratory program	External	Project Team	[Insert NAME of PROJECT CHEMIST], [Insert NAME of EPA CONTRACTOR]	[Insert NAME of LABORATORY QA MANAGER], [Insert NAME of EPA CONTRACTOR]	[Insert NAME of LABORATORY MANAGER], [Insert NAME of EPA CONTRACTOR]	[Insert NAME of PROJECT QA MANAGER or PROJECT CHEMIST], [Insert NAME of EPA CONTRACTOR]

QAPP WORKSHEET #32 (UFP-QAPP MANUAL SECTION 4.1.2) -- ASSESSMENT FINDINGS AND CORRECTIVE ACTION RESPONSES

For each type of assessment describe procedures for handling QAPP and project deviations encountered during the planned project assessments.

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (name, title, organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (name, title, organization)	Timeframe for Response
Field Readiness Review	Email documentation	[Insert NAMES of PROJECT MANAGER, FIELD TEAM LEADER, PROJECT CHEMIST], [Insert NAME of EPA CONTRACTOR]	2 days	Email documentation	[Insert NAMES of PROJECT QA MANAGER, FIELD TEAM LEADER, PROJECT CHEMIST], [Insert NAME of EPA CONTRACTOR]	2 days
Field Sampling Surveillance	Email documentation	[Insert NAMES of PROJECT MANAGER, PROJECT QA MANAGER, FIELD TEAM LEADER], [Insert NAME of EPA CONTRACTOR]	2 days	Email documentation	[Insert NAMES of PROJECT QA MANAGER and FIELD TEAM LEADER], [Insert NAME of EPA CONTRACTOR]	2 days
Laboratory Surveillance	Email documentation, checklist	[Insert NAMES of LABORATORY MANAGER and LABORATORY QA MANAGER], [Insert NAME of EPA CONTRACTOR]	5 days	Email documentation, corrective action memorandum	[Insert NAMES of PROJECT QA MANAGER and PROJECT CHEMIST], [Insert NAME of EPA CONTRACTOR]	5 days

QAPP WORKSHEET #33 (UFP QAPP MANUAL SECTION 4.2) -- QA MANAGEMENT REPORTS TABLE

Identify the frequency and type of planned QA Management Reports, the project delivery dates, the personnel responsible for report preparation, and the report recipients.

Type of Report	Frequency	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation	Report Recipient(s)
Audit Report of Field inspections and sampling procedures ¹	[Insert FREQUENCY] for each data package	[Insert DATE]	[Insert NAME of PROJECT QA MANAGER, Insert NAME of EPA CONTRACTOR]	[Insert NAMES and TITLES, Insert NAMES of ORGANIZATION (i.e. DEQ, EPA, EPA CONTRACTOR)]
Data Validation Report ¹	[Insert FREQUENCY] for each data package	[Insert DATE]	[Insert NAME of 3 RD PARTY DATA VALIDATOR Insert NAME of ORGANIZATION]	[Insert NAMES and TITLES, Insert NAMES of ORGANIZATIONS (i.e. DEQ, EPA, EPA CONTRACTOR)]
Analytical Data Review ¹	[Insert FREQUENCY] for each data package	[Insert DATE]	Insert NAME of PROJECT CHEMIST, Insert NAME of EPA CONTRACTOR]	[Insert NAMES and TITLES, Insert NAMES of ORGANIZATION (i.e. DEQ, EPA, EPA CONTRACTOR)]
Daily Progress Report	Daily	At the end of each field day	Insert NAME of FIELD TEAM LEADER, Insert NAME of EPA CONTRACTOR]	[Insert NAMES of CONTRACTOR PROJECT MANAGER, EPA WAM, and OTHER STAKEHOLDERS as specified], Insert NAMES of ORGANIZATIONS (i.e. DEQ, EPA, EPA CONTRACTOR)]
Monthly Status Report	Monthly	At the end of each month	Insert NAME of PROJECT MANAGER, Insert NAME of EPA CONTRACTOR]	[Insert NAMES of EPA CONTRACTOR MANAGER, EPA WAM], Insert EPA REGION #]]
Quality Control Summary Report	With Report Submittal	Submitted in Final Report	Insert NAME of PROJECT QA MANAGER, Insert NAME of EPA CONTRACTOR]	[Insert NAMES of EPA WAM, and OTHER STAKEHOLDERS as specified], Insert NAMES of ORGANIZATIONS (i.e. DEQ, EPA, EPA CONTRACTOR)]

¹ Reports and documentation for audits/assessments and data review/validation activities are further documented in Worksheets #32, #34, and #35.

QAPP WORKSHEET #34 (UFP-QAPP MANUAL SECTION 5.2.1) -- VERIFICATION (STEP I) PROCESS TABLE

Describe the processes that will be followed to verify project data. Describe how each item will be verified, when the activity will occur, and what documentation is necessary, and identify the person responsible. *Internal* or *external* is in relation to the data generator.

Verification Input	Description	Internal / External	Responsible for Verification (name, organization)
Audit/assessment reports	When the report is complete, a copy of all audit reports will be placed in the project file. If corrective actions are required, a copy of the documented corrective action taken will be attached to the appropriate audit report in the project file. At the beginning of each week and at the completion of the site work, project file audit reports will be reviewed internally to ensure that all appropriate corrective actions have been taken and that corrective action reports are attached. If corrective actions have not been taken, the project manager will be notified to ensure action is taken.	I	[Insert NAME of PROJECT QA MANAGER; Insert NAME of EPA CONTRACTOR]
Field notes, logbook, sampling records	Field notes will be reviewed internally and placed in the project file. A copy of the field notes will be attached to the final report.	I	[Insert NAMES of FIELD TEAM LEADER, DATA MANAGEMENT LEADER], Insert NAME of EPA CONTRACTOR]
Sample receipt	For samples shipped via commercial carrier, the chemist will verify receipt of samples by the laboratory the day following shipment.	I	[Insert NAME of PROJECT CHEMIST Insert NAME of EPA CONTRACTOR]
Sample logins	Sample login information will be reviewed and verified for completeness in accordance with the chain-of-custody forms.	I, E	[Insert NAMES of PROJECT CHEMIST and LABORATORY PROJECT MANAGER Insert NAME of EPA CONTRACTOR and LABORATORY]
Chain of custody records	Chain-of-custody forms will be reviewed internally when they are completed and verified against the packed sample coolers they represent. The shipper's signature on the chain-of-custody form should be initialed by the reviewer, a copy of the chain-of-custody form will be retained in the project file, and the original and remaining copies will be taped inside the cooler for shipment.	I, E	[Insert NAME of FIELD TEAM LEADER and PROJECT CHEMIST Insert NAME of EPA CONTRACTOR]
Laboratory data prior to release	Laboratory data will be reviewed and verified for completeness against analyses requested on the chain-of-custody forms.	I	[Insert NAME of LABORATORY PROJECT MANAGER Insert NAME of LABORATORY]

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Verification Input	Description	Internal / External	Responsible for Verification (name, organization)
Laboratory data due at turnaround time listed on chain of custody	Laboratory data will be verified that the analyses reported are consistent with the analytical suite requested on the chain-of-custody forms.	E	[Insert NAME of PROJECT CHEMIST Insert NAME of EPA CONTRACTOR and LABORATORY]
Laboratory data completeness and accuracy	All laboratory data packages will be verified for completeness and technical accuracy by the laboratory performing the work. Data packages will then be reviewed by the analytical coordinator for completeness. Subsequently, data packages will be evaluated externally by undergoing data validation (Worksheet #36).	I, E	[Insert NAMES of LABORATORY PROJECT MANAGER, PROJECT CHEMIST and 3rd PARTY DATA VALIDATOR Insert NAME of LABORATORY and EPA CONTRACTOR]
Laboratory data consistency verification	Select analyses that will undergo a data consistency review and verification. Perform consistency review of data transfer from the original laboratory bench sheets and instrument data to the result reports.	E	[Insert NAME of PROJECT CHEMIST or DATA MANAGEMENT LEAD; Insert NAME of EPA CONTRACTOR]
Field and electronic data verification and upload	One hundred percent of manual data entries (in the field or from field forms) will be reviewed against the hardcopy information, and 10 percent of electronic uploads will be checked against the hardcopy.	E	[Insert NAME of PROJECT CHEMIST or DATA MANAGEMENT LEAD; Insert NAME of EPA CONTRACTOR]
Data upload verification	Verify the correct transfer of results from the laboratory deliverables into the Database.	E	[Insert NAME of DATA MANAGEMENT LEAD; Insert NAME of EPA CONTRACTOR]

QAPP WORKSHEET #35 (UFP-QAPP MANUAL SECTION 5.2.2) -- VALIDATION (STEPS IIA AND IIB) PROCESS TABLE

Describe the processes that will be followed to validate project data. Validation inputs include items such as those listed in Table 9 of the UFP-QAPP Manual (Section 5.1). Describe how each item will be validated, when the activity will occur, and what documentation is necessary and identify the person responsible. Differentiate between steps Ila and Iib of validation.

Step Ila / Iib	Validation Input	Description	Responsible for Validation (name, organization)
Ila	Field documentation	Field logbooks and forms will be reviewed weekly for accuracy associated with each sampling event. The inspection will be documented in daily QC reports.	[Insert NAME of PROJECT MANAGER or FIELD TEAM LEADER; Insert NAME of EPA CONTRACTOR]
Ila	Chain of custody forms	Chain-of-custody forms will be reviewed daily to ensure that project information, sample analyses requested, number of field QC samples collected, and percent level III or IV validation chosen is accurate and in accordance with the requirements in this UFP-QAPP	[Insert NAME of PROJECT CHEMIST or DATA MANAGEMENT LEADER; Insert NAME of EPA CONTRACTOR]
Ila	Sample receipt	The sample cooler will be checked for compliance with temperature and packaging requirements.	[Insert NAME of LABORATORY SAMPLE CUSTODIAN; Insert NAME of LABORATORY]
Ila	Sample logins	Sample login will be reviewed for accuracy against the chain-of-custody form.	[Insert NAMES of PROJECT CHEMIST and LABORATORY PROJECT MANAGER; Insert NAMES of EPA CONTRACTOR and LABORATORY]
Ila	Laboratory data prior to release	Laboratory data will be reviewed to ensure that the data are accurate and meets the requirements in this QAPP. Before they are released, data will be validated as follows:	[Insert NAME of LABORATORY PROJECT MANAGER; Insert NAME of LABORATORY]
		100 percent of the data comply with the method- and project-specific requirements; any deviations or failure to meet criteria are documented for the project file.	[Insert NAME of LABORATORY ANALYST; Insert NAME of LABORATORY]
		100 percent of manual entries are free of transcription errors and manual calculations are accurate; computer calculations are spot-checked to verify program validity; data reported are compliant with method- and project-specific QC requirements; raw data and supporting materials are complete; spectral assignments are confirmed; descriptions of deviations from method or project requirements are documented; significant figures and rounding have been appropriately used; reported values include dilution factors; and results are reasonable.	[Insert NAME of LABORATORY PEER ANALYST; Insert NAME of LABORATORY]

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Step IIa / IIb	Validation Input	Description	Responsible for Validation (name, organization)
		Data reported comply with method- and project-specific QC requirements; the reported information is complete; the information in the report narrative is complete and accurate; and results are reasonable.	[Insert NAME of LABORATORY SUPERVISOR or SECTION LEAD; Insert NAME of LABORATORY]
		Data reported comply with method- and project-specific QC; analytical methods are performed in compliance with approved SOPs. (This review may be conducted after release of data since they involve only on 10 percent of the data.)	[Insert NAME of LABORATORY QUALITY ASSURANCE MANAGER; Insert NAME of LABORATORY]
IIa	Laboratory data due at turnaround time listed on chain of custody	Laboratory data will be reviewed to ensure that the data reported met the analyte list and limits listed in Worksheet #15.	[Insert NAME of PROJECT CHEMIST; Insert NAME of EPA CONTRACTOR]
	Laboratory data packages	All laboratory data packages will be validated by the laboratory performing the work for technical accuracy before they are submitted.	[Insert NAME of LABORATORY PROJECT MANAGER; Insert NAME of LABORATORY]
		Data packages will then be reviewed for accuracy against the laboratory data that were faxed or e-mailed at the turnaround time listed on the chain of custody.	[Insert NAME of PROJECT CHEMIST; Insert NAME of EPA CONTRACTOR]
		Data packages will be evaluated externally by undergoing data validation.	[Insert NAME of 3 rd PARTY DATA VALIDATOR; Insert NAME of ORGANIZATION]
IIb	Data validation reports	Data validation reports will be reviewed in conjunction with the project DQOs and DQIs.	[Insert NAME of PROJECT CHEMIST; Insert NAME of EPA CONTRACTOR]

QAPP WORKSHEET #36 (UFP-QAPP MANUAL SECTION 5.2.2) -- VALIDATION (STEPS IIA AND IIB) SUMMARY TABLE

Identify the matrices, analytical groups, and concentration levels that each entity performing validation will be responsible for, as well as criteria that will be used to validate those data.

Step Iia / Iib ¹	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (title and organizational affiliation)
Iia	Soil	Dioxins	Low level	In accordance with this QAPP, EPA 8290A/1613B or CLP SOW DLM02.2, and [Insert TITLE of LABORATORY SOP, Revision DATE; [Insert APPENDIX NUMBER]	[Insert NAME of LABORATORY QA MANAGER; Insert NAME of ORGANIZATION]
Iib	Soil	Dioxins	Low level	In accordance with this QAPP, EPA 8290A/1613B or CLP SOW DLM02.2, and [Insert TITLE of LABORATORY SOP, Revision DATE; [Insert APPENDIX NUMBER] and EPA CLP National Functional Guidelines for Chlorinated Dioxin/Furan Data Review	[Insert NAME of 3 rd PARTY DATA VALIDATOR; [Insert NAME of ORGANIZATION]
Iia	Soil	PCB Congeners	Low level	In accordance with this QAPP, EPA 1668A/B or CLP SOW CBC01.2, and [Insert TITLE of LABORATORY SOP, Revision DATE; [INSERT APPENDIX NUMBER]	[Insert NAME of LABORATORY QA MANAGER; Insert NAME of ORGANIZATION]
Iib	Soil	PCB congeners	Low level	In accordance with this QAPP, EPA 1668A/B or	[Insert NAME of 3 rd PARTY DATA

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Step IIa / IIb ¹	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (title and organizational affiliation)
				CLP SOW CBC01.2, and [Insert TITLE of LABORATORY SOP , Revision DATE; [INSERT APPENDIX NUMBER] ; as well as applicable elements of EPA CLP National Functional Guidelines for Organic Methods Review and EPA CLP National Functional Guidelines for Chlorinated Dioxin/ Furan Data Review	VALIDATOR; Insert NAME of ORGANIZATION]

Notes:

- 1 IIa=compliance with methods, procedures, and contracts [see Table 10, page 117, UFP-QAPP manual, V.1, March 2005].
 IIb=comparison with measurement performance criteria in the QAPP [see Table 11, page 118, UFP-QAPP manual, V.1, March 2005].

QAPP WORKSHEET #37 (UFP-QAPP MANUAL SECTION 5.2.3) -- USABILITY ASSESSMENT

Describe the procedures / methods / activities that will be used to determine whether data are of the right type, quality, and quantity to support environmental decision-making for the project. Describe how data quality issues will be addressed and how limitations on the use of the data will be handled.

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used:

Data validation will be the first step of the usability assessment. See Worksheet #28 for data quality indicators associated with the analytical measurements to be used on the project.

Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:

A data validation report will be created for the project, including a summary of all QA/QC results from the project to provide documentation that the analytical methods were in control throughout sample analysis.

Correlations between methods will not be performed since only one analytical method will be used for all samples.

Outlier analysis will not be performed; since samples should be representative of decision unit averages by physical averaging (mixing), outliers will be assumed to represent true concentrations at the site.

Describe the evaluative procedures used to assess overall measurement error associated with the project:

Overall measurement error will be assessed using the variability source QC procedure described in the User Guide.

Identify the personnel responsible for performing the usability assessment:

[Insert **NAME of PROJECT QA MANAGER or PROJECT CHEMIST**; Insert **NAME OF EPA CONTRACTOR**]