APPENDIX J

Preface

Appendix J contains the draft Screening-Level Ecological Risk Assessment (SLERA) and Baseline Ecological Risk Assessment (BERA) work plans for the Tittabawassee River and Associated Floodplains that were submitted to Michigan Department of Environmental Quality (MDEQ) on July 1, 2005. These work plans have undergone Agency review and are currently being revised.

DRAFT

DRAFT SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT WORK PLAN FOR THE TITTABAWASSEE RIVER AND ASSOCIATED FLOODPLAINS

Prepared by:
ENTRIX, Inc.
East Lansing, Michigan

Prepared for:
The Dow Chemical Company
Midland, Michigan

July 2005

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Definitions and Acronyms

ADD_{pot}	Potential average daily dose
ATL	Aquatic Toxicology Laboratory
BERA	Baseline ecological risk assessment
COPECs	Chemicals of potential ecological concern
DQOs	Data quality objectives
EEC	Estimated exposure concentration
ERA	Ecological risk assessment
FCMP	Fish containment monitoring program
HQ	Hazard quotient
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
MSU	Michigan State University
NPDES	National pollutant discharge elimination system
PBBs	Polybrominated biphenyls
PCBs	Polychlorinated biphenyls
PCDDs	Polychlorinated dibenzo-*p*-dioxins
PCDFs	Polychlorinated dibenzofurans
RI	Remedial investigation
SLERA	Screening-level ERA
SMDP	Scientific management decision point
Eco-SSL	Soil screening levels
TRV	Toxicity reference value
UF	Uncertainty factor
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United State Geological Survey
VOCs	Volatile organic compounds
WHO	World Health Organization

1.0 INTRODUCTION

As specified by USEPA guidance, the first step in the ERA process is a screening-level or Tier I ERA in which the objective is to identify and document conditions that do *not* warrant further evaluation in a more refined baseline ERA (BERA). The goal is to eliminate insignificant hazards while identifying contaminants whose concentrations are sufficiently great as to potentially pose risks to ecological receptors. A screening-level ERA (SLERA) is a simple, worst-case estimation that is accomplished by assuming conservative values for parameters that are scarce or lacking. For a SLERA, it is important to minimize the chances of concluding that there is no risk when in fact a risk exists, i.e., the technique assures that the probability of a false negative is very low. Thus, for exposure and toxicity or effect parameters for which site-specific information is minimal, assumed values, such as area-use and bioavailability, should be consistently biased in the direction of overestimating risk. This ensures that sites that might pose an ecological risk are studied further, i.e., a SLERA is deliberately designed to be protective in nature, not predictive of effects. It is important to note that SLERAs are neither designed nor intended "to provide definitive estimates of actual risk, generate cleanup goals, and in general, are not based upon site-specific assumptions" (USEPA, 2001a). If any potentially significant exposure pathways are indicated from the SLERA, then these pathways are further evaluated in a more refined BERA.

Based on historical data, it is assumed that polychlorinated dibenzo-*p*-dioxins (PCDDs) and dibenzofurans (PCDFs) will continue to be COPECs and are thus the focus of the BERA studies. The Work Plan presented here outlines the framework for a SLERA that will include an analysis of currently available data in order to identify other contaminants of potential ecological concern (COPECs) in the Tittabawassee River sediments and associated floodplain soils. As additional COPECs are identified, the potential ecological risks associated with each COPEC will be further evaluated and characterized.

1.1 Purpose and Scope

The overall purpose of this SLERA Work Plan is to present a detailed approach for conducting a SLERA for the Tittabawassee River and associated floodplains, hereafter referred to as the "Site". This SLERA Work Plan was developed in partial fulfillment of the conditions stated in the Hazardous Waste Management Facility Operating License, which was issued on June 12, 2003 by Michigan Department of Environmental Quality (MDEQ) to The Dow Chemical Company (Dow). ENTRIX, Inc. and CH2MHill, as specified in this Work Plan, will conduct supplemental investigations. The target analyte list of potential contaminants includes USEPA Appendix IX constituents, other constituents typically analyzed by MDEQ, and several constituents currently monitored as part of the Facility's groundwater monitoring program. Results from this SLERA will be used to:

- Provide a rational basis and documentation for retention of COPECs for further consideration;
- Provide a rational basis and documentation for exclusion of other potential contaminants from further consideration;
- Make objective decisions on whether there is the potential for unacceptable risks to the environment presented by COPECs (other than PCDDs and PCDFs) in the soils, sediments, and biota of the Site;
- Evaluate the need for further study or risk assessment for COPECs in the Site; and
- Focus future data collection to fill relevant data gaps.

1.2 Regulatory Guidance and Outline of Proposed Approach

This ERA Work Plan is based upon USEPA ERA guidance (Figure 1-1; USEPA, 1997, USEPA 1998, USEPA 1999a; USEPA, 2001a and 2001b), applicable state regulatory guidance including Part 201 of Act 451, and the conditions of the Operating License. Although not a Superfund site, the general proposed approach for this SLERA will follow USEPA ERA guidance for Superfund (USEPA, 1997) since this guidance is detailed and well accepted among ecological risk assessors. The eight step process within the USEPA ERA guidance for Superfund sites is designed to focus resources on key chemicals, pathways of exposure, and receptors and to eliminate from further consideration those chemicals, pathways, and receptors that are not at risk. The approach for this SLERA includes the following processes and data collections:

- **Pre-ERA Planning**
  - Compilation of existing information on the COPECs and receptor species at the site
  - Development of SLERA data quality objectives (DQOs)
- **SLERA**
  - Site visit - including site-specific biota inventory and habitat suitability characterization for the aquatic and terrestrial resources along the Tittabawassee River
  - Screening level problem formulation, exposure estimation, and risk characterization
  - Determine which COPECs need to be evaluated further in a more refined BERA

1.3 Schedule

Several major elements, proposed sequencing, and estimated timelines for activities related to conducting a SLERA for the Site (Figure 1-1) were identified. For a more detailed discussion of the ERA schedule and proposed ERA reports, refer to the BERA Work Plan (ENTRIX, 2005). For more details on schedule, refer to section 5.1.

1.4 Work Plan Organization

The remainder of this SLERA Work Plan is organized into the following sections and appendices:

Section 2.0. Screening-Level ERA Problem Formulation

This section provides details concerning the problem formulation steps of a SLERA including DQOs, description of the site, and discussion of available data.

Section 3.0. Screening-Level ERA Analysis Phase – Exposure and Effects Assessment

This section provides details concerning the various approaches that will be utilized to determine exposure, effects, and uncertainties associated.

Section 4.0. Screening-Level ERA Risk Characterization Phase

This section provides details concerning the screening-level risk characterization process.

Section 5.0. Schedule and Reporting

Section 6.0. References

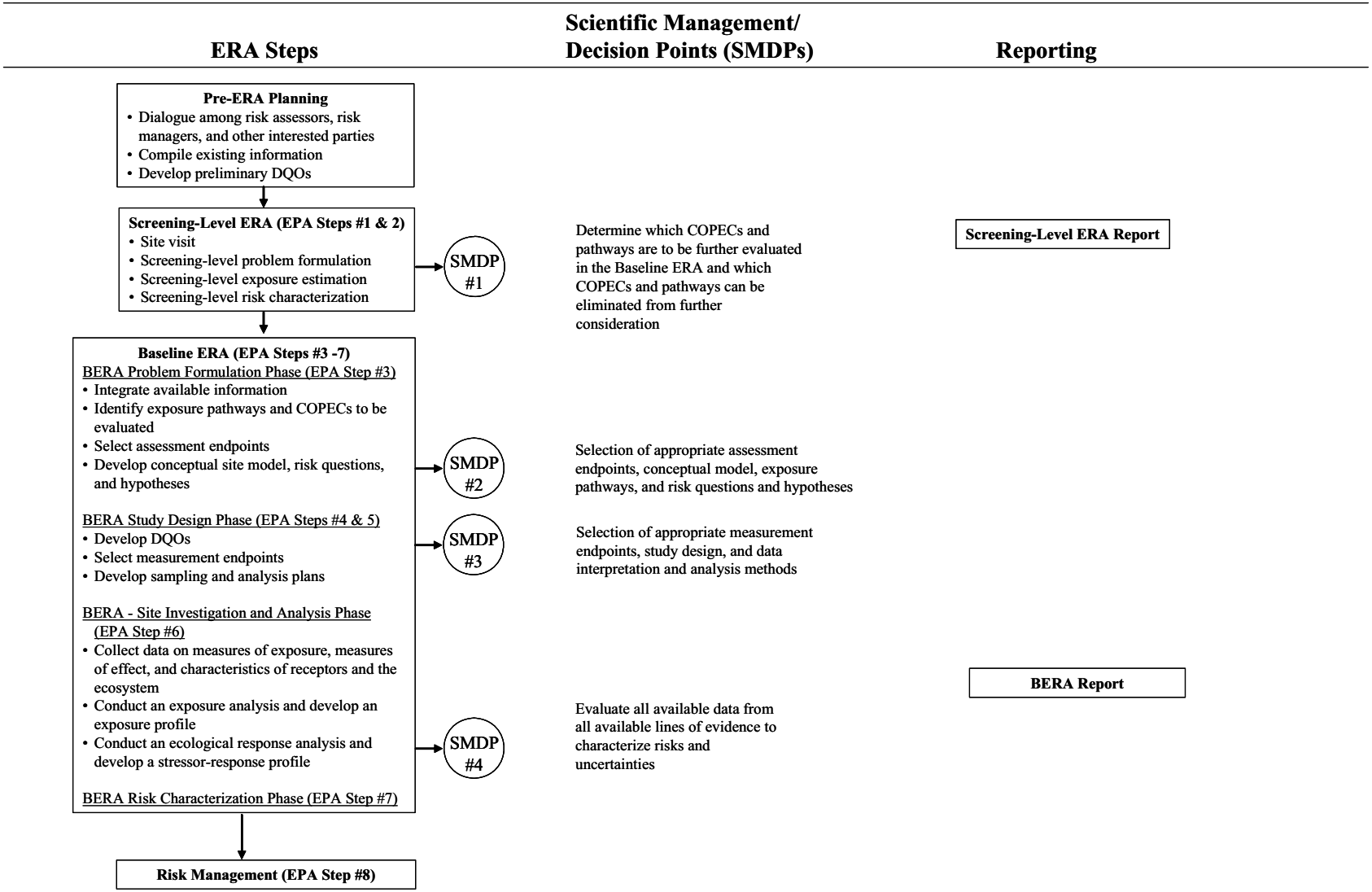


Figure 1-1. ERA steps, scientific management decision points (SMDP) and reporting (based on Superfund ERA Guidance; USEPA, 1997)

2.0 SCREENING-LEVEL ERA PROBLEM FORMULATION

In this phase of a SLERA, the study site is characterized by examining the habitat, species present, and contaminants that have been used in the vicinity. These pieces of information help to shape potential exposure pathways that will be preliminarily investigated in the SLERA. A significant purpose of the SLERA will be to identify COPECs, potential ecological receptors, and potential exposure pathways.

The SLERA will be conducted to identify and document conditions that do *not* warrant further evaluation in a more refined baseline ERA (BERA) and to identify COPECs in the Site. However, based on historical data, it is assumed that polychlorinated dibenzo-*p*-dioxins (PCDDs) and dibenzofurans (PCDFs) will be retained as COPECs beyond the SLERA and are currently the main focus of the BERA Work Plan.

2.1 Development of Screening-Level Data Quality Objectives

The DQO process is a planning tool involving a series of steps designed to ensure that the type, quantity, and quality of environmental data used for decision-making purposes are appropriate for the intended application (USEPA 2000a and 2000b). The DQO process, as defined by USEPA, is "...a strategic planning approach based on the Scientific Method that is used to prepare for a data collection activity. It provides a systematic procedure for defining the criteria that a data collection design should satisfy, including when to collect samples, where to collect samples, the tolerable level of decision errors for study, and how many samples to collect." The steps in the DQO process, as established by USEPA, are as follows:

1. Formulation of Problem Statements. This step concisely describes the problems to be studied.
2. Identification of Decisions. This step consists of accurately describing the questions to be answered that will solve the specified problems, including any actions that may result.
3. Identification of Inputs to Decisions. This step focuses on identifying qualitative and quantitative information that will support decision-making, including the types of measurements that will be required.
4. Definition of Study Boundaries. This step delineates the spatial and temporal boundaries that will be encompassed by the study and describes when and where data shall be obtained. This includes specifying characteristics of the (statistical) population of interest, defining the geographical extent of the area and timeframes to which decisions will apply, and identifying constraints on obtaining data.
5. Development of Decision Rules. This step defines the statistical measures relevant to the study and specifies the conditions by which decision-makers will choose among alternative actions.
6. Specification of Decision Error Limits. This step specifies tolerable false positive and false negative decision errors and develops statements concerning the consequences of making incorrect decisions.
7. Optimization of Sampling Design. This step considers information obtained in the previous six steps to formulate an optimal sampling design, including (if possible) estimates of the number of samples necessary to meet acceptable decision errors.

The preliminary questions to be answered in this phase of the SLERA are:

- Is there a potential for ecological risk from contaminants in soil and sediment at this site?
- What are the COPECs in the Site that should be considered in the BERA?
- What is the spatial distribution of these COPECs?
- Which media (soil, sediment, water) contain residue of COPECs which may represent a complete exposure pathway?
- What wildlife receptor species are present in the Site that are expected to be significantly exposed to COPECs and can be used in the BERA?

A detailed DQO section, including the seven steps in the process, is presented as part of the CH2MHill Ecological Risk Assessment Support Sampling (Appendix A). For the purposes of this SLERA work plan, it is assumed that all data used in the SLERA will be of adequate quantity and quality. If after a review of the data, deficiencies are identified, then further data collection may be undertaken or other means employed to more fully characterize exposures.

2.2 Environmental Setting and Habitat Characteristics

As part of the problem formulation phase of the SLERA, a site visit will be conducted and the environmental setting of the study site will be characterized. The Site area includes sediments and floodplain soils of the Tittabawassee River downstream of Midland, Michigan. Specifically, approximately 23 miles of the Tittabawassee River from the upstream boundary of the Dow Chemical Company to the confluence of the Tittabawassee and Shiawassee Rivers downstream of Greenpoint Island (Figure 2-1). The Site includes only one dam, which is within the confines of The Dow Chemical Company property. Beyond the Dow Dam, the Tittabawassee River is free flowing to the confluence with the Saginaw River and eventually into Saginaw Bay.

The Saginaw basin is comprised of 6,260 square miles of drainage and contains urban populations in Flint, Midland, Bay City, and Saginaw. It is the largest system in Michigan. The Tittabawassee River is the main tributary of the Saginaw River, flowing from the north through Midland, Michigan in a southeastern direction to the confluence with the Saginaw River just above the City of Saginaw. The floodplains along the Tittabawassee River are periodically inundated, usually during high flows in the spring and following major storm events. In addition, releases from the Sanford dam upstream of Midland cause periodic changes in water levels and flow rates in the Tittabawassee River. Data available from 1937 to 2002 at USGS gauging station 04156000 indicate that the flows of the Tittabawassee River periodically fluctuate with high flows in the spring with occasional, short-duration periods of high flow throughout the year following substantial rain events (Figure 2-2; Figure 2-3).

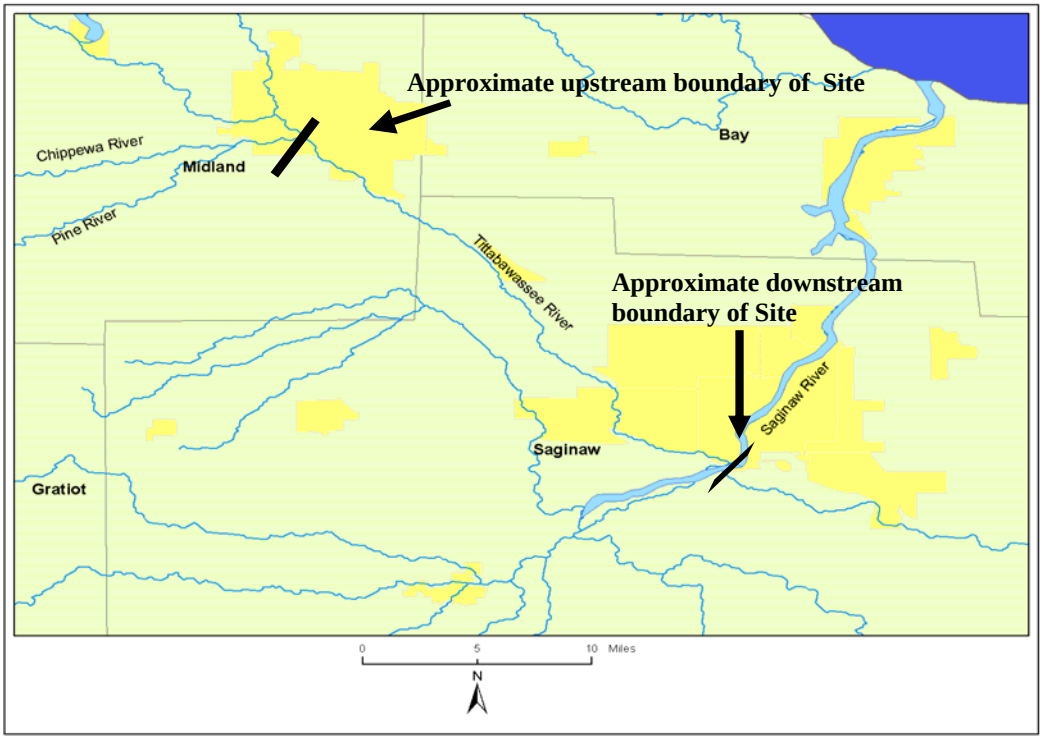
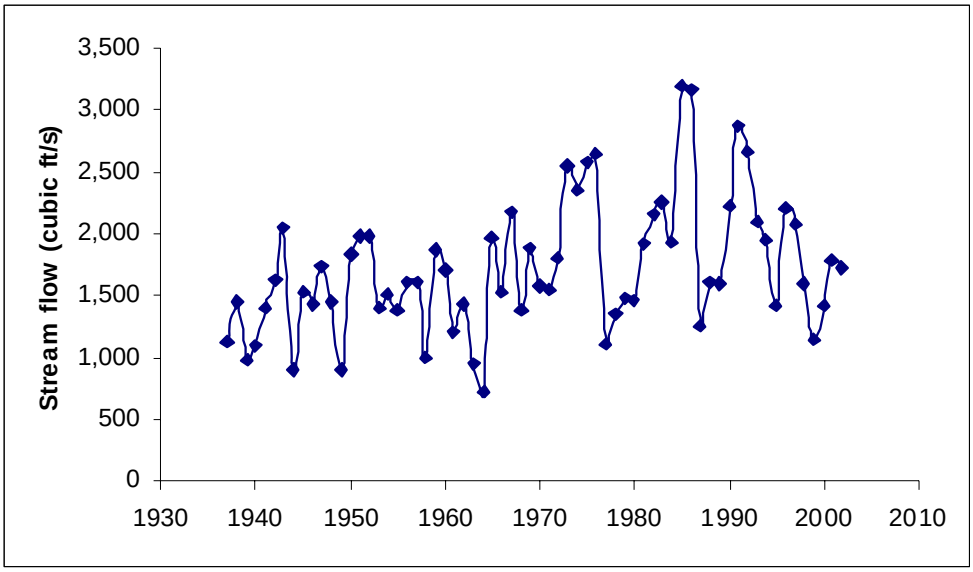


Figure 2-1. General location map showing upstream and downstream boundaries of the Site.



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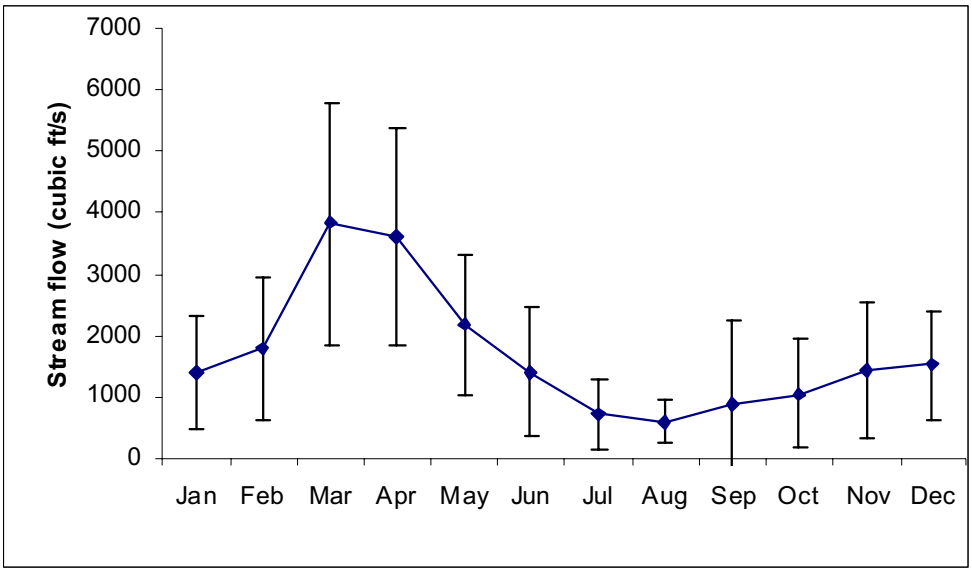

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2.3 Characteristics and Definitions of Sediment and Floodplain Soil

Sediments and soils are typically very distinct from each other based, in part, on differences in physical characteristics, functions, and influences on fate, transport and exposure pathways for COPECs. However, for a floodplain, in which the site is periodically inundated and then not covered with water for substantial amounts of time each year, the distinctions between sediments and soils are less clear. Since chemical fate, transport, and availability are significantly different between floodplain or wetland soils and true sediments, it is important to have a working definition to differentiate between these two matrices. For the purposes of this SLERA Work Plan, sediments at this site are defined as those portions of the site that are permanently flooded or are flooded for most of the time with little to no emergent vegetation present. This is consistent with USEPA guidance, which considers the regularity, depth, and duration of flooding as well as the presence or absence of emergent vegetation in making the determination. If soils are flooded enough to qualify as sediments and are not vegetated with emergent species, then Ecological Soil Screening Levels (Eco-SSLs) should not be used (USEPA, 2005).

2.4 Contaminants Known or Suspected to be at the Site

Historical information of the site under investigation is an important consideration when attempting to identify chemicals of potential ecological concern (COPECs) in environmental media.

2.4.1 Historical Data Sources

Several historical data sources have been identified to date. Data from these sources will be incorporated in the SLERA analysis. A list of reference studies, including those cited below, is provided (Table 2-1). This list will likely expand as studies are identified or as new data become available.

Dow, Michigan Department of Natural Resources (MDNR), Michigan Department of Environmental Quality (MDEQ), and other agencies and parties have conducted activities to evaluate the environmental quality of the Tittabawassee River since the 1960's. Work to date has been conducted as independent studies and in conjunction with conditions in Dow's operating permits (e.g. NPDES, Hazardous Waste Operating License). Environmental studies starting in the 1960s and 1970s focused on macroinvertebrate populations in the river sediments, general water quality, and fish mortality rates. PCDD and PCDF measurement in fish began in the mid-1970s. Baseline type studies were conducted in the early to mid-1980s in conjunction with the NPDES-permitting process. Water column and sediment sampling were conducted in 1981. A wastewater characterization study was conducted in 1986 that reviewed, both fish and wastewater-related data from the previous 8 years. Three regional studies published in 1988, 1993, and 1994 provide corresponding information on the drainage area in terms of topography, hydrology, land uses, soil types, and transport of solids under various flow conditions. River sediments were first sampled by USEPA in 1981 with subsequent sediment and floodplain soil samples collected in 1984 to expand the analytical suite to include polychlorinated dibenzo-*p*-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), and other chlorinated hydrocarbons. In 1996, MDEQ collected and analyzed a number of surface soil, river plain, and river sediment samples. Additional samples collected in 2000 as part of a MDNR wetland mitigation project segued into MDEQ investigations, including a Phase I floodplain soil study (MDEQ, 2001), a baseline sediment study (MDEQ, 2002), a Phase II floodplain soil study (MDEQ, 2003), and a residential floodplain soil sampling study (MDEQ, 2004). These four MDEQ studies have produced the greatest volume of Tittabawassee River sediment and floodplain soil data to date. In particular, the Baseline Chemical Characterization Study (MDEQ, 2002) analyzed soil and sediment samples for a wide range of volatile and semi-volatile organic compounds (e.g., VOCs and sVOCs), pesticides, polychlorinated biphenyls (PCBs), polybrominated biphenyls (PBBs), and metals. Another source of data is the Michigan Fish Contaminant Monitoring Program (FCMP), conducted by MDEQ. The FCMP includes data from areas upstream and downstream of Midland for caged catfish, skin-on and skin-off fillets for a variety of native fish species, and a few native whole fish samples (MDEQ, 2005). The analyte list for the FCMP varies by year and location, but generally includes mercury, PCBs, PCDDs, PCDFs, and organochlorines.

Table 2-1. Historical data sources for studies conducted in the area of concern

Matrix Analyzed for Contaminants	Agency or Author	Year	Title
Sediments	Rossman et al. (USEPA)	1983	The impact of pollutants on the Tittabawassee River
Sediments and fish	Amendola et al. (USEPA)	1986	Dow Chemical wastewater characterization study: Tittabawassee River sediments and native fish.
Fish	USEPA Region V	1988	Proposed risk management actions for dioxin contamination at Midland, Michigan
Water quality	Michigan DNR	1988	Saginaw River and Saginaw Bay area of concern remedial action plan
Suspended soils	Jude et al. (University of Michigan)	1993	Suspended solids and bedload transport of nutrients, heavy metals, and PCBs in 16 major tributaries to Saginaw Bay, 1990 – 1992
Sediments	University of California, Santa Barbara	1994	The transport of sediments and contaminants in the Lower Saginaw River
Semi-permeable membrane devices, sediments, and fish	Gale et al.	1997	Comparison of the uptake of dioxin-like compounds by caged channel catfish and semi-permeable membrane devices in the Saginaw River, Michigan
Soil	Michigan DEQ	2001	Phase I Tittabawassee/Saginaw River dioxin floodplain sampling study
Soil and bird eggs	Michigan DEQ	2002	Baseline chemical characterization of Saginaw Bay watershed sediments
Soil	Michigan DEQ	2003	Final report. Phase II Tittabawassee/Saginaw River dioxin floodplain sampling study
Fish and some bird eggs	Michigan DEQ (prepared by Galbraith Environmental Sciences)	2003	Tittabawassee River aquatic ecological risk assessment: polychlorinated dibenzo-p-dioxins, polychlorinated dibenzofurans
Fish	Michigan DEQ	1980-2003	Michigan Fish Contaminant Monitoring Program
Soil, sediment, plants, invertebrates, earthworms	MSU/ENTRIX	2004	Concentrations of PCDDs and PCDFs in Soils, Sediments, and Biota from the Aquatic and Terrestrial Food Webs of the Tittabawassee River (Data from Fall 2003)
Deer, turkeys, and squirrels	ENTRIX/Dow Chemical	2004	Evaluation of PCDDs and PCDFs in the wild game taken from the floodplain along the Tittabawassee River
Soil	Michigan DEQ	2004	Preliminary analytical results for soil samples taken at residential properties in the Tittabawassee River floodplain by the MDEQ in June through December of 2003

2.4.2 ERA-Related Activities

Although data have been collected for several decades, there have been no comprehensive ecological evaluations of the entire study area. This SLERA Work Plan is designed to build upon currently available data. Such data are available from studies conducted through MDEQ investigations, Michigan State University (MSU), Dow, ENTRIX, CH2MHILL, USFWS, and others (Table 2-1).

2.5 Species Present or Potentially Present at the Site

Based on a preliminary review of existing data, the Site provides habitat for a wide variety of vegetation, invertebrates, fish, birds, mammals, and amphibians and reptiles. An estimated total of more than 380 species, including birds (>260), mammals (>30), reptiles and amphibians (>20), and fish (>70), potentially inhabit the Tittabawassee River and floodplain (USFWS, 2001). Species expected to be most common in the floodplain include tree swallow (*Tachycineta bicolor*), barn swallow (*Hirundo rustica*), bank swallow (*Riparia riparia*), American crow (*Corvus brachyrhynchos*), American robin (*Turdus migratorius*), European starling (*Sturnus vulgaris*), red-winged blackbird (*Agelaius phoeniceus*), common grackle (*Quiscalus quiscula*), mallard (*Anas platyrhynchos*), muskrat (*Ondatra zibethica*), meadow vole (*Microtus pennsylvanicus*), raccoon (*Procyon lotor*), green frog (*Rana clamitans*), northern leopard frog (*Rana pipiens*), and common garter snake (*Thamnophis sirtalis*). Other notable species that have been observed include bald eagle (*Haliaeetus leucocephalus*), osprey (*Pandior haliaetus*), great blue heron (*Ardea herodias*), black-crowned night heron (*Nycticorax nycticorax*), belted kingfisher (*Ceryle alcyon*), great horned owl (*Bubo virginianus*), red-tailed hawk (*Buteo jamaicensis*), red fox (*Vulpes vulpes*), mink (*Mustela vison*), and short-tailed shrews (*Blarina brevicauda*).

3.0 SCREENING LEVEL ERA ANALYSIS PHASE – EXPOSURE AND EFFECTS ASSESSMENT

During the analysis phase, exposure to stressors and the relationship between stressor concentrations and ecological effects are evaluated.

3.1 Screening Level Estimates of Exposure

For most COPECs, exposure to receptors will not be calculated during the SLERA, rather the maximum concentration in a media will be compared to an appropriate screening level benchmark (discussed later). However, for some COPECs, the exposure pathways for ecological receptors (e.g., plants and animals) may be considered based on limited exposure data. In order to estimate exposures in cases when site-specific information is lacking, conservative exposure assumptions are made in order to minimize the chance of concluding there is no risk when risk may exist. These conservative assumptions include (1) ecological receptors are present within the contaminated area 100% of the time, (2) contaminants at the site are 100% bioavailable to biota, (3) the most sensitive life stage of the organism is being exposed to contaminants, and (4) the species in question feeds entirely upon the most contaminated food source. In addition to these assumptions, estimates of bioaccumulation, body weight, and ingestion rates are made in a conservative fashion in order to estimate exposure.

Exposure point concentrations of COPECs will be determined and compared to toxicity reference values in order to calculate the potential for adverse effects. In general, there are two primary approaches, dietary-based and receptor tissue-based, for assessing exposure and effects of persistent, bioaccumulative COPECs in wildlife assessments (Fairbrother, 2003). Each of these approaches is discussed in the following sections.

3.1.1 Dietary Exposure Modeling Approach

The dietary-based method is one of the most widely used approaches to assess wildlife exposure, ranging from simplistic to complex. In general, an average daily dose is calculated by food web modeling in which one makes assumptions regarding dietary composition, applies bioaccumulation models (if necessary), and utilizes concentrations of residues measured at lower levels of the food chain, soil, and sediment. In a SLERA, this can be based on very limited data. However, as one moves into a BERA, this approach accommodates more site-specific data including dietary composition data for individual receptors and concentrations of residues in dietary items. The exposure that is calculated from this dietary exposure-based approach can then be compared to dietary-based toxicity reference values (TRVs) derived from dietary exposures.

3.1.1.1 Exposure Characteristics of Avian and Mammalian Wildlife Receptors

Characteristics of key receptors will be presented in the SLERA, including exposure assumptions for body weight, ingestion rate, dietary composition, area use factor, etc. The primary source of exposure assumptions is the USEPA Exposure Factors Handbook (USEPA, 1993). Additional sources of information include primary peer-reviewed scientific literature, site surveys, and professional judgment, and other compendia of region-specific and species-specific information (Sample and Suter, 1994). Whenever available, site-specific and/or region-specific exposure information will be utilized. The selected species might be exposed to COPECs through contact with and/or ingestion of contaminated media (e.g., primarily through dietary exposure). Exposure estimates for all species will be calculated for COPECs detected in dietary items and incidental soil ingestion.

Exposure calculations will be conducted with exposure concentrations derived from either measured concentrations of chemical stressors or concentrations predicted from models in the case when no measured concentrations are available. Bioaccumulation models are often fraught with uncertainty because bioavailability depends upon highly variable site-specific considerations such as soil type, pH, moisture, clay content, organic carbon, cation exchange capacity, and receptor-specific considerations such as uptake mechanisms. In particular, available information suggests very limited assimilation and accumulation of particulate-bound COPECs into vegetation, invertebrates, and small mammals.

3.1.1.2 Estimation of Oral Exposure for Avian and Mammalian Wildlife Receptors

Estimates of daily contaminant exposure experienced by individual receptor species are calculated using a modification of the generalized exposure model presented by Sample and Suter (1994). The generalized exposure model is depicted (Eq. 5-1):

$$ADD_{pot} = \frac{[(IR_{diet}\, x\, C_{diet}) + (IR_{soil}\, x\, C_{soil}) + (IR_{sed}\, x C_{sed})]\, x\, SUF}{BW} \qquad \textbf{Eq. 3-1}$$

Where:

ADD_{pot} = potential average daily dose (*e.g.*, mg/kg-d)

IR_{diet} = Amount of prey or vegetation ingested (kg/d)

C_{diet} = Concentration of chemical in prey or vegetation (mg/kg)

IR_{soil} = Amount of soil ingested (kg/d)

C_{soil} = Concentration of chemical in soil (mg/kg)

IR_{sed} = Amount of sediment ingested (kg/d)

C_{sed} = Concentration of chemical in sediment (mg/kg)

SUF = Site use factor (unitless) (foraging area/site area)

BW = Body weight (kg)

As stated previously, area use factor will be assumed to be 100% during the SLERA even though some species may forage in only a portion of the site and/or there may be limitations on the availability of suitable habitat for a given receptor.

In addition, bioavailability will be assumed to be 100% during the SLERA even though a fractional absorption value will be included in the BERA exposure model to account for the fraction of the oral dose that is absorbed through the gastrointestinal tract. The resulting ADD_{pot} is also termed the estimated environmental concentration (EEC) since the ADD_{pot} is a rough estimate of exposure based on conservative assumptions. This fractional absorption factor is especially important for incidental ingestion of sediments and soils. It has been shown that sorption of COPECs to soil may substantially reduce its bioavailability.

3.1.2 Receptor Tissue Exposure Approach

In addition to the dietary-based approach, exposure to several of the receptors may be evaluated based on concentrations of residues in receptor tissues. For the SLERA, this analysis is based on modeled residue

data using literature-based bioaccumulation factors. However, receptor tissues will be collected as part of the BERA as discussed in the receptor-specific study plans of the BERA. The exposure that is calculated from this receptor tissue residue-based approach can then be compared to residue-based toxicity reference values (TRVs).

3.2 Screening Level Ecological Effects Assessment

The purpose of the effects assessment phase is to summarize available toxicological data, establish toxicity reference values and benchmarks for COPECs for the SLERA, and present ecologically relevant field observations. The availability of both dietary exposure and tissue residue-based toxicological data will be evaluated for COPECs as needed and the limitations of these toxicity data discussed. This information will be utilized with exposure data to conduct the risk characterization (Section 4.0).

3.2.1 Screening Level Ecological Benchmarks

In this step of the screening-level ERA, the risk assessor determines, from a review of the scientific literature, the toxicity benchmark values that are protective of plants and animals present at the study site. It is important to note that these benchmarks are for screening purposes only and do not represent remedial action cleanup levels. The list of potentially applicable or suitably analogous toxicity benchmarks that will be evaluated include:

- USEPA National Recommended Water Quality Criteria (USEPA, 1999b);
- USEPA Region IV Ecological Screening Values (USEPA Region IV, 2004);
- Oak Ridge National Laboratory Ecotoxicological Screening Benchmark Reports;
- USEPA's Ecotox Thresholds (USEPA, 1996);
- Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota (Suter and Tsao, 1996)
- Ecological Soil Screening Levels (Eco-SSLs; USEPA, 2005);
- Concentrations reported in the scientific literature to be associated, or potentially associated, with toxic effects.

3.2.2 Development of Toxicity Reference Values (TRVs)

A toxicity reference value (TRV) is a concentration of a chemical in water, food, or tissues of a receptor below which toxicological effects are not expected. Ideally, toxicity reference values are derived from chronic toxicity studies in which a dose-response relationship has been observed for ecologically-relevant endpoint(s) in the species of concern, or a closely related species. Specifically, some of the ideal characteristics of high quality toxicity studies that can be used to derive TRVs include:

1. Relatedness of the test species to the receptor of concern;
2. Chronic duration of exposure including sensitive life stages to evaluate potential developmental and reproductive effects;
3. Measurement of ecologically relevant endpoints; and
4. Minimal impact of co-contaminants.

It is essential to perform a critical evaluation of the applicability of the toxicological data to the site-specific receptors of concern and exposure pathways. TRVs derived in the same species are generally not available for the majority of wildlife receptors and, therefore, it is necessary to derive TRVs using toxicological data for surrogate species in combination with uncertainty factors. Uncertainty concerning interpretation of the toxicity test information among different species, different laboratory endpoints, and differences in experimental design, age of test animals, duration of test, etc., are addressed by applying uncertainty factors (UFs) to the toxicology data to derive the final TRV.

4.0 SCREENING-LEVEL ERA RISK CHARACTERIZATION PHASE

This section presents approaches for identifying COPECs and characterizing risk.

4.1 Screening Level Risk Calculation

By using maximum exposures and the lowest possible screening benchmarks, the SLERA is designed to minimize chances of eliminating a COPEC from further consideration when it may pose an actual ecological risk. Thus, the resulting risk calculation is an overestimate and can not be used to derive remedial action cleanup levels (USEPA, 1997). From the available data, potential ecological risks can be estimated based upon a series of calculated hazard quotients (HQs). In short, a HQ is calculated by dividing the estimated exposure dose or estimated environmental concentration (EEC) by a toxicity benchmark for each receptor (Eq. 2-1, Eq. 2-2).

$$HQ = \frac{\text{Dose}}{\text{Toxicity Benchmark}} \qquad \textbf{Eq. 4-1}$$

$$HQ = \frac{\text{EEC}}{\text{Toxicity Benchmark}} \qquad \textbf{Eq. 4-2}$$

If the HQ $\geq$ 1.0, the exposure pathway will be further evaluated in the BERA. If the HQ < 1.0, this indicates that harmful effects are not likely and the exposure pathway can be eliminated from further BERA investigations. For COPECs that are retained for further evaluation, exposure pathways will be evaluated to determine which potentially significant exposure pathways require further evaluation. For example, available data may indicate that a COPEC is below an ecological screening benchmark in one medium but exceeds an ecological screening benchmark for another medium. This evaluation will help focus resources to evaluate only those COPECs and exposure pathway combinations that exceed ecological screening benchmarks.

COPECs on the Site will be assessed by measuring concentrations in floodplain soils and river sediments. COPECs will be evaluated by one or more of the following approaches:

(1) Compare media-specific concentrations to corresponding media-specific conservative benchmarks;

(2) Compare estimated exposure doses to toxicity reference values for select receptors of concern;

(3) Compare media-specific concentrations to background to determine potential non-site-related concentrations of COPECs (both natural and anthropogenic); and/or

(4) Evaluate the frequency and magnitude of detection (provide indication of whether the detection limit is below the associated screening benchmark, if available).

A decision tree for determining which COPECs are to be retained or dropped for further assessment will be followed (Figure 4-1). COPECs that exceed the ecological screening benchmarks or reported toxic doses will be carried forward into the BERA for further evaluation. Based on historical data, it is assumed that polychlorinated dibenzo-*p*-dioxins (PCDDs) and dibenzofurans (PCDFs) will be retained as COPECs beyond the SLERA and are the main focus the BERA Work Plan.

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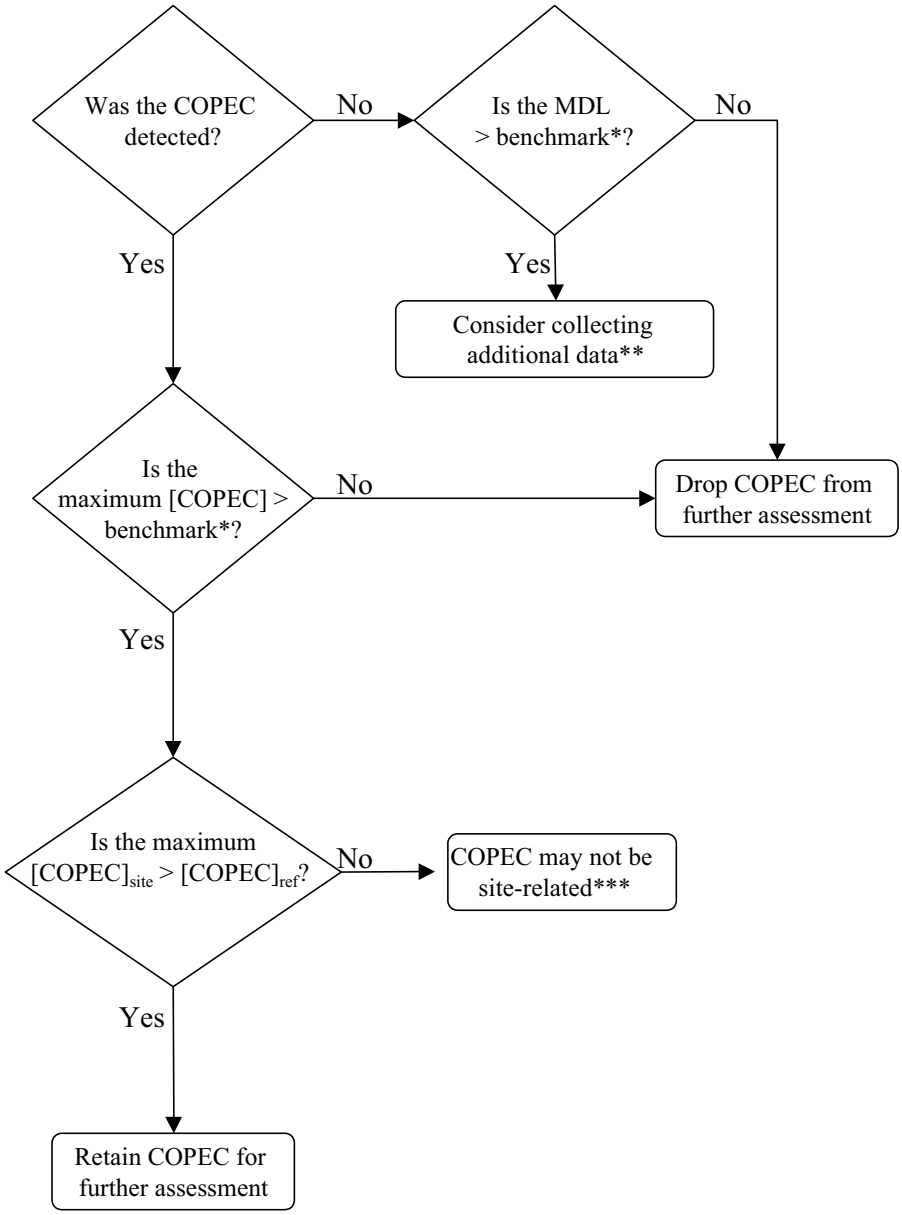

* If benchmark is not available, attempts will be made to develop benchmark for COPEC &/or consider other factors, which may include exposure modeling

** May include re-analysis of sample with lower MDL or collection of new sample(s)

*** This most commonly occurs with naturally occurring inorganic constituents, but may occur with any COPEC for which additional non-site-related sources are present

Figure 4-1. Decision tree for screening COPECs.

4.2 Uncertainty in the Screening Level ERA

Since a SLERA is deliberately designed to be protective in nature, not predictive of effects, it follows that there is a considerable amount of uncertainty associated with results from a SLERA. For example, the exposure assumptions of 100% presence on a contaminated site may not be true for many species. Likewise, the assumption of 100% contaminant bioavailability may not be true for COPECs that are tightly bound to soils and sediments. All sources of uncertainty and their potential impact on the SLERA results will be discussed when evaluating the results of the SLERA.

4.3 Scientific Management Decision Point #1

Based on the SLERA, decisions can be made to determine which COPECs and pathways are to be further evaluated in the BERA *and* which COPECs and pathways can be eliminated from further consideration. Following the SLERA, decisions will be made in consultation with MDEQ based on the determination of potential ecological risks. Thus, three possible decisions can be reached following the SLERA:

- There is enough information to conclude that ecological risks are low or non-existent and there is no need to clean up the site on the basis of ecological risk,
- There is not enough information to make a decision and the ERA will proceed, or
- The information indicates a potential for adverse ecological effects, and a higher tiered BERA is required.

5.0 SCHEDULE AND REPORTING

5.1 Schedule

Once MDEQ provides comments on the draft SLERA work plan, Dow and ENTRIX will respond to comments and prepare a revised SLERA work plan within 60 days. Following approval of the SLERA workplan and once consensus has been reached for scientific management decision point (SMDP) #1 (section 4.3), Dow and ENTRIX will submit a schedule for the preparation of a draft SLERA report within 30 days. Once MDEQ provides comments on the draft SLERA report, Dow and ENTRIX will respond to comments and prepare a revised SLERA report within 60 days.

5.2 Reporting

If any major deviations from the approved Work Plan are necessary because of unanticipated field conditions, the MDEQ will be notified as soon as possible for approval and modification of the Work Plan, if needed. In addition, bimonthly progress reports will be provided to MDEQ beginning after approval of this Work Plan.

Reports from this project will include data obtained from the field and laboratory phases of the study. At the termination of the study, MDEQ will be provided with an electronic copy of both laboratory and field data packages.

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Appendix A. CH2MHill 2005 Ecological Risk Assessment Support Sampling

Report

Ecological Risk Assessment Support Sampling

Prepared for

Dow Chemical Company

Midland, MI

March 2005

CH2MHILL

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Attachment
1 Sampling and Analysis Plan for Ecological Risk Assessment Support Sampling

Acronyms

ENTRIX	Entrix Inc.
EPA	Environmental Protection Agency
ERA	Ecological Risk Assessment
Facility	Dow Midland facility
IDW	Investigative derived waste
LCS	Lab Control Sample
LCS/LCSD	Lab Control Sample/Lab Control Sample Duplicate
MDEQ	Michigan Department of Environmental Quality
MDL	Minimum Detection Limit
MOCA	Midland Offsite Corrective Action
MS/MSD	Matrix Spike/Matrix Spike Duplicates
MSU	Michigan State University
PARCCs	Precision, Accuracy, Representiveness, Completeness and Comparability
PCOIs	Potential constituents of interest
PPE	Personal Protective Equipment
QA/QC	Quality assurance/quality control
QAPP	Quality Assurance Project Plan
RDCC	Residential Direct Contact Criterion
RI	Remedial Investigation
RPD	Relative percent differences
RRF	Relative Response Factor
SAP	Sampling and Analysis Plan
SVOCs	Semi-volatile organic compounds
TEQ	Toxicity equivalency quotients
VOCs	Volatile organic compounds

Ecological Risk Assessment Support Sampling

1.0 Introduction

This report documents the field activities and presents the results of the environmental sampling conducted by CH2M HILL, Inc. (CH2M HILL) to support The Dow Chemical Company, Michigan Operations, Midland Offsite Corrective Action (MOCA), Ecological Risk Assessment (ERA). As discussed in the ERA Support Sampling and Analysis Plan (SAP; CH2M HILL, 2004), there were two objectives for this sample collection. The first objective was to provide Michigan State University (MSU) with data necessary to support the ERA. A second objective was to use the data for a preliminary evaluation of potential constituents of interest (PCOIs) along the Tittabawassee River. The SAP for ERA Support Sampling is included with this report as Attachment 1.

1.1 Sampling Design

MSU established six study areas for the purpose of conducting ecological investigations under the ERA. Five of these areas are located along the Tittabawasssee River (one of which is upstream of Dow), and one is located upstream of the Facility along the Chippewa River. The upstream study areas provide reference sites outside of any influence from the Dow Midland Facility. Each study area includes a pair of study plots: a terrestrial plot located along the river bank, and an aquatic plot located within the river.

To represent the areas of ecological exposure, surface soil (0″-6″) and surface sediment (0″-2″) samples were identified for collection. Four samples of each media per plot were identified by MSU as the sufficient number. The planned sample locations were placed along the perimeter of each plot, approximately half-way between each corner. The target analytes for these samples include dioxins/furans and other potential contaminants of interest (PCOIs) in soil and sediment in the vicinity of the ERA study plots. Other PCOIs include USEPA Appendix IX constituents, constituents typically analyzed by the Michigan Department of Environmental Quality (MDEQ), and several additional constituents currently monitored as part of the Facility's groundwater monitoring program. A complete list of analytes can be found in the SAP (Attachment 1).

2.0 Summary of Field Activities

2.1 Soil Sampling

Soil sampling in support of the ERA was performed from June 1st through June 4th 2004. Sample locations at ERA Plots 1 (Gladwin Forest) and 2 (Chippewa Nature Center) were collected using a track mounted Geoprobe rig. Eight locations (4 at each pilot area) were sampled using direct push technology to depths where the water table was encountered.

Due to difficulty with the Geoprobe rig and accessing the ERA plots without disturbing the plots and surrounding areas, the decision was made to discontinue use of the rig and finish

sampling by hand auger. Therefore, only surface soil samples (depth of 0.5 ft.) were collected at remaining Plots 3 through 6 (Plot 3 – Smiths Crossing, Plot 4 – Tittabawassee Township Park, Plot 5 – Freeland Festival Park, and Plot 6 – Imerman Park).

As part of the SAP, location coordinates were to be collected from both the corners of the ERA Plots 1 through 6 and at each sampling station. However, the flags marking the corners of ERA Plot 2 were no longer present so the corresponding location coordinates for the Plot corners could not be collected. The station locations (Station IDs), location coordinates, Sample ID's, sample depth intervals, and associated analytical batches are summarized in Appendix A.

Quality Control Samples

Quality control samples were collected in accordance with the program Quality Assurance Project Plan (QAPP; CH2M HILL 2004), in addition to the forty-one field soil samples. The QC sample type, event frequency and SAP specified frequency for QC sample collection are summarized in Table A-2 of Appendix A.

Investigation Derived Waste

Sample equipment was decontaminated at each sample location and aqueous investigative derived waste (IDW) was disposed at each sampling location at the consent of the land-owner/steward, and in accordance to the *Handling and Disposal of Investigative-Derived Waste Field SOP* (CH2M HILL, 2004). Soil cores were processed at each sampling location and excess soil was placed back into the boring which it originated. Personal Protective Equipment (PPE) was containerized in trash bags and disposed of at the municipal landfill via office dumpster.

2.2 Sediment Sampling

Sediment sampling in support of the ERA was performed from June 28th through June 30th 2004. The six aquatic plots were located using a Trimble GeoXT GPS receiver. Trees that were adjacent to the upstream and downstream edges of the terrestrial plot were also marked with flagging tape to help the field team locate the appropriate aquatic plots. Upon arrival at each plot, the sampling team positioned the sampling boat just outside the plot at the midpoint between each corner. The GPS receiver contained pre-loaded location coordinates for each of the sampling locations which were used to guide the field crew to each sampling station. The field team then anchored the boat at each location and then recorded real-time location coordinates, both by logging the coordinates into the GPS receiver and also recording them in the field notebook.

Once positioned at each location, the top approximate 2 inches (0.2 feet) of sediment were collected using a ponar dredge. Due to the imprecise nature of the ponar dredge for the collection of surface sediment samples at specific depths, the depth interval measurement should be considered estimated by the data user. Due to the large amount of sand and gravel at most of the locations, it took multiple attempts to collect a sufficient amount of sample to fill the appropriate number of sample containers for analysis. The station locations (Station IDs), location coordinates, Sample ID's, sample depth intervals, and associated analytical batches are summarized in Appendix A.

Quality Control Samples

Twenty-four sediment field samples (not inclusive of QC samples) were collected during the ERA Support soil sampling. The summary of the QC sample type, event frequency and SAP specified frequency for QC sample collection is presented in Table A-4 of Appendix A.

Investigation Derived Waste

Tittabawassee River water was used to decontaminate the ponar dredge and sampling equipment used to homogenize the sediment (stainless steel bowl and spoon). The river water used was then discarded back into the river. Excess sediment was also placed back in the river at the location it was taken. Personal Protective Equipment (PPE) was containerized in trash bags and discarded at the municipal landfill via office dumpster.

3.0 Laboratory Analysis

All soil and groundwater samples were analyzed for volatile organic compounds (VOCs) by EPA Method 8260, semi-volatile organic compounds (SVOCs) by EPA Methods 8270 and 3510, total metals by EPA Method 6010B, Mercury by EPA Method 7471A, total Cyanide by EPA Method 9012, Pesticides by EPA Method 8081A, PCBs by EPA Method 8082, Organophosphorus Pesticides by EPA Method 8141, Chlorinated Phenoxy Acid Herbicides by EPA Method 8151A, and Dioxins and Furans by EPA Method 8290.

Sample analysis was conducted at two separate environmental laboratories. Analyses for dioxins/furans were performed at Alta Analytical Laboratory in El Dorado Hills, California. Analyses for all other PCOIs were conducted at Golf Coast Analytical Laboratory in New Orleans, Louisiana. All analyses were performed in accordance with the Dow MOCA Quality Assurance Project Plan (CH2M HILL 2004).

4.0 Validation

All data collected under the ERA Support Sampling effort were validated to Level III per the MOCA QAPP. An overall evaluation of the data indicates that the sample handling, shipment, and analytical procedures have been adequately completed. The validation review demonstrated that the analytical systems were generally in control and the data results can be used for its intended purpose.

Conclusions of the data quality evaluation process include the following:

- The laboratory analyzed the samples according to the EPA methods stated in the work plan as demonstrated by the deliverable summaries and analytical run sequences.
- Concentrations of blank contaminants were applied according to EPA *National Functional Guidelines* in order to reflect sample values that may be attributed to field or laboratory contamination.
- Sample results for metals above the Minimum Detection Limit (MDL) but less than five times the MDL may be attributed to instrument noise and/or low level contamination. Therefore, results at these low concentration levels may be described as potential false positives.

- Sample results for target organic compounds above the MDL but less than the contract required quantitation limit should be considered as uncertain but indicative of the presence of that compound at an estimated concentration.
- Except for lower recoveries of 4-Bromofluorobenzene, the low number of surrogate spike recoveries, MS/MSD, and field duplicate results, out of acceptance limits, indicate that the sample matrix did not significantly interfere with the overall analytical process
- Twenty-four antimony results were rejected, "R", due low Matrix Spike/Matrix Spike Duplicates recoveries. The recoveries were less than 30 percent, ranging from 20-28 percent.

The project objectives for Precision, Accuracy, Representiveness, Completeness and Comparability (PARCCs) were met, and the data can be used as qualified by the data quality evaluation process. The full Validation Summary is provided in Appendix B.

5.0 Summary of Analytical Data

This report presents analytical data from the ERA Support Sampling effort in tabular form. Tables 1 and 2 present the dioxin/furan data as toxicity equivalency quotients (TEQs) by location, and individually for each media (Table 1 presents soil TEQs, Table 2 presents sediment TEQs). TEQ results for each location are shown on Figure 1-1. Samples collected during this study were analyzed for all 17 of the 2,3,7,8-substituted dioxin and furan congeners that are necessary to evaluate the TEQ. TEQs were calculated according to World Health Organization methodology (Van den Berg, et al., 1998), using toxicity equivalency factors for mammals. Laboratory non-detect results for individual congeners were factored into the TEQ calculation using a value of one-half the laboratory detection limit.

Analytical results for all other PCOIs are also presented in tabular form as summaries of analytical detections. Tables 3 and 4 list all detected PCOIs in soil and sediment, respectively, by location.

The complete file of all analytical data collected under the ERA Support Sampling effort are included on the compact disc transmitted with this report.

6.0 References

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Tables

TABLE 1
Soil TEQ Results - ERA Support
Dow Chemical Company, Michigan Operations

Sampling Location	Location ID	Field Sample ID	Sample Media	Sample Depth (ft)	TEQ (ng/kg)
Plot 1: Reference Site - Sanford, MI Gladwin Forest	TRU-02687	060104-SOI-02687-00.5	Soil	0.0-0.5	1.77
	TRU-02688	060104-SOI-02688-00.5	Soil	0.0-0.5	0.28
	TRU-02689	060104-SOI-02689-00.5	Soil	0.0-0.5	3.57
	TRU-02690	060104-SOI-02690-00.5	Soil	0.0-0.5	0.42
Plot 2: Reference Site - Chippewa Nature Preserve	CHR-02695	060204-SOI-02695-00.5	Soil	0.0-0.5	9.26
	CHR-02696	060204-SOI-02696-00.5	Soil	0.0-0.5	13.90
	CHR-02697	060204-SOI-02697-00.5	Soil	0.0-0.5	9.20
	CHR-02698	060204-SOI-02698-00.5	Soil	0.0-0.5	16.98
Plot 3: Smith's Crossing (near Bailey Bridge Rd.)	MIC-02703	060304-SOI-02703-00.5	Soil	0.0-0.5	326.89
	MIC-02704	060304-SOI-02704-00.5	Soil	0.0-0.5	3159.40
	MIC-02705	060304-SOI-02705-00.5	Soil	0.0-0.5	2067.16
	MIC-02706	060304-SOI-02706-00.5	Soil	0.0-0.5	451.22
Plot 4: Tittabawassee Township Park	FRE-02711	060404-SOI-02711-00.5	Soil	0.0-0.5	1704.41
	FRE-02712	060404-SOI-02712-00.5	Soil	0.0-0.5	1487.74
	FRE-02713	060404-SOI-02713-00.5	Soil	0.0-0.5	3867.11
	FRE-02714	060404-SOI-02714-00.5	Soil	0.0-0.5	1359.28
Plot 5: Freeland Festival Park	FRE-02719	060304-SOI-02719-00.5	Soil	0.0-0.5	264.53
	FRE-02720	060304-SOI-02720-00.5	Soil	0.0-0.5	8919.82
	FRE-02721	060304-SOI-02721-00.5	Soil	0.0-0.5	164.21
	FRE-02722	060304-SOI-02722-00.5	Soil	0.0-0.5	3141.30
Plot 6: Imerman Park	THT-02727	060404-SOI-02727-00.5	Soil	0.0-0.5	4230.73
	THT-02728	060404-SOI-02728-00.5	Soil	0.0-0.5	2157.02
	THT-02729	060404-SOI-02729-00.5	Soil	0.0-0.5	2261.57
	THT-02730	060404-SOI-02730-00.5	Soil	0.0-0.5	4082.15

TABLE 2
Sediment TEQ Results - ERA Support
Dow Chemical Company, Michigan Operations

Sampling Location	Location ID	Field Sample ID	Sample Media	Sample Depth (ft)	TEQ (ng/kg)
Plot 1: Reference Site - Sanford, MI Gladwin Forest	TRU-02691	062804-SED-02691-00.2	Sediment	0.0-0.2	0.26
	TRU-02692	062804-SED-02692-00.2	Sediment	0.0-0.2	0.27
	TRU-02693	062804-SED-02693-00.2	Sediment	0.0-0.2	0.25
	TRU-02694	062804-SED-02694-00.2	Sediment	0.0-0.2	0.23
Plot 2: Reference Site - Chippewa Nature Preserve	CHR-02699	062904-SED-02699-00.2	Sediment	0.0-0.2	0.28
	CHR-02700	062904-SED-02700-00.2	Sediment	0.0-0.2	0.31
	CHR-02701	062904-SED-02701-00.2	Sediment	0.0-0.2	0.74
	CHR-02702	062904-SED-02702-00.2	Sediment	0.0-0.2	0.33
Plot 3: Smith's Crossing (near Bailey Bridge Rd.)	MIC-02707	063004-SED-02707-00.2	Sediment	0.0-0.2	4.73
	MIC-02708	063004-SED-02708-00.2	Sediment	0.0-0.2	3.79
	MIC-02709	063004-SED-02709-00.2	Sediment	0.0-0.2	9.64
	MIC-02710	063004-SED-02710-00.2	Sediment	0.0-0.2	43.12
Plot 4: Tittabawassee Township Park	FRE-02715	063004-SED-02715-00.2	Sediment	0.0-0.2	9.27
	FRE-02716	063004-SED-02716-00.2	Sediment	0.0-0.2	9.24
	FRE-02717	063004-SED-02717-00.2	Sediment	0.0-0.2	177.69
	FRE-02718	063004-SED-02718-00.2	Sediment	0.0-0.2	12.32
Plot 5: Freeland Festival Park	FRE-02723	063004-SED-02723-00.2	Sediment	0.0-0.2	14.14
	FRE-02724	063004-SED-02724-00.2	Sediment	0.0-0.2	366.29
	FRE-02725	063004-SED-02725-00.2	Sediment	0.0-0.2	133.63
	FRE-02726	063004-SED-02726-00.2	Sediment	0.0-0.2	195.45
Plot 6: Imerman Park	THT-02731	062904-SED-02731-00.2	Sediment	0.0-0.2	3.95
	THT-02732	062904-SED-02732-00.2	Sediment	0.0-0.2	8.06
	THT-02733	062904-SED-02733-00.2	Sediment	0.0-0.2	44.79
	THT-02734	062904-SED-02734-00.2	Sediment	0.0-0.2	4.85

TABLE 3
Detected Constituents in Soil - ERA Support
Dow Chemical Company, Michigan Operations

Chemical Name	Plot 1: Reference Site - Sanford, MI Gladwin Forest			Plot 2: Reference Site - Chippewa Nature Preserve			Plot 3: Smith's Crossing (near Bailey Bridge Rd.)			Plot 4: Smith's Crossing			Plot 5: Freeland Festival Park			Plot 6: Imerman Park		
	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect
VOCs (ug/kg)																		
1,1,1,2-TETRACHLOROETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
1,1,1-TRICHLOROETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
1,1,2,2-TETRACHLOROETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
1,1,2-TRICHLOROETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
1,1-DICHLOROETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
1,1-DICHLOROETHENE	0	4		0	4		0	4		0	4		0	4		0	4	
1,2,3-TRICHLOROBENZENE	0	4		0	4		0	4		0	4		0	4		0	4	
1,2,3-TRICHLOROPROPANE	0	4		0	4		0	4		0	4		0	4		0	4	
1,2,4-TRICHLOROBENZENE	0	8		0	4		0	8		0	8		0	8		0	8	
1,2,4-TRIMETHYLBENZENE	1	4	0.7	0	3		4	4	3.5	4	4	6.0	2	4	2.4	4	4	6.2
1,2-DIBROMOETHANE (EDB)	0	4		0	4		0	4		0	4		0	4		0	4	
1,2-DICHLOROBENZENE	0	4		0	3		3	4	1.5	0	4		0	4		0	4	
1,2-DICHLOROETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
1,2-DICHLOROPROPANE	0	4		0	4		0	4		0	4		0	4		0	4	
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	0	4		0	3		4	4	1.4	4	4	2.1	2	4	1.6	4	4	5.5
1,3-DICHLOROBENZENE	0	4		0	4		1	4	0.6	0	4		0	4		0	4	
1,4-DICHLOROBENZENE	0	4		0	4		3	4	5.3	0	4		0	4		1	4	2.3
2-HEXANONE	0	4		0	4		0	4		0	4		0	4		0	4	
ACETONE	4	4	142.0	4	4	168.0	4	4	86.7	4	4	109.0	2	4	144.0	4	4	218.0
ACETONITRILE	0	4		0	4		0	4		0	4		0	4		0	4	
ACROLEIN	0	4		0	4		0	4		0	4		0	4		0	4	
ACRYLONITRILE	0	4		0	4		0	4		0	4		0	4		0	4	
ALLYL CHLORIDE (3-CHLOROPROPENE)	0	4		0	4		0	4		0	4		0	4		0	4	
BENZENE	1	4	2.6	0	4		4	4	4.2	4	4	8.4	2	4	9.4	4	4	8.6
BROMOBENZENE	0	4		0	4		0	4		0	4		0	4		0	4	
BROMOCHLOROMETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
BROMODICHLOROMETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
BROMOFORM	0	4		0	4		0	4		0	4		0	4		0	4	
BROMOMETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
CARBON DISULFIDE	3	4	10.7	3	4	13.4	4	4	30.5	4	4	24.9	2	4	25.8	4	4	35.9
CARBON TETRACHLORIDE	0	4		0	4		0	4		0	4		0	4		0	4	
CHLOROBENZENE	0	4		0	4		4	4	10.3	0	4		0	4		1	4	2.6
CHLOROETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
CHLOROFORM	0	4		0	4		0	4		0	4		0	4		0	4	
CHLOROMETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
CHLOROPRENE (2-CHLORO-1,3-BUTADIENE)	0	4		0	4		0	4		0	4		0	4		0	4	
cis-1,2-DICHLOROETHENE	0	4		0	4		0	4		0	4		0	4		1	4	1.8
cis-1,3-DICHLOROPROPENE	0	4		0	4		0	4		0	4		0	4		0	4	
DIBROMOCHLOROMETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
DIBROMOMETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
DICHLORODIFLUOROMETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
DIETHYL ETHER (ETHYL ETHER)	0	4		0	4		0	4		0	4		0	4		0	4	
ETHYL BENZENE	3	4	1.4	1	4	1.6	4	4	4.0	4	4	6.6	2	4	5.2	4	4	6.8
ETHYL METHACRYLATE	0	4		0	3		0	4		0	4		0	4		0	4	
ISOBUTANOL	0	4		0	4		0	4		0	4		0	4		0	4	
ISOPROPYLBENZENE (CUMENE)	0	4		0	3		0	4		0	4		0	4		0	4	
m,p-XYLENES	1	4	1.2	0	3		4	4	5.0	4	4	7.9	2	4	6.6	4	4	7.9

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Chemical Name	Plot 1: Reference Site - Sanford, MI Gladwin Forest			Plot 2: Reference Site - Chippewa Nature Preserve			Plot 3: Smith's Crossing (near Bailey Bridge Rd.)			Plot 4: Smith's Crossing			Plot 5: Freeland Festival Park			Plot 6: Imerman Park		
	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect
METHYL ETHYL KETONE (2-BUTANONE)	4	4	12.8	3	4	17.3	1	4	5.4	4	4	17.5	2	4	18.4	4	4	36.1
METHYL IODIDE (IODOMETHANE)	0	4		0	4		0	4		0	4		0	4		0	4	
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	0	4		0	3		0	4		0	4		0	4		0	4	
METHYL METHACRYLATE	0	4		0	3		0	4		0	4		0	4		0	4	
METHYL tert-BUTYL ETHER (MTBE)	0	4		0	4		0	4		0	4		0	4		0	4	
METHYLACRYLONITRILE	0	4		0	4		0	4		0	4		0	4		0	4	
METHYLENE CHLORIDE	0	4		0	4		0	4		0	4		0	4		0	4	
N-BUTYLBENZENE	0	4		0	3		0	4		0	4		0	4		0	4	
N-PROPYLBENZENE	0	4		0	3		1	4	0.6	3	4	1.5	1	4	0.8	2	4	1.5
O-XYLENE	0	4		0	3		4	4	1.9	4	4	3.1	2	4	2.2	4	4	3.0
PENTOCHLORETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
P-ISOPROPYLTOLUENE (P-CYMENE)	0	4		0	7		0	4		0	4		0	4		0	4	
PROPIONITRILE, ETHYL CYANIDE	0	4		0	4		0	4		0	4		0	4		0	4	
SEC-BUTYLBENZENE	0	4		0	4		0	4		0	4		0	4		0	4	
STYRENE	0	4		0	4		0	4		0	4		0	4		0	4	
TERT-BUTYLBENZENE	0	4		0	4		0	4		0	4		0	4		0	4	
TETRACHLOROETHENE (PCE)	0	4		0	4		0	4		0	4		0	4		0	4	
TETRAHYDROFURAN	0	4		0	3		0	4		0	4		0	4		0	4	
TOLUENE	3	4	3.7	1	4	5.1	4	4	11.6	4	4	20.0	2	4	18.2	4	4	21.9
TRANS-1,2-DICHLOROETHENE	0	4		0	4		0	4		0	4		0	4		0	4	
TRANS-1,3-DICHLOROPROPENE	0	4		0	3		0	4		0	4		0	4		0	4	
TRANS-1,4-DICHLORO-2-BUTENE	0	4		0	7		0	4		0	4		0	4		0	4	
TRICHLOROETHENE (TCE)	0	4		0	3		0	4		0	4		0	4		0	4	
TRICHLOROFLUOROMETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
VINYL ACETATE	0	4		0	4		0	4		0	4		0	4		0	4	
VINYL CHLORIDE	0	4		0	4		0	4		0	4		0	4		0	4	
XYLENES, TOTAL	1	4	1.2	1	3	1.2	4	4	6.9	4	4	11.0	2	4	8.7	4	4	10.9
SVOCs (ug/kg)																		
1,2,3,4-TETRACHLOROBENZENE	0	4		0	4		3	4	56.7	0	4		0	4		0	4	
1,2,4,5-TETRACHLOROBENZENE	0	4		0	4		0	4		0	4		0	4		0	4	
1,3-DINITROBENZENE	0	4		0	4		0	4		0	4		0	4		0	4	
1,4-DIOXANE	0	4		0	4		0	4		0	4		0	4		0	4	
1,4-NAPHTHOQUINONE	0	4		0	4		0	4		0	4		0	4		0	4	
1-NAPHTHYLAMINE	0	4		0	4		0	4		0	4		0	4		0	4	
2,3,4,6-TETRACHLOROPHENOL	0	4		0	4		3	4	337.0	1	4	121.0	0	4		0	4	
2,4,5-TRICHLOROPHENOL	0	4		0	4		0	4		0	4		0	4		0	4	
2,4,6-TRICHLOROPHENOL	0	4		0	4		3	4	22.1	1	4	15.8	2	4	29.8	4	4	30.3
2,4-DICHLOROPHENOL	0	4		0	4		0	4		0	4		0	4		0	4	
2,4-DIMETHYLPHENOL	0	4		0	4		0	4		0	4		0	4		0	4	
2,4-DINITROPHENOL	0	4		0	4		0	4		0	4		0	4		0	4	
2,4-DINITROTOLUENE	0	4		0	4		0	4		0	4		0	4		0	4	
2,6-DICHLOROPHENOL	0	4		0	4		0	4		0	4		0	4		0	4	
2,6-DINITROTOLUENE	0	4		0	4		0	4		0	4		0	4		0	4	
2-CHLORONAPHTHALENE	0	4		0	4		0	4		0	4		0	4		0	4	
2-CHLOROPHENOL	0	4		0	4		0	4		0	4		0	4		0	4	
2-METHYLNAPHTHALENE	0	4		0	4		0	4		0	4		0	4		0	4	
2-METHYLPHENOL (O-CRESOL)	0	4		0	4		0	4		0	4		0	4		0	4	

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Chemical Name	Plot 1: Reference Site - Sanford, MI Gladwin Forest			Plot 2: Reference Site - Chippewa Nature Preserve			Plot 3: Smith's Crossing (near Bailey Bridge Rd.)			Plot 4: Smith's Crossing			Plot 5: Freeland Festival Park			Plot 6: Imerman Park		
	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect
2-NAPHTHYLAMINE	0	4		0	4		0	4		0	4		0	4		0	4	
2-NITROANILINE	0	4		0	4		0	4		0	4		0	4		0	4	
2-NITROPHENOL	0	4		0	4		0	4		0	4		0	4		0	4	
2-PICOLINE (ALPHA-PICOLINE)	0	4		0	4		0	4		0	4		0	4		0	4	
3 & 4-METHYLPHENOL (M,P-CRESOL)	0	4		0	4		0	4		0	4		0	4		0	4	
3,3'-DICHLOROBENZIDINE	0	4		0	4		0	4		0	4		0	4		0	4	
3,3'-DIMETHYLBENZIDINE	0	4		0	4		0	4		0	4		0	4		0	4	
3-METHYLCHOLANTHRENE	0	4		0	4		0	4		0	4		0	4		0	4	
3-NITROANILINE	0	4		0	4		0	4		0	4		0	4		0	4	
4,6-DINITRO-2-METHYLPHENOL	0	4		0	4		0	4		0	4		0	4		0	4	
4-AMINOBIPHENYL	0	4		0	4		0	4		0	4		0	4		0	4	
4-BROMOPHENYL PHENYL ETHER	0	4		0	4		0	4		0	4		0	4		0	4	
4-CHLORO-3-METHYLPHENOL	0	4		0	4		0	4		0	4		0	4		0	4	
4-CHLOROANILINE	0	4		0	4		0	4		0	4		0	4		0	4	
4-CHLOROPHENYL PHENYL ETHER	0	4		0	4		0	4		0	4		0	4		0	4	
4-NITROANILINE	0	4		0	4		0	4		0	4		0	4		0	4	
4-NITROPHENOL	0	4		0	4		0	4		0	4		0	4		0	4	
4-NITROQUINOLINE-1-OXIDE	0	4		0	4		0	4		0	4		0	4		0	4	
4-TERT BUTYLPHENOL	0	4		0	4		0	4		0	4		0	4		0	4	
5-NITRO-O-TOLUIDINE	0	4		0	4		0	4		0	4		0	4		0	4	
7,12-DIMETHYLBENZ(a)ANTHRACENE	0	4		0	4		0	4		0	4		0	4		0	4	
ACENAPHTHENE	0	4		0	4		0	4		0	4		0	4		0	4	
ACENAPHTHYLENE	0	4		0	4		1	4	9.3	0	4		2	4	23.1	3	4	35.0
ACETOPHENONE	0	4		0	4		0	4		0	4		0	4		0	4	
ALPHA, ALPHA DIMETHYLPHENETHYLAMINE	0	4		0	4		0	4		0	4		0	4		0	4	
ANILINE	0	4		0	4		0	4		0	4		0	4		0	4	
ANTHRACENE	0	4		0	4		4	4	32.6	4	4	19.0	2	4	26.2	4	4	30.5
ARAMITE (TOTAL)	0	4		0	4		0	4		0	4		0	4		0	4	
BENZO(a)ANTHRACENE	0	4		0	4		3	4	85.2	4	4	54.9	4	4	87.6	4	4	96.9
BENZO(a)PYRENE	0	4		0	4		4	4	79.4	4	4	61.1	4	4	85.0	4	4	111.0
BENZO(b)FLUORANTHENE	0	4		0	4		4	4	156.0	4	4	88.2	4	4	115.0	4	4	157.0
BENZO(g,h,i)PERYLENE	0	4		0	4		4	4	69.3	4	4	28.7	3	4	38.0	4	4	61.6
BENZO(k)FLUORANTHENE	0	4		0	4		4	4	148.0	4	4	44.2	3	4	57.6	4	4	73.2
BENZYL ALCOHOL	0	4		4	4	35.8	3	4	25.2	3	4	27.4	4	4	34.5	0	4	
BENZYL BUTYL PHTHALATE	0	4		0	4		0	4		0	4		0	4		0	4	
BIS(2-CHLOROETHOXY) METHANE	0	4		0	4		0	4		0	4		0	4		0	4	
BIS(2-CHLOROETHYL) ETHER	0	4		0	4		0	4		0	4		0	4		0	4	
BIS(2-ETHYLHEXYL) PHTHALATE	3	4	48.0	4	4	58.5	4	4	159.0	3	4	42.9	4	4	51.3	4	4	55.5
CARBAZOLE	0	4		0	4		2	4	22.6	2	4	13.0	0	4		3	4	14.1
CHLOROBENZILATE	0	4		0	4		0	4		0	4		0	4		0	4	
CHRYSENE	0	4		1	4	8.1	4	4	104.0	4	4	69.6	4	4	106.0	4	4	134.0
DIALLATE (TOTAL of Cis and Trans Isomers)	0	4		0	4		0	4		0	4		0	4		0	4	
DIBENZ(a,h)ANTHRACENE	0	4		0	4		0	4		0	4		0	4		0	4	
DIBENZOFURAN	0	4		0	4		1	4	11.1	0	4		0	4		0	4	
DIETHYL PHTHALATE	0	4		0	4		0	4		0	4		0	4		0	4	
DIMETHYL PHTHALATE	0	4		0	4		0	4		0	4		0	4		0	4	
DI-N-BUTYL PHTHALATE	0	4		0	4		2	4	21.8	3	4	15.0	3	4	12.4	4	4	50.7
DI-N-OCTYLPHTHALATE	0	4		0	4		0	4		0	4		0	4		0	4	

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	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect
DIPHENYLAMINE	0	4		0	4		0	4		0	4		0	4		0	4	
ETHYL METHANESULFONATE	0	4		0	4		0	4		0	4		0	4		0	4	
FLUORANTHENE	0	4		1	4	16.7	4	4	218.0	4	4	116.0	4	4	191.0	4	4	218.0
FLUORENE	0	4		0	4		1	4	18.3	0	4		0	4		1	4	11.9
HEXABROMOBENZENE	0	4		0	4		0	4		0	4		0	4		0	4	
HEXACHLOROBENZENE	0	4		0	4		4	4	46.9	4	4	56.0	2	4	150.0	4	4	153.0
HEXACHLOROBUTADIENE	0	4		0	4		0	4		0	4		0	4		0	4	
HEXACHLOROCYCLOPENTADIENE	0	4		0	4		0	4		0	4		0	4		0	4	
HEXACHLOROETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
HEXACHLOROPHENE	0	4		0	4		0	4		0	4		0	4		0	4	
HEXACHLOROPROPENE	0	4		0	4		0	4		0	4		0	4		0	4	
INDENO(1,2,3-c,d)PYRENE	0	4		0	4		1	4	51.4	0	4		0	4		0	4	
ISODRIN	0	4		0	4		0	4		0	4		0	4		0	4	
ISOPHORONE	0	4		0	4		0	4		0	4		0	4		0	4	
ISOSAFROLE	0	4		0	4		0	4		0	4		0	4		0	4	
METHAPYRILENE	0	4		0	4		0	4		0	4		0	4		0	4	
METHYL METHANESULFONATE	0	4		0	4		0	4		0	4		0	4		0	4	
NAPHTHALENE	0	4		0	4		0	4		0	4		0	4		0	4	
NITROBENZENE	0	4		0	4		0	4		0	4		0	4		0	4	
N-NITROSODIETHYLAMINE	0	4		0	4		0	4		0	4		0	4		0	4	
N-NITROSODIMETHYLAMINE	0	4		0	4		0	4		0	4		0	4		0	4	
N-NITROSO-DI-N-BUTYLAMINE	0	4		0	4		0	4		0	4		0	4		0	4	
N-NITROSODI-N-PROPYLAMINE	0	4		0	4		0	4		0	4		0	4		0	4	
N-NITROSODIPHENYLAMINE	0	4		0	4		0	4		0	4		0	4		0	4	
N-NITROSOMETHYLETHYLAMINE	0	4		0	4		0	4		0	4		0	4		0	4	
N-NITROSOMORPHOLINE	0	4		0	4		0	4		0	4		0	4		0	4	
N-NITROSOPIPERIDINE	0	4		0	4		0	4		0	4		0	4		0	4	
N-NITROSOPYRROLIDINE	0	4		0	4		0	4		0	4		0	4		0	4	
O-PHENYL PHENOL	0	4		0	4		1	4	53.9	0	4		0	4		0	4	
O-TOLUIDINE	0	4		0	4		0	4		0	4		0	4		0	4	
P-DIMETHYLAMINOAZOBENZENE	0	4		0	4		0	4		0	4		0	4		0	4	
PENTACHLOROBENZENE	0	4		0	4		0	4		0	4		0	4		0	4	
PENTACHLORONITROBENZENE	0	4		0	4		0	4		0	4		0	4		0	4	
PENTACHLOROPHENOL	0	4		0	4		1	4	114.0	0	4		0	4		0	4	
PHENACETIN	0	4		0	4		0	4		0	4		0	4		0	4	
PHENANTHRENE	0	4		0	4		4	4	167.0	4	4	60.7	4	4	100.0	4	4	113.0
PHENOL	0	4		0	4		0	4		0	4		0	4		0	4	
P-PHENYLENEDIAMINE	1	4	1210.0	0	4		0	4		0	4		0	4		0	4	
PRONAMIDE	0	4		0	4		0	4		0	4		0	4		0	4	
PYRENE	0	4		1	4	10.3	4	4	155.0	4	4	72.0	4	4	114.0	4	4	146.0
PYRIDINE	0	4		0	4		0	4		0	4		0	4		0	4	
RONNEL	0	4		0	4		0	4		0	4		0	4		0	4	
SAFROLE	0	4		0	4		0	4		0	4		0	4		0	4	
SYM-TRINITROBENZENE	0	4		0	4		0	4		0	4		0	4		0	4	
PCBs (ug/kg)																		
PCB-1016 (AROCLOR 1016)	0	4		0	4		0	4		0	4		0	4		0	4	
PCB-1221 (AROCLOR 1221)	0	4		0	4		0	4		0	4		0	4		0	4	
PCB-1232 (AROCLOR 1232)	0	4		0	4		0	4		0	4		0	4		0	4	

TABLE 3
Detected Constituents in Soil - ERA Support
Dow Chemical Company, Michigan Operations

Chemical Name	Plot 1: Reference Site - Sanford, MI Gladwin Forest			Plot 2: Reference Site - Chippewa Nature Preserve			Plot 3: Smith's Crossing (near Bailey Bridge Rd.)			Plot 4: Smith's Crossing			Plot 5: Freeland Festival Park			Plot 6: Imerman Park		
	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect
PCB-1242 (AROCLOR 1242)	0	4		0	4		0	4		0	4		0	4		0	4	
PCB-1248 (AROCLOR 1248)	0	4		0	4		0	4		0	4		0	4		0	4	
PCB-1254 (AROCLOR 1254)	0	4		0	4		0	4		0	4		0	4		0	4	
PCB-1260 (AROCLOR 1260)	0	4		0	4		0	4		0	4		0	4		0	4	
PCB-1262 (AROCLOR 1262)	0	4		0	4		0	4		0	4		0	4		0	4	
PCB-1268 (AROCLOR 1268)	0	4		0	4		0	4		0	4		0	4		0	4	
Pesticides (ug/kg)																		
1,2-DIBROMO-3-CHLOROPROPANE	0	4		0	4		0	4		0	4		0	4		0	4	
4,4'-DDD	0	4		0	4		4	4	9.3	3	4	50.2	3	4	13.6	2	4	50.3
4,4'-DDE	0	4		0	4		4	4	11.4	4	4	130.0	3	4	4.4	2	4	125.0
4,4'-DDT	0	4		0	4		3	4	20.0	4	4	258.0	2	4	18.4	2	4	156.0
ALDRIN	0	4		0	4		0	4		0	4		0	4		0	4	
ALPHA BHC	0	4		0	4		0	4		0	4		0	4		0	4	
ALPHA-CHLORDANE	0	4		0	4		0	4		0	4		0	4		0	4	
BETA BHC	0	4		0	4		0	4		0	4		0	4		0	4	
BP-6(PBB)	0	4		0	4		0	4		0	4		0	4		0	4	
CHLORDANE	0	4		0	4		0	4		0	4		0	4		0	4	
DELTA BHC	0	4		0	4		0	4		0	4		0	4		0	4	
DIELDRIN	0	4		0	4		1	4	3.9	0	4		1	4	2.2	0	4	
DIMETHOATE	0	4		0	4		0	4		0	4		0	4		0	4	
DISULFOTON	0	4		0	4		0	4		0	4		0	4		0	4	
ENDOSULFAN I	0	4		0	3		0	4		0	4		0	4		0	4	
ENDOSULFAN II	0	4		0	4		0	4		1	4	37.2	0	4		0	4	
ENDOSULFAN SULFATE	0	4		0	4		0	4		0	4		0	4		0	4	
ENDRIN	0	4		0	4		4	4	12.2	2	4	37.9	2	4	14.4	2	4	38.1
ENDRIN ALDEHYDE	0	4		0	4		0	4		0	4		0	4		0	4	
ENDRIN KETONE	0	4		0	4		0	4		0	4		0	4		0	4	
FAMPHUR	0	4		0	4		0	4		0	4		0	4		0	4	
GAMMA BHC (LINDANE)	0	4		0	4		0	4		0	4		0	4		1	4	18.0
GAMMA-CHLORDANE	0	4		0	4		0	4		0	4		0	4		0	4	
HEPTACHLOR	0	4		0	4		0	4		0	4		0	4		0	4	
HEPTACHLOR EPOXIDE	0	4		0	4		0	4		0	4		0	4		0	4	
KEPONE	0	2		0	4		0	4		0	4		0	4		0	4	
METHOXYCHLOR	0	4		0	4		1	4	8.1	2	4	150.0	3	4	32.7	0	4	
MIREX	0	4		0	4		0	4		0	4		0	4		0	4	
O,O,O-TRIETHYL PHOSPHOROTHIOATE	0	4		0	4		0	4		0	4		0	4		0	4	
O,O-DIETHYL O-2-PYRAZINYL PHOSPHOROTHIOATE (THIONAZIN)	0	4		0	4		0	4		0	4		0	4		0	4	
PARATHION, ETHYL (PARATHION)	0	4		0	4		0	4		0	4		0	4		0	4	
PARATHION, METHYL	0	4		0	4		0	4		0	4		0	4		0	4	
PHORATE	0	4		0	4		0	4		0	4		0	4		0	4	
TETRAETHYL DITHIOPYROPHOSPHATE (SULFOTEPP)	0	4		0	4		0	4		0	4		0	4		0	4	
TOXAPHENE	0	4		0	4		0	4		0	4		0	4		0	4	
Herbicides (ug/kg)																		
2,4,5-T (TRICHLOROPHENOXYACETIC ACID)	0	4		0	4		0	4		0	4		0	4		0	4	
2,4-D (DICHLOROPHENOXYACETIC ACID)	0	4		0	4		0	4		0	4		0	4		0	4	
DINOSEB	0	4		0	4		0	4		0	4		0	4		0	4	

TABLE 3
Detected Constituents in Soil - ERA Support
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Chemical Name	Plot 1: Reference Site - Sanford, MI Gladwin Forest			Plot 2: Reference Site - Chippewa Nature Preserve			Plot 3: Smith's Crossing (near Bailey Bridge Rd.)			Plot 4: Smith's Crossing			Plot 5: Freeland Festival Park			Plot 6: Imerman Park		
	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect
SILVEX (2,4,5-TP)	0	4		0	4		0	4		0	4		0	4		0	4	
Metals (ug/kg)																		
ANTIMONY	0	4		0	4		0	4		0	4		0	4		1	4	187.0
ARSENIC	4	4	3020.0	4	4	6050.0	3	4	2980.0	4	4	8910.0	4	4	5820.0	4	4	14200.0
BARIUM	4	4	34300.0	4	4	68800.0	4	4	21700.0	4	4	63500.0	4	4	58800.0	4	4	72200.0
BERYLLIUM	3	4	219.0	4	4	434.0	3	4	139.0	4	4	439.0	4	4	348.0	4	4	527.0
CADMIUM	0	4		4	4	533.0	3	4	313.0	4	4	610.0	4	4	678.0	4	4	897.0
CHROMIUM, TOTAL	4	4	5520.0	4	4	15400.0	4	4	6380.0	4	4	14500.0	4	4	10500.0	4	4	26400.0
COBALT	4	4	2830.0	4	4	5390.0	4	4	1830.0	4	4	5150.0	4	4	3530.0	4	4	5740.0
COPPER	4	4	3970.0	4	4	26900.0	4	4	13300.0	4	4	30100.0	4	4	13700.0	4	4	51900.0
LEAD	4	4	9210.0	4	4	15000.0	4	4	10900.0	4	4	21500.0	4	4	15000.0	4	4	40200.0
LITHIUM	4	4	4830.0	4	4	8770.0	4	4	3180.0	4	4	11200.0	4	4	8280.0	4	4	13100.0
MERCURY	4	4	25.2	4	4	66.7	4	4	82.4	4	4	119.0	4	4	114.0	4	4	239.0
NICKEL	4	4	5320.0	4	4	13200.0	4	4	4600.0	4	4	12900.0	4	4	8890.0	4	4	16300.0
SELENIUM	0	4		0	4		0	4		0	4		0	4		0	4	
SILVER	0	4		0	4		0	4		0	4		0	4		0	4	
THALLIUM	0	4		0	4		0	4		0	4		0	4		0	4	
TIN	0	4		0	4		1	4	1790.0	0	4		0	4		0	4	
VANADIUM	4	4	7690.0	4	4	14700.0	4	4	4180.0	4	4	13600.0	4	4	9080.0	4	4	16100.0
ZINC	4	4	18000.0	4	4	48700.0	4	4	36500.0	4	4	84100.0	4	4	73800.0	4	4	112000.0
Other (mg/kg)																		
CYANIDE, TOTAL	2	4	0.1	3	4	0.2	1	4	0.1	4	4	2.3	4	4	0.2	4	4	2.0
TOTAL ORGANIC CARBON	4	4	12802.0	4	4	26130.0	4	4	33798.0	4	4	39375.0	2	4	6659.0	4	4	27520.0

TABLE 4
Detected Constituents in Sediment - ERA Support
Dow Chemical Company, Michigan Operations

Chemical Name	Plot 1: Reference Site - Sanford, MI Gladwin Forest			Plot 2: Reference Site - Chippewa Nature Preserve			Plot 3: Smith's Crossing (near Bailey Bridge Rd.)			Plot 4: Smith's Crosiing			Plot 5: Freeland Festival Park			Plot 6: Imerman Park		
	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect
VOCs (ug/kg)																		
1,1,1,2-TETRACHLOROETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
1,1,1-TRICHLOROETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
1,1,2,2-TETRACHLOROETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
1,1,2-TRICHLOROETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
1,1-DICHLOROETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
1,1-DICHLOROETHENE	0	4		0	4		0	4		0	4		0	4		0	4	
1,2,3-TRICHLOROBENZENE	1	4	1.1	0	4		0	4		0	4		0	4		0	4	
1,2,3-TRICHLOROPROPANE	0	4		0	4		0	4		0	4		0	4		0	4	
1,2,4-TRICHLOROBENZENE	1	8	0.9	0	8		0	8		0	8		0	8		0	8	
1,2,4-TRIMETHYLBENZENE	4	4	2.9	4	4	3.4	4	4	2.1	4	4	2.7	4	4	3.0	4	4	1.7
1,2-DIBROMOETHANE (EDB)	0	4		0	4		0	4		0	4		0	4		0	4	
1,2-DICHLOROBENZENE	0	4		0	4		0	4		0	4		0	4		0	4	
1,2-DICHLOROETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
1,2-DICHLOROPROPANE	0	4		0	4		0	4		0	4		0	4		0	4	
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	4	4	1.0	4	4	1.3	0	4		0	4		2	4	3.4	1	4	1.4
1,3-DICHLOROBENZENE	0	4		0	4		0	4		0	4		0	4		0	4	
1,4-DICHLOROBENZENE	0	4		0	4		2	4	2.2	0	4		0	4		0	4	
2-HEXANONE	0	4		0	4		0	4		0	4		0	4		1	4	17.6
ACETONE	0	4		1	4	3.8	1	4	6.2	1	4	6.3	0	4		0	4	
ACETONITRILE	0	4		0	4		0	4		0	4		0	4		0	4	
ACROLEIN	0	4		0	4		0	4		0	4		0	4		0	4	
ACRYLONITRILE	0	4		0	4		0	4		0	4		0	4		0	4	
ALLYL CHLORIDE (3-CHLOROPROPENE)	0	4		0	4		0	4		0	4		0	4		0	4	
BENZENE	1	4	6.3	3	4	4.8	4	4	5.1	4	4	4.8	4	4	4.8	3	4	4.2
BROMOBENZENE	0	4		0	4		0	4		0	4		0	4		0	4	
BROMOCHLOROMETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
BROMODICHLOROMETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
BROMOFORM	0	4		0	4		0	4		0	4		0	4		0	4	
BROMOMETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
CARBON DISULFIDE	4	4	34.4	4	4	24.9	4	4	25.4	4	4	35.0	4	4	84.9	4	4	14.2
CARBON TETRACHLORIDE	0	4		0	4		0	4		0	4		0	4		0	4	
CHLOROBENZENE	0	4		0	4		1	4	4.4	0	4		0	4		0	4	
CHLOROETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
CHLOROFORM	0	4		0	4		0	4		0	4		0	4		0	4	
CHLOROMETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
CHLOROPRENE (2-CHLORO-1,3-BUTADIENE)	0	4		0	4		0	4		0	4		0	4		0	4	
cis-1,2-DICHLOROETHENE	0	4		0	4		0	4		0	4		0	4		0	4	
cis-1,3-DICHLOROPROPENE	0	4		0	4		0	4		0	4		0	4		0	4	
DIBROMOCHLOROMETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
DIBROMOMETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
DICHLORODIFLUOROMETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
DIETHYL ETHER (ETHYL ETHER)	0	4		0	4		0	4		0	4		0	4		0	4	
ETHYL BENZENE	4	4	4.4	4	4	4.9	4	4	2.9	4	4	3.9	4	4	4.9	4	4	2.5
ETHYL METHACRYLATE	0	4		0	4		0	4		0	4		0	4		0	4	
ISOBUTANOL	0	4		0	4		0	4		0	4		0	4		0	4	
ISOPROPYLBENZENE (CUMENE)	0	4		0	4		0	4		0	4		0	4		0	4	
m,p-XYLENES	4	4	5.4	4	4	5.6	4	4	3.8	4	4	4.8	4	4	5.7	4	4	2.8
METHYL ETHYL KETONE (2-BUTANONE)	0	4		0	4		0	4		0	4		0	4		0	4	

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Dow Chemical Company, Michigan Operations

Chemical Name	Plot 1: Reference Site - Sanford, MI Gladwin Forest			Plot 2: Reference Site - Chippewa Nature Preserve			Plot 3: Smith's Crossing (near Bailey Bridge Rd.)			Plot 4: Smith's Crosiing			Plot 5: Freeland Festival Park			Plot 6: Imerman Park		
	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect
METHYL IODIDE (IODOMETHANE)	0	4		0	4		0	4		0	4		0	4		0	4	
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	0	4		0	4		0	4		0	4		0	4		0	4	
METHYL METHACRYLATE	0	4		0	4		0	4		0	4		0	4		0	4	
METHYL tert-BUTYL ETHER (MTBE)	0	4		0	4		0	4		0	4		0	4		0	4	
METHYLACRYLONITRILE	0	4		0	4		0	4		0	4		0	4		0	4	
METHYLENE CHLORIDE	0	4		0	4		0	4		0	4		0	4		0	4	
N-BUTYLBENZENE	4	4	0.7	1	4	0.6	0	4		0	4		0	4		0	4	
N-PROPYLBENZENE	4	4	0.8	3	4	1.0	0	4		0	4		0	4		0	4	
O-XYLENE	4	4	2.7	4	4	2.4	4	4	1.5	4	4	2.0	4	4	2.7	3	4	1.1
PENTOCHLORETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
P-ISOPROPYLTOLUENE (P-CYMENE)	0	4		0	4		0	4		0	4		0	4		0	4	
PROPIONITRILE, ETHYL CYANIDE	0	4		0	4		0	4		0	4		0	4		0	4	
SEC-BUTYLBENZENE	0	4		0	4		0	4		0	4		0	4		0	4	
STYRENE	0	4		0	4		0	4		0	4		0	4		0	4	
TERT-BUTYLBENZENE	0	4		0	4		0	4		0	4		0	4		0	4	
TETRACHLOROETHENE (PCE)	0	4		0	4		0	4		0	4		0	4		0	4	
TETRAHYDROFURAN	0	4		0	4		0	4		0	4		0	4		0	4	
TOLUENE	4	4	13.1	4	4	12.0	4	4	5.8	4	4	10.3	4	4	8.6	4	4	5.5
TRANS-1,2-DICHLOROETHENE	0	4		0	4		0	4		0	4		0	4		0	4	
TRANS-1,3-DICHLOROPROPENE	0	4		0	4		0	4		0	4		0	4		0	4	
TRANS-1,4-DICHLORO-2-BUTENE	0	4		0	4		0	4		0	4		0	4		0	4	
TRICHLOROETHENE (TCE)	0	4		0	4		0	4		0	4		0	4		0	4	
TRICHLOROFLUOROMETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
VINYL ACETATE	0	4		0	4		0	4		0	4		0	4		0	4	
VINYL CHLORIDE	0	4		0	4		0	4		0	4		0	4		0	4	
XYLENES, TOTAL	4	4	7.8	4	4	7.9	4	4	5.3	4	4	6.7	4	4	8.3	4	4	4.0
SVOCs (ug/kg)																		
1,2,3,4-TETRACHLOROBENZENE	0	4		0	4		0	4		0	4		0	4		0	4	
1,2,4,5-TETRACHLOROBENZENE	0	4		0	4		0	4		0	4		0	4		0	4	
1,3-DINITROBENZENE	0	4		0	4		0	4		0	4		0	4		0	4	
1,4-DIOXANE	0	4		0	4		0	4		0	4		0	4		0	4	
1,4-NAPHTHOQUINONE	0	4		0	4		0	4		0	4		0	4		0	4	
1-NAPHTHYLAMINE	0	4		0	4		0	4		0	4		0	4		0	4	
2,3,4,6-TETRACHLOROPHENOL	0	4		0	4		1	4	158.0	0	4		0	4		0	4	
2,4,5-TRICHLOROPHENOL	0	4		0	4		1	4	12.1	0	4		0	4		0	4	
2,4,6-TRICHLOROPHENOL	0	4		0	4		0	4		0	4		0	4		0	4	
2,4-DICHLOROPHENOL	0	4		0	4		0	4		0	4		0	4		0	4	
2,4-DIMETHYLPHENOL	0	4		0	4		0	4		0	4		0	4		0	4	
2,4-DINITROPHENOL	0	4		0	4		0	4		0	4		0	4		0	4	
2,4-DINITROTOLUENE	0	4		0	4		0	4		0	4		0	4		0	4	
2,6-DICHLOROPHENOL	0	4		0	4		0	4		0	4		0	4		0	4	
2,6-DINITROTOLUENE	0	4		0	4		0	4		0	4		0	4		0	4	
2-CHLORONAPHTHALENE	0	4		0	4		0	4		0	4		0	4		0	4	
2-CHLOROPHENOL	0	4		0	4		0	4		0	4		0	4		0	4	
2-METHYLNAPHTHALENE	0	4		0	4		0	4		0	4		0	4		0	4	
2-METHYLPHENOL (O-CRESOL)	0	4		0	4		0	4		0	4		0	4		0	4	
2-NAPHTHYLAMINE	0	4		0	4		0	4		0	4		0	4		0	4	
2-NITROANILINE	0	4		0	4		0	4		0	4		0	4		0	4	

TABLE 4
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Chemical Name	Plot 1: Reference Site - Sanford, MI Gladwin Forest			Plot 2: Reference Site - Chippewa Nature Preserve			Plot 3: Smith's Crossing (near Bailey Bridge Rd.)			Plot 4: Smith's Crosiing			Plot 5: Freeland Festival Park			Plot 6: Imerman Park		
	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect
2-NITROPHENOL	0	4		0	4		0	4		0	4		0	4		0	4	
2-PICOLINE (ALPHA-PICOLINE)	0	4		0	4		0	4		0	4		0	4		0	4	
3 & 4-METHYLPHENOL (M,P-CRESOL)	0	4		0	4		0	4		0	4		0	4		0	4	
3,3'-DICHLOROBENZIDINE	0	4		0	4		0	4		0	4		0	4		0	4	
3,3'-DIMETHYLBENZIDINE	0	4		0	4		0	4		0	4		0	4		0	4	
3-METHYLCHOLANTHRENE	0	4		0	4		0	4		0	4		0	4		0	4	
3-NITROANILINE	0	4		0	4		0	4		0	4		0	4		0	4	
4,6-DINITRO-2-METHYLPHENOL	0	4		0	4		0	4		0	4		0	4		0	4	
4-AMINOBIPHENYL	0	4		0	4		0	4		0	4		0	4		0	4	
4-BROMOPHENYL PHENYL ETHER	0	4		0	4		0	4		0	4		0	4		0	4	
4-CHLORO-3-METHYLPHENOL	0	4		0	4		0	4		0	4		0	4		0	4	
4-CHLOROANILINE	0	4		0	4		0	4		0	4		0	4		0	4	
4-CHLOROPHENYL PHENYL ETHER	0	4		0	4		0	4		0	4		0	4		0	4	
4-NITROANILINE	0	4		0	4		0	4		0	4		0	4		0	4	
4-NITROPHENOL	0	4		0	4		0	4		0	4		0	4		0	4	
4-NITROQUINOLINE-1-OXIDE	0	4		0	4		0	4		0	4		0	4		0	4	
4-TERT BUTYLPHENOL	0	4		0	4		0	4		0	4		0	4		0	4	
5-NITRO-O-TOLUIDINE	0	4		0	4		0	4		0	4		0	4		0	4	
7,12-DIMETHYLBENZ(a)ANTHRACENE	0	4		0	4		0	4		0	4		0	4		0	4	
ACENAPHTHENE	0	4		0	4		0	4		0	4		1	4	11.9	1	4	18.0
ACENAPHTHYLENE	1	4	183.0	0	4		0	4		0	4		0	4		0	4	
ACETOPHENONE	0	4		0	4		0	4		0	4		0	4		0	4	
ALPHA, ALPHA DIMETHYLPHENETHYLAMINE	0	4		0	4		0	4		0	4		0	4		0	4	
ANILINE	0	4		0	4		0	4		0	4		0	4		0	4	
ANTHRACENE	1	4	41.5	1	4	16.2	1	4	8.4	1	4	15.3	1	4	14.6	2	4	53.7
ARAMITE (TOTAL)	0	4		0	4		0	4		0	4		0	4		0	4	
BENZO(a)ANTHRACENE	1	4	256.0	1	4	51.7	0	4		0	4		1	4	51.4	2	4	90.9
BENZO(a)PYRENE	1	4	331.0	1	4	34.5	1	4	10.5	2	4	31.1	1	4	58.6	2	4	65.0
BENZO(b)FLUORANTHENE	1	4	607.0	1	4	38.8	0	4		2	4	27.6	1	4	68.2	2	4	60.4
BENZO(g,h,i)PERYLENE	1	4	345.0	1	4	16.2	0	4		2	4	12.5	1	4	65.6	2	4	23.3
BENZO(k)FLUORANTHENE	1	4	207.0	1	4	13.9	0	4		2	4	44.8	1	4	28.6	2	4	48.7
BENZYL ALCOHOL	0	4		0	4		0	4		0	4		0	4		0	4	
BENZYL BUTYL PHTHALATE	0	4		0	4		0	4		0	4		0	4		0	4	
BIS(2-CHLOROETHOXY) METHANE	0	4		0	4		0	4		0	4		0	4		0	4	
BIS(2-CHLOROETHYL) ETHER	0	4		0	4		0	4		0	4		0	4		0	4	
BIS(2-ETHYLHEXYL) PHTHALATE	0	4		0	4		0	4		0	4		1	4	43.1	0	4	
CARBAZOLE	1	4	34.8	0	4		0	4		0	4		0	4		1	4	19.0
CHLOROBENZILATE	0	4		0	4		0	4		0	4		0	4		0	4	
CHRYSENE	1	4	414.0	1	4	38.8	1	4	8.2	2	4	43.8	1	4	43.7	2	4	90.0
DIALLATE (TOTAL of Cis and Trans Isomers)	0	4		0	4		0	4		0	4		0	4		0	4	
DIBENZ(a,h)ANTHRACENE	0	4		0	4		0	4		0	4		0	4		0	4	
DIBENZOFURAN	0	4		0	4		0	4		0	4		0	4		1	4	17.4
DIETHYL PHTHALATE	0	4		0	4		0	4		0	4		0	4		0	4	
DIMETHYL PHTHALATE	0	4		0	4		0	4		0	4		0	4		0	4	
DI-N-BUTYL PHTHALATE	0	4		0	4		2	4	60.2	3	4	149.0	0	4		0	4	
DI-N-OCTYLPHTHALATE	0	4		0	4		0	4		0	4		0	4		0	4	
DIPHENYLAMINE	0	4		0	4		0	4		0	4		0	4		0	4	
ETHYL METHANESULFONATE	0	4		0	4		0	4		0	4		0	4		0	4	
FLUORANTHENE	1	4	247.0	1	4	65.9	2	4	14.5	2	4	94.2	2	4	67.9	2	4	225.0

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	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect
FLUORENE	1	4	25.8	0	4		0	4		0	4		0	4		1	4	32.3
HEXABROMOBENZENE	0	4		0	4		0	4		0	4		0	4		0	4	
HEXACHLOROBENZENE	0	4		0	4		0	4		0	4		0	4		0	4	
HEXACHLOROBUTADIENE	0	4		0	4		0	4		0	4		0	4		0	4	
HEXACHLOROCYCLOPENTADIENE	0	4		0	4		0	4		0	4		0	4		0	4	
HEXACHLOROETHANE	0	4		0	4		0	4		0	4		0	4		0	4	
HEXACHLOROPHENE	0	4		0	4		0	4		0	4		0	4		0	4	
HEXACHLOROPROPENE	0	4		0	4		0	4		0	4		0	4		0	4	
INDENO(1,2,3-c,d)PYRENE	1	4	305.0	0	4		0	4		0	4		0	4		0	4	
ISODRIN	0	4		0	4		0	4		0	4		0	4		0	4	
ISOPHORONE	0	4		0	4		0	4		0	4		0	4		0	4	
ISOSAFROLE	0	4		0	4		0	4		0	4		0	4		0	4	
METHAPYRILENE	0	4		0	4		0	4		0	4		0	4		0	4	
METHYL METHANESULFONATE	0	4		0	4		0	4		0	4		0	4		0	4	
NAPHTHALENE	0	4		0	4		0	4		0	4		0	4		0	4	
NITROBENZENE	0	4		0	4		0	4		0	4		0	4		0	4	
N-NITROSODIETHYLAMINE	0	4		0	4		0	4		0	4		0	4		0	4	
N-NITROSODIMETHYLAMINE	0	4		0	4		0	4		0	4		0	4		0	4	
N-NITROSO-DI-N-BUTYLAMINE	0	4		0	4		0	4		0	4		0	4		0	4	
N-NITROSODI-N-PROPYLAMINE	0	4		0	4		0	4		0	4		0	4		0	4	
N-NITROSODIPHENYLAMINE	0	4		0	4		0	4		0	4		0	4		0	4	
N-NITROSOMETHYLETHYLAMINE	0	4		0	4		0	4		0	4		0	4		0	4	
N-NITROSOMORPHOLINE	0	4		0	4		0	4		0	4		0	4		0	4	
N-NITROSOPIPERIDINE	0	4		0	4		0	4		0	4		0	4		0	4	
N-NITROSOPYRROLIDINE	0	4		0	4		0	4		0	4		0	4		0	4	
O-PHENYL PHENOL	0	4		0	4		0	4		0	4		0	4		0	4	
O-TOLUIDINE	0	4		0	4		0	4		0	4		0	4		0	4	
P-DIMETHYLAMINOAZOBENZENE	0	4		0	4		0	4		0	4		0	4		0	4	
PENTACHLOROBENZENE	0	4		0	4		0	4		0	4		0	4		0	4	
PENTACHLORONITROBENZENE	0	4		0	4		0	4		0	4		0	4		0	4	
PENTACHLOROPHENOL	0	4		0	4		1	4	75.2	0	4		0	4		0	4	
PHENACETIN	0	4		0	4		0	4		0	4		0	4		0	4	
PHENANTHRENE	1	4	25.5	1	4	21.9	1	4	14.1	2	4	63.1	2	4	35.5	2	4	239.0
PHENOL	0	4		0	4		0	4		0	4		0	4		0	4	
P-PHENYLENEDIAMINE	0	4		0	4		0	4		0	4		0	4		0	4	
PRONAMIDE	0	4		0	4		0	4		0	4		0	4		0	4	
PYRENE	1	4	261.0	1	4	60.9	1	4	15.2	2	4	89.8	2	4	57.8	2	4	167.0
PYRIDINE	0	4		0	4		0	4		0	4		0	4		0	4	
RONNEL	0	4		0	4		0	4		0	4		0	4		0	4	
SAFROLE	0	4		0	4		0	4		0	4		0	4		0	4	
SYM-TRINITROBENZENE	0	4		0	4		0	4		0	4		0	4		0	4	
PCBs (ug/kg)																		
PCB-1016 (AROCLOR 1016)	0	4		0	4		0	4		0	4		0	4		0	4	
PCB-1221 (AROCLOR 1221)	0	4		0	4		0	4		0	4		0	4		0	4	
PCB-1232 (AROCLOR 1232)	0	4		0	4		0	4		0	4		0	4		0	4	
PCB-1242 (AROCLOR 1242)	0	4		0	4		0	4		0	4		0	4		0	4	
PCB-1248 (AROCLOR 1248)	0	4		0	4		0	4		0	4		0	4		0	4	
PCB-1254 (AROCLOR 1254)	0	4		0	4		0	4		0	4		0	4		0	4	
PCB-1260 (AROCLOR 1260)	0	4		0	4		0	4		0	4		0	4		0	4	

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	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect
PCB-1262 (AROCLOR 1262)	0	4		0	4		0	4		0	4		0	4		0	4	
PCB-1268 (AROCLOR 1268)	0	4		0	4		0	4		0	4		0	4		0	4	
Pesticides (ug/kg)																		
1,2-DIBROMO-3-CHLOROPROPANE	0	4		0	4		0	4		0	4		0	4		0	4	
4,4'-DDD	0	4		4	4	10.0	0	4		0	4		0	4		0	4	
4,4'-DDE	0	4		2	4	4.9	0	4		0	4		0	4		0	4	
4,4'-DDT	0	4		2	4	15.5	0	4		0	4		0	4		0	4	
ALDRIN	0	4		0	4		0	4		0	4		0	4		0	4	
ALPHA BHC	0	4		0	4		0	4		0	4		0	4		0	4	
ALPHA-CHLORDANE	0	4		0	4		0	4		0	4		0	4		0	4	
BETA BHC	0	4		0	4		0	4		0	4		0	4		0	4	
BP-6 (2,2',4,4',5,5'-HEXABROMOBIPHENYL)	0	4		0	4		0	4		0	4		0	4		0	4	
CHLORDANE	0	4		0	4		0	4		0	4		0	4		0	4	
DELTA BHC	0	4		0	4		0	4		0	4		0	4		0	4	
DIELDRIN	0	4		0	4		0	4		0	4		0	4		0	4	
DIMETHOATE	0	4		0	4		0	4		0	4		0	4		0	4	
DISULFOTON	0	4		0	4		0	4		0	4		0	4		0	4	
ENDOSULFAN I	0	4		0	4		0	4		0	4		0	4		0	4	
ENDOSULFAN II	0	4		0	4		0	4		0	4		0	4		0	4	
ENDOSULFAN SULFATE	0	4		0	4		0	4		0	4		0	4		0	4	
ENDRIN	0	4		0	4		0	4		0	4		0	4		0	4	
ENDRIN ALDEHYDE	0	4		0	4		0	4		0	4		0	4		0	4	
ENDRIN KETONE	0	4		0	4		0	4		0	4		0	4		0	4	
FAMPHUR	0	4		0	4		0	4		0	4		0	4		0	4	
GAMMA BHC (LINDANE)	0	4		0	4		0	4		0	4		0	4		0	4	
GAMMA-CHLORDANE	0	4		0	4		0	4		0	4		0	4		0	4	
HEPTACHLOR	0	4		0	4		0	4		0	4		0	4		0	4	
HEPTACHLOR EPOXIDE	0	4		0	4		0	4		0	4		0	4		0	4	
KEPONE	0	4		0	4		0	4		0	4		0	4		0	4	
METHOXYCHLOR	0	4		0	4		0	4		0	4		0	4		0	4	
MIREX	0	4		0	4		0	4		0	4		0	4		0	4	
O,O,O-TRIETHYL PHOSPHOROTHIOATE	0	4		0	4		0	4		0	4		0	4		0	4	
O,O-DIETHYL O-2-PYRAZINYL PHOSPHOROTHIOATE (THIONAZIN)	0	4		0	4		0	4		0	4		0	4		0	4	
PARATHION, ETHYL (PARATHION)	0	4		0	4		0	4		0	4		0	4		0	4	
PARATHION, METHYL	0	4		0	4		0	4		0	4		0	4		0	4	
PHORATE	0	4		0	4		0	4		0	4		0	4		0	4	
TETRAETHYL DITHIOPYROPHOSPHATE (SULFOTEPP)	0	4		0	4		0	4		0	4		0	4		0	4	
TOXAPHENE	0	4		0	4		0	4		0	4		0	4		0	4	
Herbecides (ug/kg)																		
2,4,5-T (TRICHLOROPHENOXYACETIC ACID)	0	4		0	4		0	4		0	4		0	4		0	4	
2,4-D (DICHLOROPHENOXYACETIC ACID)	0	4		0	4		0	4		0	4		0	4		0	4	
DINOSEB	0	4		0	4		0	4		0	4		0	4		0	4	
SILVEX (2,4,5-TP)	0	4		0	4		0	4		0	4		0	4		0	4	
Metals (ug/kg)																		
ANTIMONY	0	4		0	4		0	4		0	4		0	4		0	4	
ARSENIC	4	4	1960.0	3	4	1220.0	2	4	2800.0	1	4	4700.0	3	4	2260.0	2	4	3170.0
BARIUM	4	4	19900.0	4	4	11600.0	4	4	13400.0	4	4	11600.0	4	4	6260.0	4	4	11700.0

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Dow Chemical Company, Michigan Operations

Chemical Name	Plot 1: Reference Site - Sanford, MI Gladwin Forest			Plot 2: Reference Site - Chippewa Nature Preserve			Plot 3: Smith's Crossing (near Bailey Bridge Rd.)			Plot 4: Smith's Crosiing			Plot 5: Freeland Festival Park			Plot 6: Imerman Park		
	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect	Detects	Number of Samples	Max Detect
BERYLLIUM	4	4	182.0	4	4	135.0	4	4	69.9	4	4	75.7	4	4	164.0	2	4	98.3
CADMIUM	0	4		0	4		0	4		0	4		0	4		2	4	378.0
CHROMIUM, TOTAL	4	4	2400.0	4	4	3730.0	4	4	4550.0	4	4	4880.0	4	4	5120.0	4	4	5880.0
COBALT	4	4	1170.0	4	4	1380.0	4	4	1710.0	4	4	1530.0	4	4	1650.0	4	4	1600.0
COPPER	3	4	1990.0	4	4	2700.0	1	4	1670.0	1	4	1680.0	1	4	1590.0	4	4	2910.0
LEAD	4	4	2410.0	4	4	3830.0	4	4	2780.0	4	4	1980.0	4	4	1840.0	4	4	2210.0
LITHIUM	4	4	2930.0	4	4	2940.0	4	4	2390.0	4	4	2260.0	4	4	3180.0	4	4	2350.0
MERCURY	4	4	4.1	4	4	4.1	0	4		0	4		0	4		4	4	13.7
NICKEL	4	4	2560.0	4	4	2230.0	4	4	2730.0	4	4	3080.0	4	4	2950.0	4	4	2410.0
SELENIUM	0	4		0	4		0	4		0	4		0	4		0	4	
SILVER	0	4		0	4		0	4		0	4		0	4		0	4	
THALLIUM	0	4		0	4		0	4		0	4		1	4	1400.0	0	4	
TIN	0	4		0	4		0	4		0	4		0	4		1	4	76200.0
VANADIUM	4	4	4120.0	4	4	4780.0	4	4	2970.0	4	4	3460.0	4	4	4280.0	4	4	3170.0
ZINC	4	4	6760.0	4	4	12300.0	4	4	71300.0	4	4	13600.0	4	4	26700.0	4	4	22300.0
Other (mg/kg)																		
CYANIDE, TOTAL	4	4	4.6	4	4	7.0	3	4	2.5	3	4	7.1	4	4	2.3	1	4	1.1
TOTAL ORGANIC CARBON	0	4		0	4		0	4		0	4		0	4		1	4	1159.0

Figure

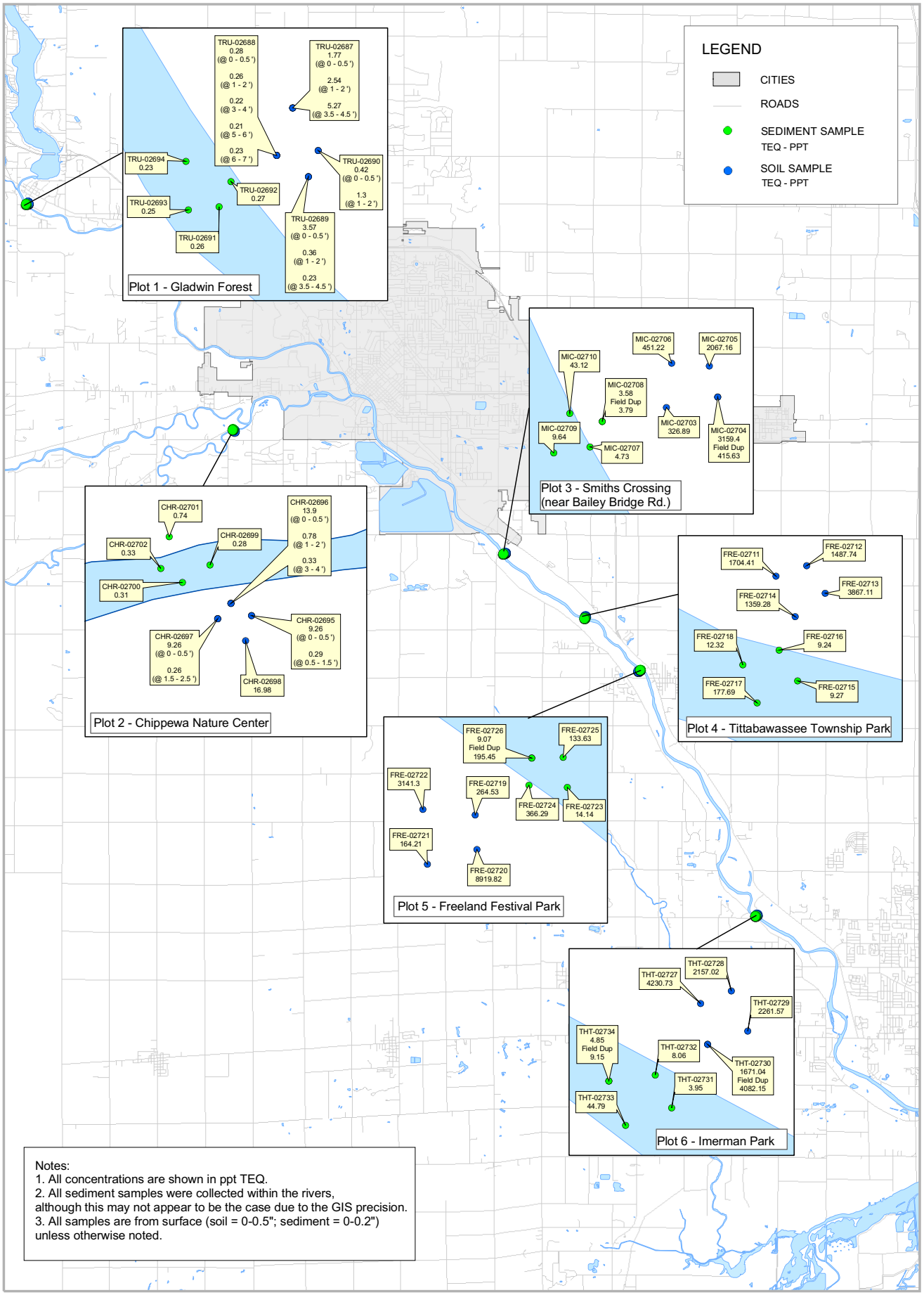

FIGURE 1-1
Dioxin TEQ Concentrations from ERA Support Soil and Sediment Sampling
ERA Support Data Report
Dow Midland Offsite Corrective Actions Program

CH2MHILL

Appendix A
Sample Station Summary

TABLE A-1
Sample Station Summary
Dow MOCA – ERA Support Sampling

Station ID	Northing	Easting	Sample ID	Sample Depth Interval	Analytical Batch
CHR-02695	765367.00989686	13141613.0021610	060204-SOI-02695-00.5	0-0.5	204060425/25032
CHR-02695	765367.00989686	13141613.0021610	060204-SOI-02695-01.5	0.5-1.5	204060425/25032
CHR-02696	765399.30515686	13141559.6117187	060204-SOI-02696-00.5	0-0.5	204060425/25032
CHR-02696	765399.30515686	13141559.6117187	060204-SOI-02696-02.0	1-2	204060425/25032
CHR-02696	765399.30515686	13141559.6117187	060204-SOI-02696-04.0	3-4	204060425/204060509/25032
CHR-02697	765359.31427275	13141525.4179058	060204-SOI-02697-00.5	0-0.5	204060425/25032
CHR-02697	765359.31427275	13141525.4179058	060204-SOI-02697-00.5-D	0-0.5	204060425/25032
CHR-02697	765359.31427275	13141525.4179058	060204-SOI-02697-02.5	1.5-2.5	204060425/25032
CHR-02698	765302.12326401	13141598.2032890	060204-SOI-02698-00.5	0-0.5	204060425/25032
FRE-02711	744827.69925104	13180400.7368453	060404-SOI-02711-00.5	0-0.5	204060509/25040
FRE-02712	744849.82450890	13180467.5506191	060404-SOI-02712-00.5	0-0.5	204060509/25040
FRE-02713	744790.61653224	13180507.4894427	060404-SOI-02713-00.5	0-0.5	204060509/25040
FRE-02714	744740.10371104	13180442.1587911	060404-SOI-02714-00.5	0-0.5	204060509/25040
FRE-02719	738806.19974040	13186387.0484284	060304-SOI-02719-00.5	0-0.5	204060509/25041
FRE-02720	738737.05182083	13186390.6120142	060304-SOI-02720-00.5	0-0.5	204060425/204060509/25041
FRE-02721	738707.95120931	13186291.1177929	060304-SOI-02721-00.5	0-0.5	204060509/25041
FRE-02722	738817.25913436	13186282.5613651	060304-SOI-02722-00.5	0-0.5	204060509/25041
MIC-02703	751785.17118242	13171532.9393020	060304-SOI-02703-00.5	0-0.5	204060509/25041
MIC-02704	751805.25840742	13171632.8169052	060304-SOI-02704-00.5	0-0.5	204060509/25041
MIC-02704	751805.25840742	13171632.8169052	060304-SOI-02704-00.5-D	0-0.5	204060509/25041
MIC-02705	751865.94634652	13171616.7263010	060304-SOI-02705-00.5	0-0.5	204060509/25041
MIC-02706	751871.45106650	13171542.7441283	060304-SOI-02706-00.5	0-0.5	204060509/25041
THT-02727	711828.45064237	13199410.3319258	060404-SOI-02727-00.5	0-0.5	204060509/25040

TABLE A-1
Sample Station Summary
Dow MOCA – ERA Support Sampling

Station ID	Northing	Easting	Sample ID	Sample Depth Interval	Analytical Batch
THT-02728	711851.84551420	13199466.3487147	060404-SOI-02728-00.5	0-0.5	204060509/25040
THT-02729	711777.76719517	13199496.6124118	060404-SOI-02729-00.5	0-0.5	204060509/25040
THT-02730	711753.85668371	13199422.9301136	060404-SOI-02730-00.5	0-0.5	204060509/25040
THT-02730	711753.85668371	13199422.9301136	060404-SOI-02730-00.5-D	0-0.5	204060509/25040
TRU-02687	790591.14750209	13118737.7895843	060104-SOI-02687-00.5-D	0-0.5	204060324/25027
TRU-02687	790591.14750209	13118737.7895843	060104-SOI-02687-00.5	0-0.5	204060324/25072
TRU-02687	790591.14750209	13118737.7895843	060104-SOI-02687-02.0	1-2	204060324/204060425/25027
TRU-02687	790591.14750209	13118737.7895843	060104-SOI-02687-04.5	3.5-4.5	204060324/25027
TRU-02688	790483.04404016	13118701.1853406	060104-SOI-02688-00.5	0-0.5	204060324/25027
TRU-02688	790483.04404016	13118701.1853406	060104-SOI-02688-02.0	1-2	204060324/25027
TRU-02688	790483.04404016	13118701.1853406	060104-SOI-02688-04.0	3-4	204060324/25027
TRU-02688	790483.04404016	13118701.1853406	060104-SOI-02688-06.0	5-6	204060324/25027
TRU-02688	790483.04404016	13118701.1853406	060104-SOI-02688-07.0	6-7	204060324/25027
TRU-02689	790435.03313188	13118773.5889969	060104-SOI-02689-00.5	0-0.5	204060324/25027
TRU-02689	790435.03313188	13118773.5889969	060104-SOI-02689-02.0	1-2	204060324/25027
TRU-02689	790435.03313188	13118773.5889969	060104-SOI-02689-04.5	3.5-4.5	204060324/25027
TRU-02690	790494.66601846	13118795.9438626	060104-SOI-02690-00.5	0-0.5	204060324/25027
TRU-02690	790494.66601846	13118795.9438626	060104-SOI-02690-02.0	1-2	204060324/25027

TABLE A-2
QC Sample Summary
Dow MOCA – ERA Support Sampling

QC Sample Type	Number of QC Samples Collected	Actual Event Frequency	MOCA QAPP-Specified Frequency[1]
Trip Blanks	11	One per cooler containing samples for VOC analysis	One per cooler containing samples for VOC analysis.
Matrix Spikes/Matrix Spike Duplicates	2	4.9%	5.0%
Field Duplicates	4	9.8%	10%
Field Blanks	2*	4.9%	One per source of water used for decontamination
Equipment Blanks	2	4.9%	5.0%

[1] MOCA Program Requirement. Not necessary to meet this on a project-specific or media-specific basis..
* - Field blank 060204-QCW-02743-B did not contain sample containers for SVOC analysis. Field blank 060304-QCW-02744-B did not contain a sample container for TOC analysis.

TABLE A-3
Sample Station Summary
Dow MOCA – ERA Support Sampling

Station ID	Northing	Easting	Sample ID	Sample Depth Interval (ft.)	Analytical Batch
CHR-02699	765499.20048020	13141504.9419111	062904-SED-02699-00.2	0-0.2	204063023/25104
CHR-02700	765453.33325440	13141433.4080832	062904-SED-02700-00.2	0-0.2	204063023/25104
CHR-02701	765572.05850760	13141398.7836199	062904-SED-02701-00.2	0-0.2	204063023/25104
CHR-02702	765489.86264560	13141377.6794184	062904-SED-02702-00.2	0-0.2	204063023/25104
FRE-02715	744601.77355420	13180447.5877071	063004-SED-02715-00.2	0-0.2	204070208/25108
FRE-02716	744667.46255530	13180407.8073088	063004-SED-02716-00.2	0-0.2	204070208/25108
FRE-02717	744553.94177620	13180360.1578401	063004-SED-02717-00.2	0-0.2	204070208/25108
FRE-02718	744636.25809250	13180329.4630902	063004-SED-02718-00.2	0-0.2	204070208/25108
FRE-02723	738861.18675550	13186570.3195981	063004-SED-02723-00.2	0-0.2	204070208/25108
FRE-02724	738865.65970140	13186493.6837365	063004-SED-02724-00.2	0-0.2	204070208/25108
FRE-02725	738921.29244450	13186562.1414993	063004-SED-02725-00.2	0-0.2	204070208/25108
FRE-02726	738919.39949370	13186499.7127128	063004-SED-02726-00.2	0-0.2	204070208/25108
FRE-02726	738919.39949370	13186499.7127128	063004-SED-02726-00.2-D	0-0.2	204070208/25108
MIC-02707	751707.86357190	13171383.6847607	063004-SED-02707-00.2	0-0.2	204070208/25108
MIC-02708	751757.34912300	13171407.5558159	063004-SED-02708-00.2	0-0.2	204070208/25108
MIC-02708	751757.34912300	13171407.5558159	063004-SED-02708-00.2-D	0-0.2	204070208/25108
MIC-02709	751696.58412850	13171312.6318133	063004-SED-02709-00.2	0-0.2	204070208/25108
MIC-02710	751773.62680640	13171343.6385509	063004-SED-02710-00.2	0-0.2	204070208/25108
THT-02731	711637.17938430	13199357.2068423	062904-SED-02731-00.2	0-0.2	204063023/20407 0208/25104
THT-02732	711697.15480300	13199326.6545232	062904-SED-02732-00.2	0-0.2	204063023/25104
THT-02733	711604.84688760	13199272.1500566	062904-SED-02733-00.2	0-0.2	204063023/25104
THT-02734	711686.28496590	13199241.6845073	062904-SED-02734-00.2	0-0.2	204063023/25104
THT-02734	711686.28496590	13199241.6845073	062904-SED-02734-00.2-D	0-0.2	204063023/25104
TRU-02691	790367.25776800	13118570.7168383	062804-SED-02691-00.2	0-0.2	204063023/25103
TRU-02691	790367.25776800	13118570.7168383	062804-SED-02692-00.2	0-0.2	204063023/25103
TRU-02693	790359.43711170	13118501.4681201	062804-SED-02693-00.2	0-0.2	204063023/25103
TRU-02694	790469.91488880	13118496.0703482	062804-SED-02694-00.2	0-0.2	204063023/25103

TABLE A-4
QC Sample Summary
Dow MOCA – ERA Support Sampling

QC Sample Type	Number of QC Samples Collected	Actual Event Frequency	MOCA QAPP-Specified Frequency[1]
Trip Blanks	2	One per cooler containing samples for VOC analysis	One per cooler containing samples for VOC analysis.
Matrix Spikes/Matrix Spike Duplicates	3	12.5%	5.0%
Field Duplicates	3	12.5%	10%
Field Blanks	0*	0%	One per source of water used for decontamination
Equipment Blanks	2	8.3%	5.0%

[1] = Frequency requirements are program wide frequencies and requirements, if not met above, will be met on a program wide basis.
* - The Tittabawassee River water was used to decontaminate the sample equipment so no Field Blank was collected.

Appendix B
Analytical Validation Summary

Data Validation Summary – Midland ERA Support Sampling

The purpose of this document is to present the results of the data validation process for the samples collected for The Dow Chemical Company ERA Support Sampling Event at the Dow Chemical Company site in Midland, Michigan. The samples were collected between the dates of June 14 and July 16, 2004.

The Quality Control areas that were reviewed and the resulting findings are documented within each subsection that follows. This data was validated for compliance with the analytical method requirements. This process also included a review of the data to assess the accuracy, precision, and completeness based upon procedures described in the guidance documents such as the Environmental Protection Agency (EPA) National Functional Guidelines for Inorganic Data Review (EPA 2002), National Functional Guidelines for Organic Data Review (EPA 1999), National Functional Guidelines for Chlorinated Dioxin/Furan Data Review (EPA 2002), and the Quality Control Criteria provided in the Quality Assurance Project Plan (QAPP). Quality assurance/Quality control (QA/QC) summary forms and data reports provided by the laboratory were reviewed.

Samples were submitted to Gulf Coast Analytical Laboratories, Inc., in Baton Rouge, Louisiana for all analyses, except for the Dioxin/Furan analyses. The samples requiring Dioxin/Furan analyses were submitted to Alta Analytical Laboratory, Inc., in El Dorado Hills, California.

Sample results that were not within the acceptance limits were appended with a primary qualifying flag by CH2M HILL, which consisted of a single- or double-letter code that indicated a possible problem with the data. The qualifying flags originated during the data review and validation processes. In addition, secondary, "sub-qualifier" flags were also applied. The secondary qualifiers provide the reasoning behind the assignment of a qualifier flag to the data.

Table B.1 lists the changes in data qualifiers, due to the validation process, except for specific samples requiring volatile analyses that were qualified due to low surrogate recoveries only. It contains columns for the Laboratory Qualifier (Lab Qual) as received from the laboratory, primary qualifiers (Final Qual), and secondary qualifiers (Validation Reasons). The primary and secondary qualifiers are presented and defined below.

The following primary flags were used to qualify the data:

[=] Detected. The analyte was analyzed for and detected at the concentration shown.

[J] Estimated. The analyte was present but the reported value may not be accurate or precise.

[U] Undetected. The analyte was analyzed for but not detected above the method detection limit.

[UJ] Detection limit estimated. The analyte was analyzed for but qualified as not detected; the result is estimated.

[R] Rejected. The data is not useable.

The following Secondary Qualifier Codes were used to qualify the data.

Validation Reason	Definition
2SH	Second source calibration verification standard greater than the upper control limit
2SL	Second source calibration verification standard less than the lower control limit
ABH	Ambient blank concentration greater than the RL
ABL	Ambient blank concentration less than the RL
BKD	The result is qualified because the DDT and/or Endrin breakdown was greater than 20%.
CBKD	The result is qualified because the combined DDT/Endrin breakdown is greater than 30%.
CCBH	Continuing calibration blank concentration greater than the RL
CCBL	Continuing calibration blank concentration less than RL
CCC	CCC Failure
CCRRF	Continuing calibration relative response factor below the LCL
CCVF	Continuing Calibration not analyzed at the required frequency
CCVH	Continuing calibration recovery greater than upper control limit
CCVL	Continuing calibration recovery less than lower control limit
CF	Confirmation result
CFP	Confirmation precision exceeded
CO	Compounds were reported combined on one column
DL	Secondary dilution
EBH	Equipment blank concentration greater than the RL
EBL	Equipment blank concentration less than the RL
EMPC	Estimated Maximum Possible Concentration Reported
FBH	Field blank concentration greater than the RL
FBL	Field blank concentration less than the RL

lidation Reason	Definition
FD	Field duplicate exceeds RPD criteria
GPC	The results are qualified due to GPC calibration deficiencies.
HTA	Analytical Holding Time exceeded
HTP	Preparation Holding Time exceeded
IB	Result between the MDL and RL
ICBH	Initial calibration blank concentration greater than the RL
ICBL	Initial calibration blank concentration less than RL
ICR2	Initial calibration exceeded the R2 for first order regression
ICRR	Exceeds RSD criteria and initial calibration exceeded the R2 for first order regression
ICRRF	Initial calibration relative response factor below the LCL
ICRSD	Initial calibration RSD exceeded
ICSP	Single Point Initial Calibration used for Quantitation
ICVSH	Initial calibration verification recovery greater than upper control limit
ICVSL	Initial calibration verification recovery less than lower control limit
ISH	Internal standard response exceeded the UCL criteria
ISL	Internal standard response exceeded the LCL criteria
LBH	Laboratory blank contamination greater than the RL
LBL	Laboratory blank contamination less than the RL
LCSDH	LCSD recovery greater than criteria
LCSDL	LCSD recovery less than the criteria
LCSH	LCS recovery greater than criteria
LCSL	LCS recovery less than the criteria
LCSP	LCS/LCSD RPD criteria exceeded

lidation Reason	Definition
LDP	Laboratory Duplicate Precision out
LR	Linear range exceeded. Concentration above linear range.
MSA	Quantitated by the method of standard additions
MSALL	Global matrix spike flagging
MSAR2	method of standard additions R2 out
MSDH	Matrix spike duplicate recovery criteria greater than the upper limit
MSDL	Matrix spike duplicate recovery criteria less than the lower limit
MSDP	Matrix Spike Duplicate RPD criteria exceedance
MSH	Matrix spike recovery criteria greater than the upper limit
MSL	Matrix spike recovery criteria less than the lower limit
NMS	Not Site-specific Matrix Spike
PH	Sample pH out. Not properly preserved.
PRM	Result differs from Preliminary Result
PSH	Post spike recovery criteria greater than the upper limit
PSL	Post spike recovery criteria less than the lower limit
RA	Sample was reanalyzed
RE	Sample was re-extracted and reanalyzed
RT	Result is outside the laboratory determined retention time window
SCRN	Screening method and/or data
SDIL	Serial Dilution %D exceeds the upper control limit
SPCC	SPCC Failure
SSH	Surrogate recovery greater than upper limit
SSL	Surrogate recovery less than lower limit

lidation Reason	Definition
SSR	Surrogate spike recovery <10%
TBH	Trip blank concentration greater than the RL
TBL	Trip blank concentration less than the RL
TD	Total Concentration < Dissolved Concentration
TEMP	Cooler temperature out upon arrival
TIC	Tentatively identified compound
TN	GC/MS tune does not meet criteria
XCC	No Continuing Calibration analyzed in the analytical batch
X-DL	Data not used due to dilution; another value is more appropriate or data was not requested
XIC	No initial calibration analyzed in the analytical batch
XICVS	Initial calibration verification standard was not analyzed
XLCS	No LCS in the analytical batch
XLD	Laboratory Duplicate not reported
XMS	Matrix Spike not reported
XMSD	Matrix Spike Duplicate not reported
X-RE	Data not used due to reanalysis another value is more appropriate or data was not requested

Organic Parameters

Quality Control Review

The following list represents the QA/QC measures that were reviewed during the data quality evaluation procedure for the Dioxin/Furan data.

- **Holding Times –** The holding times are evaluated to verify that samples were extracted and analyzed within holding times.
- **Blank samples –** Method blanks and equipment blanks were provided for this project. Blank samples enable the reviewer to determine if an analyte may be attributed to sampling or laboratory procedures, rather than environmental contamination from site activities.
- **Surrogate Recoveries –** Surrogate Compounds are added to each sample and the recoveries are used to monitor lab performance and possible matrix interference.
- **Lab Control Sample/Lab Control Sample Duplicate (LCS/LCSD) –** These samples are a "controlled matrix", either laboratory reagent water or Ottawa sand, in which target compounds have been added prior to extraction/analysis. The recoveries serve as a monitor of the overall performance of each step during the analysis, including sample preparation.
- **Matrix Spike/Matrix Spike Duplicate (MS/MSD) Samples –** Spike recovery is used to evaluate potential matrix interferences, as well as accuracy. Precision information is also determined by calculating the reproducibility between the recoveries of each spiked parameter.
- **Field Duplicate Samples –** These samples are collected to determine precision between a native and its duplicate. This information can only be determined when target compounds are detected.
- **GC/MS Tuning –** The mass spectrum of the tuning compound is evaluated for method compliance. The criteria are established to verify the proper mass assignment and mass resolution.
- **Initial Calibration –** The initial calibration ensures that the instrument is capable of producing acceptable qualitative and quantitative data for the compounds of interest.
- **Continuing Calibration –** The continuing calibration checks satisfactory performance of the instrument and its predicted response to the target compounds.
- **Internal Standards –** The internal standards (retention time and response) are evaluated for method compliance. The internal standards are used in quantitation of the target parameters and monitor the instrument sensitivity and response for stability during each analysis.
- **Labeled Standard and Cleanup Standard Recoveries –** Labeled Standards and Cleanup Standard are added to each sample. The recoveries are used to monitor laboratory and method performance, and possible matrix interference.

- **Window Defining Mix/Column Performance Check** - The window defining mix establishes the appropriate switching times for the Selected Ion Monitoring (SIM) descriptors, and contains the first and last eluting isomers in each homologue.
- **Confirmation** – SW-846 method 8000 requires confirmation when the composition of samples is not well characterized. Chromatographic interferences result from co-elution of one or more compounds with the analyte of interest, or may be the result of the presence of a non-analyte peak in the retention time window of an analyte. Such co-elution problems affect quantitation as well as identification, and may result in poor agreement between the quantitative results from two dissimilar columns. Therefore, even when the identification has been confirmed on a dissimilar column, the agreement of the quantitative results on both columns is evaluated. Per SW-86 method 8000, 40% RPD criteria was used as the acceptance limit.

Holding Times

The holding times for each parameter were evaluated according to SW-846 requirements and those presented in the QAPP.

All holding time requirements were met. No flags were applied.

Blank Samples

Blank samples for each parameter were evaluated according to SW-846 requirements and those presented in the QAPP.

If a target parameter determined to be a common contaminant was reported in a field sample, and the concentration was below the level determined to be due to blank contamination, the following actions were taken:

- If the concentration was above or below the reporting limit, the numeric result was unchanged, but it was flagged "U", as undetected.
- If the concentration was below the reporting limit, the numeric result was changed to the value of the reporting limit, and it was flagged "U", as undetected.

Table B.2 lists the target parameters that were detected in the associated blank samples. Only dioxin/furan sample results were qualified "J", as estimated, due to potential blank contamination and are listed in Table B.1 with a Validation Note of “EBL” or “FBL”.

Surrogates

The surrogate recoveries for each parameter were evaluated according to SW-846 requirements and those presented in the QAPP.

The surrogate recoveries for 4-Bromofluorobenzene in several Volatile samples were below QC criteria of 84 percent, and were qualified "J" or "UJ" as estimated. The recoveries ranged from 65-83 percent. All other surrogate recoveries in the samples were within QC limits. The Laboratory sample Ids were 20406032401-09 and 20406032412-16, 20406042501-05, 07, 08 10

and 11, 204060450901-07 and 204060450910-20, and 20507020801, 08 and 15. In addition, selected semivolatile, pesticide, and herbicide sample results were qualified due to surrogate recoveries out of criteria and are listed in Table B.1 with a Validation Note of "SSL" or "SSH".

Lab Control Sample/Lab Control Sample Duplicate (LCS/LCSD)

The LCS/LCSD recoveries and relative percent differences (RPD) for each parameter were evaluated according to SW-846 requirements and those presented in the QAPP.

Volatile and semivolatile sample results were qualified due to LCS recoveries out of criteria and are listed in Table B.1 with a Validation Note of "LCSL" or "LCSDL".

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Samples

The MS/MSD recoveries and relative percent differences (RPD) for each parameter were evaluated according to SW-846 requirements and those presented in the QAPP.

Volatile, semivolatile, and pesticide sample results were qualified due to MS/MSD recoveries and RPDs out of criteria and are listed in Table B.1 with a Validation Note of "MSL", "MSDL", "MSDH", or "MSDP".

Field Duplicate Samples

The field duplicate precision for each parameter were evaluated according to SW-846 requirements and those presented in the QAPP.

In general, all field duplicate precision criteria were met. No flags were applied.

GC/MS Tuning

The GC/MS tuning criteria for each parameter were evaluated according to SW-846 requirements.

All tuning criteria were met. No flags were applied.

Initial and Continuing Calibration

The initial and continuing calibration criteria for each parameter were evaluated according to SW-846 requirements and those presented in the QAPP.

Flags were applied to the compounds in the associated samples in the following manner:

- When the percent Relative Standard Deviation (%RSD) or correlation coefficient (R^2) was out in the initial calibration, all associated samples were qualified. Detected compounds were flagged "J" and non-detected compounds were flagged "UJ", as estimated.

- When the percent difference (%D) was low in the continuing calibration standards, detected compounds were flagged "J" and non-detected compounds were flagged "UJ", as estimated.
- When the percent difference (%D) was high in the continuing calibration standards, detected compounds were flagged "J", as estimated. Non-detected compounds were not flagged.
- When the Average Relative Response Factor (RRF) was low in the initial calibration, detected compounds were flagged "J", and non-detected compounds were flagged "UJ", as estimated.
- When the Relative Response Factor (RRF) was low in the continuing calibration, detected compounds were flagged "J", and non-detected compounds were flagged "UJ", as estimated.
- In extreme cases where the RRF was significantly low or there was no response, detected compounds were flagged "J", as estimated, and non-detected compounds were qualified "R", as rejected.
- When the Relative Response Factor (RRF) was low in the continuing calibration, detected compounds were flagged "J", and non-detected compounds were flagged "UJ", as estimated.
- In extreme cases where the RRF was significantly low or there was no response, detected compounds were flagged "J", as estimated, and non-detected compounds were qualified "R", as rejected.

Volatile, semivolatile, pesticide, and herbicide sample results were qualified due to calibration recoveries out of criteria and are listed in Table B.1 with a Validation Note of "CCVL", "CCVH", "CCRRF", "ICRSD", or "ICRRF".

Internal Standards

The internal standards for each parameter were evaluated according to SW-846 requirements and those presented in the QAPP.

Volatile, pesticide, and dioxin sample results were qualified due to internal standard recoveries out of criteria and are listed in Table B.1 with a Validation Note of "ISL", or "ISH".

Labeled Standard and Cleanup Standards

The standard recoveries for each parameter were evaluated according to SW-846 requirements and those presented in the QAPP.

All standards criteria were met. No flags were applied.

Window Defining Mix/Column Performance Check

The window defining mix and column performance check were evaluated according to SW-846 requirements and those presented in the QAPP.

All window defining mix criteria were met. No flags were applied.

Confirmation

The confirmation results for each parameter were evaluated according to SW-846 requirements and those presented in the QAPP.

All confirmation criteria were met. No flags were applied.

Inorganic Parameters

Quality Control Review

The following list represents the QA/QC measures that are typically reviewed during the data quality evaluation procedure for inorganic parameters.

- **Holding Times –** The holding times are evaluated to verify that samples were extracted and analyzed within holding times.
- **Blank samples –** Sample preparation blanks, field blanks, initial calibration blanks/continuing calibration blanks were provided for this project. Blank samples enable the reviewer to determine if an analyte may be attributed to sampling or laboratory procedures, rather than environmental contamination from site activities.
- **Lab Control Sample (LCS) –** This sample is a "controlled matrix", in which target parameters have been added prior to digestion/analysis. The recoveries serve as a monitor of the overall performance of each step during the analysis, including sample preparation.
- **Field Duplicate Samples –** These samples are collected to determine precision between a native and its duplicate. This information can only be determined when target compounds are detected.
- **Pre/Post Digestion Spike (MS/MSD) –** Spike recovery is used to evaluate potential matrix interferences, as well as accuracy. Precision information is also determined by calculating the reproducibility between the recoveries of each spiked parameter.
- **ICP Interference Check Sample –** This sample verifies the lab's interelement and background correction factors.
- **Initial Calibration Verification –** This parameter ensures that the instrument is capable of producing acceptable quantitative data for the target analyte list to be measured.
- **Continuing Calibration Verification –** This one-point, mid-range parameter establishes that the initial calibration is still valid by checking the performance of the instrument on a continual basis.
- **ICP Serial Dilution–** The serial dilution of samples quantitated by ICP determines whether or not significant physical or chemical interferences exist due to the sample matrix.

Holding Times

The holding times for each parameter were evaluated according to SW-846 requirements and those presented in the QAPP.

All holding time requirements were met. No flags were applied.

Blank Samples

Blank samples for each parameter were evaluated according to SW-846 requirements and those presented in the QAPP.

If a target parameter was reported in a field sample, and the concentration was below the level determined to be due to blank contamination (5 times the concentration in the associated QC blank samples), it was flagged as "U", not detected. Initial and continuing calibration blanks were also evaluated for possible contamination.

Metals sample results were qualified due to potential blank contamination and are listed in Table B.1 with a Validation Note of “EBL”, “CCBL” or “LBL”.

Lab Control Sample (LCS)

The LCS recoveries for each parameter were evaluated according to SW-846 requirements and those presented in the QAPP.

All LCS criteria were met. No flags were applied.

Field Duplicate Samples

The field duplicate precision for each parameter were evaluated according to SW-846 requirements and those presented in the QAPP.

All field duplicate precision criteria were met. No flags were applied.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Samples

The MS/MSD recoveries and relative percent differences (RPD) for each parameter were evaluated according to SW-846 requirements and those presented in the QAPP.

Metals sample results were qualified due to MS/MSD recoveries out of criteria and are listed in Table B.1 with a Validation Note of “MSL” or “MSDL”. Additionally, twenty-four antimony results were rejected, “R”, due to low MS/MSD recoveries. The recoveries were less than 30 percent, ranging from 20-28 percent.

ICP Interference Check Sample

The ICP Interference Check Sample criteria for each parameter were evaluated according to SW-846 requirements and those presented in the QAPP.

All ICP Interference Check Sample criteria were met. No flags were applied.

Initial and Continuing Calibration

The initial and continuing calibration criteria for each parameter were evaluated according to SW-846 requirements and those presented in the QAPP.

All initial and continuing calibration criteria were met. No flags were applied.

Serial Dilution

The serial dilutions for each parameter were evaluated according to SW-846 requirements and those presented in the QAPP.

Metals sample results were qualified due to serial dilution exceedances and are listed in Table B.1 with a Validation Note of “SDIL”.

Rejected Data

There were selected results qualified as "R", rejected, due to associated QC parameters out of criteria, such that there is not a valid result for that parameter in each sample. As discussed above, twenty-four antimony results were rejected, “R”, due to low MS/MSD recoveries.

Conclusion

A review of the analytical data submitted for The Dow Chemical Company ERA Support has been completed. An overall evaluation of the data indicates that the sample handling, shipment, and analytical procedures have been adequately completed. The validation review demonstrated that the analytical systems were generally in control and the data results can be used in the decision making process.

Conclusions of the data quality evaluation process include the following:

- The laboratory analyzed the samples according to the EPA methods stated in the work plan as demonstrated by the deliverable summaries and analytical run sequences.
- Concentrations of blank contaminants were applied according to EPA *National Functional Guidelines* in order to reflect sample values that may be attributed to field or laboratory contamination.
- Sample results for metals above the MDL but less than five times the MDL may be attributed to instrument noise and/or low level contamination. Therefore, results at these low concentration levels may be described as potential false positives and may not be due to site-related activities.
- Sample results for target organic compounds above the MDL but less than the CRQL should be considered as uncertain but indicative of the presence of that compound at an estimated concentration.
- Except for the lower recoveries of 4-Bromofluorobenzene as discussed previously, the low number of surrogate spike recoveries, MS/MSD, and field duplicate results, out of acceptance limits, indicate that the sample matrix did not significantly interfere with the overall analytical process.

The project objectives or PARCCs were met, and the data can be used in the project decision-making process as qualified by the data quality evaluation process.

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SED	DIOXIN	25104_009	062904-SED-02734-00.2-D	FD	SW8290	METHOD	OCDD	93.3	=	93.3	NG/KG	J	4.98	EBL
SED	DIOXIN	25104_009	062904-SED-02734-00.2-D	FD	SW8290	METHOD	1,2,3,4,7,8-HXCDF	4.36	=	4.36	NG/KG	J	2.48	EBL
SED	DIOXIN	25108_014	063004-SED-02726-00.2-D	FD	SW8290	METHOD	TOTAL TCDF	168	=D	168	NG/KG	J	0.5	EBL
SED	DIOXIN	25108_013	063004-SED-02726-00.2	N	SW8290	METHOD	OCDD	1030	=B	1030	NG/KG	J	4.96	EBL
SED	DIOXIN	25108_013	063004-SED-02726-00.2	N	SW8290	METHOD	TOTAL TCDF	2260	=D	2260	NG/KG	J	0.496	EBL
SED	DIOXIN	25104_009	062904-SED-02734-00.2-D	FD	SW8290	METHOD	TOTAL HXCDF	19.2	=	19.2	NG/KG	J	2.48	EBL
SED	DIOXIN	25104_008	062904-SED-02734-00.2	N	SW8290	METHOD	OCDD	56.2	=	56.2	NG/KG	J	4.85	EBL
SED	DIOXIN	25104_008	062904-SED-02734-00.2	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	2.93	=	2.93	NG/KG	J	2.42	EBL
SED	DIOXIN	25104_008	062904-SED-02734-00.2	N	SW8290	METHOD	TOTAL HXCDF	14.4	=	14.4	NG/KG	J	2.42	EBL
SED	DIOXIN	25104_007	062904-SED-02733-00.2	N	SW8290	METHOD	OCDD	125	=	125	NG/KG	J	5.06	EBL
SED	DIOXIN	25104_007	062904-SED-02733-00.2	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	14	=	14	NG/KG	J	2.53	EBL
SED	DIOXIN	25104_007	062904-SED-02733-00.2	N	SW8290	METHOD	TOTAL HXCDF	52	=	52	NG/KG	J	2.53	EBL
SED	DIOXIN	25104_006	062904-SED-02732-00.2	N	SW8290	METHOD	OCDD	133	=	133	NG/KG	J	4.96	EBL
SED	DIOXIN	25104_006	062904-SED-02732-00.2	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	6.75	=	6.75	NG/KG	J	2.48	EBL
SED	DIOXIN	25104_006	062904-SED-02732-00.2	N	SW8290	METHOD	TOTAL HXCDF	28	=	28	NG/KG	J	2.48	EBL
SED	DIOXIN	25104_005	062904-SED-02731-00.2	N	SW8290	METHOD	OCDD	78.7	=	78.7	NG/KG	J	4.85	EBL
SED	DIOXIN	25104_005	062904-SED-02731-00.2	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	3.35	=	3.35	NG/KG	J	2.43	EBL
SED	DIOXIN	25104_005	062904-SED-02731-00.2	N	SW8290	METHOD	TOTAL HXCDF	12.4	=	12.4	NG/KG	J	2.43	EBL
SED	DIOXIN	25104_004	062904-SED-02702-00.2	N	SW8290	METHOD	OCDD	7.35	=	7.35	NG/KG	J	5.03	EBL
SED	DIOXIN	25104_004	062904-SED-02702-00.2	N	SW8290	METHOD	TOTAL HXCDF	0.369	=	0.369	NG/KG	J	2.52	EBL
SED	DIOXIN	25104_003	062904-SED-02701-00.2	N	SW8290	METHOD	OCDD	46.8	=	46.8	NG/KG	J	4.86	EBL
SED	DIOXIN	25104_003	062904-SED-02701-00.2	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	0.525	=J	0.525	NG/KG	J	2.43	EBL
SED	DIOXIN	25104_003	062904-SED-02701-00.2	N	SW8290	METHOD	TOTAL HXCDF	3.65	=	3.65	NG/KG	J	2.43	EBL
SED	DIOXIN	25104_002	062904-SED-02700-00.2	N	SW8290	METHOD	OCDD	5.47	=	5.47	NG/KG	J	4.86	EBL
SED	DIOXIN	25108_007	063004-SED-02716-00.2	N	SW8290	METHOD	OCDD	346	=B	346	NG/KG	J	4.93	EBL
SED	DIOXIN	25108_007	063004-SED-02716-00.2	N	SW8290	METHOD	TOTAL TCDF	161	=D	161	NG/KG	J	0.493	EBL
SED	DIOXIN	25108_006	063004-SED-02715-00.2	N	SW8290	METHOD	OCDD	392	=B	392	NG/KG	J	4.88	EBL
SED	DIOXIN	25108_006	063004-SED-02715-00.2	N	SW8290	METHOD	TOTAL TCDF	112	=D	112	NG/KG	J	0.488	EBL
SED	DIOXIN	25108_005	063004-SED-02710-00.2	N	SW8290	METHOD	TOTAL TCDF	240	=D	240	NG/KG	J	0.488	EBL
SED	DIOXIN	25108_004	063004-SED-02709-00.2	N	SW8290	METHOD	OCDD	145	=B	145	NG/KG	J	4.94	EBL
SED	DIOXIN	25108_004	063004-SED-02709-00.2	N	SW8290	METHOD	TOTAL TCDF	157	=D	157	NG/KG	J	0.494	EBL
SED	DIOXIN	25108_011	063004-SED-02724-00.2	N	SW8290	METHOD	TOTAL TCDF	238	=D	238	NG/KG	J	0.498	EBL
SED	DIOXIN	25108_010	063004-SED-02723-00.2	N	SW8290	METHOD	OCDD	85.6	=B	85.6	NG/KG	J	4.9	EBL
SED	DIOXIN	25108_010	063004-SED-02723-00.2	N	SW8290	METHOD	TOTAL TCDF	254	=D	254	NG/KG	J	0.49	EBL
SED	DIOXIN	25104_002	062904-SED-02700-00.2	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	0.161	=J	0.161	NG/KG	J	2.43	EBL
SED	DIOXIN	25104_002	062904-SED-02700-00.2	N	SW8290	METHOD	TOTAL HXCDF	0.767	=	0.767	NG/KG	J	2.43	EBL
SED	DIOXIN	25104_001	062904-SED-02699-00.2	N	SW8290	METHOD	OCDD	5.54	=	5.54	NG/KG	J	4.45	EBL
SED	DIOXIN	25104_001	062904-SED-02699-00.2	N	SW8290	METHOD	TOTAL HXCDF	0.552	=	0.552	NG/KG	J	2.22	EBL
SED	DIOXIN	25108_014	063004-SED-02726-00.2-D	FD	SW8290	METHOD	OCDD	94.1	=B	94.1	NG/KG	J	5	EBL
SED	DIOXIN	25108_009	063004-SED-02718-00.2	N	SW8290	METHOD	TOTAL TCDF	149	=D	149	NG/KG	J	0.493	EBL
SED	DIOXIN	25108_008	063004-SED-02717-00.2	N	SW8290	METHOD	OCDD	1150	=B	1150	NG/KG	J	4.93	EBL
SED	DIOXIN	25108_009	063004-SED-02718-00.2	N	SW8290	METHOD	OCDD	88.8	=B	88.8	NG/KG	J	4.93	EBL
SED	DIOXIN	25108_012	063004-SED-02725-00.2	N	SW8290	METHOD	TOTAL TCDF	949	=D	949	NG/KG	J	0.499	EBL
SED	DIOXIN	25108_012	063004-SED-02725-00.2	N	SW8290	METHOD	TOTAL HPCDF	8660	=E	8660	NG/KG	J	2.5	EBL
SED	DIOXIN	25108_002	063004-SED-02708-00.2	N	SW8290	METHOD	OCDD	109	=	109	NG/KG	J	5	EBL
SED	DIOXIN	25108_002	063004-SED-02708-00.2	N	SW8290	METHOD	TOTAL TCDF	25.1	=D	25.1	NG/KG	J	0.5	EBL
SED	DIOXIN	25108_003	063004-SED-02708-00.2-D	FD	SW8290	METHOD	OCDD	101	=B	101	NG/KG	J	5.01	EBL
SED	DIOXIN	25108_003	063004-SED-02708-00.2-D	FD	SW8290	METHOD	TOTAL TCDF	37.9	=D	37.9	NG/KG	J	0.501	EBL
SED	DIOXIN	25108_001	063004-SED-02707-00.2	N	SW8290	METHOD	OCDD	196	=B	196	NG/KG	J	5.09	EBL
SED	DIOXIN	25108_001	063004-SED-02707-00.2	N	SW8290	METHOD	TOTAL TCDF	81.2	=D	81.2	NG/KG	J	0.509	EBL
SOI	DIOXIN	25032_007	060204-SOI-02698-00.5	N	SW8290	METHOD	TOTAL HXCDF	45.2	=	45.2	NG/KG	J	2.56	FBL
SOI	DIOXIN	25032_006	060204-SOI-02697-02.5	N	SW8290	METHOD	OCDD	3.72	=J	3.72	NG/KG	J	4.92	FBL
SOI	DIOXIN	25032_009	060204-SOI-02696-00.5	N	SW8290	METHOD	OCDD	703	=	703	NG/KG	J	5.06	FBL
SOI	DIOXIN	25032_009	060204-SOI-02696-00.5	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	6.02	=	6.02	NG/KG	J	2.53	FBL
SOI	DIOXIN	25032_008	060204-SOI-02696-02.0	N	SW8290	METHOD	TOTAL HXCDF	1.75	=	1.75	NG/KG	J	2.47	FBL
SOI	DIOXIN	25032_007	060204-SOI-02698-00.5	N	SW8290	METHOD	OCDD	598	=	598	NG/KG	J	5.1	FBL
SOI	DIOXIN	25032_004	060204-SOI-02695-00.5	N	SW8290	METHOD	TOTAL HXCDF	18.2	=	18.2	NG/KG	J	2.52	FBL
SOI	DIOXIN	25032_003	060204-SOI-02697-00.5-D	FD	SW8290	METHOD	OCDD	398	=	398	NG/KG	J	5.09	FBL
SOI	DIOXIN	25032_003	060204-SOI-02697-00.5-D	FD	SW8290	METHOD	1,2,3,4,7,8-HXCDF	2.1	=J	2.1	NG/KG	J	2.54	FBL
SOI	DIOXIN	25032_010	060204-SOI-02696-04.0	N	SW8290	METHOD	OCDD	2.85	=J	2.85	NG/KG	J	5.02	FBL
SOI	DIOXIN	25032_010	060204-SOI-02696-04.0	N	SW8290	METHOD	OCDF	0.359	=J	0.359	NG/KG	J	5.02	FBL
SOI	DIOXIN	25032_004	060204-SOI-02695-00.5	N	SW8290	METHOD	OCDD	358	=	358	NG/KG	J	5.04	FBL
SOI	DIOXIN	25032_004	060204-SOI-02695-00.5	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	1.74	=J	1.74	NG/KG	J	2.52	FBL
SOI	DIOXIN	25032_004	060204-SOI-02695-00.5	N	SW8290	METHOD	OCDF	24.2	=	24.2	NG/KG	J	5.04	FBL
SOI	DIOXIN	25032_002	060204-SOI-02697-00.5	N	SW8290	METHOD	OCDD	424	=	424	NG/KG	J	5.03	FBL
SOI	DIOXIN	25032_002	060204-SOI-02697-00.5	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	2.32	=J	2.32	NG/KG	J	2.52	FBL
SOI	DIOXIN	25032_002	060204-SOI-02697-00.5	N	SW8290	METHOD	OCDF	28.9	=	28.9	NG/KG	J	5.03	FBL
SOI	DIOXIN	25027_003	060104-SOI-02687-00.5	N	SW8290	METHOD	OCDD	64.1	=	64.1	NG/KG	J	5	FBL

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SOI	DIOXIN	25027_003	060104-SOI-02687-00.5	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	0.58	=J	0.58	NG/KG	J	2.5	FBL
SOI	DIOXIN	25027_003	060104-SOI-02687-00.5	N	SW8290	METHOD	OCDF	5.34	=	5.34	NG/KG	J	5	FBL
SOI	DIOXIN	25027_012	060104-SOI-02688-02.0	N	SW8290	METHOD	TOTAL HXCDF	0.31	=	0.31	NG/KG	J	2.49	FBL
SOI	DIOXIN	25027_011	060104-SOI-02687-02.0	N	SW8290	METHOD	OCDD	83.6	=	83.6	NG/KG	J	4.96	FBL
SOI	DIOXIN	25027_011	060104-SOI-02687-02.0	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	0.834	=J	0.834	NG/KG	J	2.49	FBL
SOI	DIOXIN	25027_009	060104-SOI-02688-06.0	N	SW8290	METHOD	OCDD	1.94	=J	1.94	NG/KG	J	5.02	FBL
SOI	DIOXIN	25027_009	060104-SOI-02688-06.0	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	0.125	=J	0.125	NG/KG	J	2.52	FBL
SOI	DIOXIN	25027_009	060104-SOI-02688-06.0	N	SW8290	METHOD	OCDF	0.316	=J	0.316	NG/KG	J	5.02	FBL
SOI	DIOXIN	25027_009	060104-SOI-02688-06.0	N	SW8290	METHOD	TOTAL HXCDF	0.276	=	0.276	NG/KG	J	2.52	FBL
SOI	DIOXIN	25027_003	060104-SOI-02687-00.5	N	SW8290	METHOD	TOTAL HXCDF	5.09	=	5.09	NG/KG	J	2.5	FBL
SOI	DIOXIN	25027_002	060104-SOI-02690-02.0	N	SW8290	METHOD	OCDD	55.9	=	55.9	NG/KG	J	4.75	FBL
SOI	DIOXIN	25027_002	060104-SOI-02690-02.0	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	0.801	=J	0.801	NG/KG	J	2.37	FBL
SOI	DIOXIN	25027_014	060104-SOI-02688-04.0	N	SW8290	METHOD	TOTAL HXCDF	0.735	=	0.735	NG/KG	J	2.44	FBL
SOI	DIOXIN	25027_007	060104-SOI-02688-07.0	N	SW8290	METHOD	OCDF	0.269	=J	0.269	NG/KG	J	4.89	FBL
SOI	DIOXIN	25027_007	060104-SOI-02688-07.0	N	SW8290	METHOD	TOTAL HXCDF	0.273	=	0.273	NG/KG	J	2.45	FBL
SOI	DIOXIN	25027_008	060104-SOI-02687-04.5	N	SW8290	METHOD	OCDF	92	=	92	NG/KG	J	4.88	FBL
SOI	DIOXIN	25027_011	060104-SOI-02687-02.0	N	SW8290	METHOD	OCDF	5.53	=	5.53	NG/KG	J	4.96	FBL
SOI	DIOXIN	25027_011	060104-SOI-02687-02.0	N	SW8290	METHOD	TOTAL HXCDF	7.46	=	7.46	NG/KG	J	2.49	FBL
SOI	DIOXIN	25027_010	060104-SOI-02690-00.5	N	SW8290	METHOD	OCDD	25.6	=	25.6	NG/KG	J	5.08	FBL
SOI	DIOXIN	25027_014	060104-SOI-02688-04.0	N	SW8290	METHOD	OCDD	2.15	=J	2.15	NG/KG	J	4.89	FBL
SOI	DIOXIN	25027_014	060104-SOI-02688-04.0	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	0.193	=J	0.193	NG/KG	J	2.44	FBL
SOI	DIOXIN	25027_013	060104-SOI-02689-00.5	N	SW8290	METHOD	OCDD	155	=	155	NG/KG	J	5.09	FBL
SOI	DIOXIN	25027_013	060104-SOI-02689-00.5	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	0.964	=J	0.964	NG/KG	J	2.54	FBL
SOI	DIOXIN	25027_013	060104-SOI-02689-00.5	N	SW8290	METHOD	OCDF	9.15	=	9.15	NG/KG	J	5.09	FBL
SOI	DIOXIN	25027_004	060104-SOI-02689-02.0	N	SW8290	METHOD	OCDD	2.51	=J	2.51	NG/KG	J	4.95	FBL
SOI	DIOXIN	25027_006	060104-SOI-02689-04.5	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	0.13	=J	0.13	NG/KG	J	2.49	FBL
SOI	DIOXIN	25027_006	060104-SOI-02689-04.5	N	SW8290	METHOD	OCDF	0.395	=J	0.395	NG/KG	J	4.96	FBL
SOI	DIOXIN	25027_006	060104-SOI-02689-04.5	N	SW8290	METHOD	TOTAL HXCDF	0.13	=	0.13	NG/KG	J	2.49	FBL
SOI	DIOXIN	25032_009	060204-SOI-02696-00.5	N	SW8290	METHOD	TOTAL HXCDF	45.4	=	45.4	NG/KG	J	2.53	FBL
SOI	DIOXIN	25032_008	060204-SOI-02696-02.0	N	SW8290	METHOD	OCDD	16.9	=	16.9	NG/KG	J	4.93	FBL
SOI	DIOXIN	25032_008	060204-SOI-02696-02.0	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	0.293	=J	0.293	NG/KG	J	2.47	FBL
SOI	DIOXIN	25032_005	060204-SOI-02695-01.5	N	SW8290	METHOD	OCDD	3.66	=J	3.66	NG/KG	J	5.05	FBL
SOI	DIOXIN	25032_003	060204-SOI-02697-00.5-D	FD	SW8290	METHOD	OCDF	28.1	=	28.1	NG/KG	J	5.09	FBL
SOI	DIOXIN	25032_003	060204-SOI-02697-00.5-D	FD	SW8290	METHOD	TOTAL HXCDF	21.1	=	21.1	NG/KG	J	2.54	FBL
SOI	DIOXIN	25032_009	060204-SOI-02696-00.5	N	SW8290	METHOD	OCDF	62	=	62	NG/KG	J	5.06	FBL
SOI	DIOXIN	25032_005	060204-SOI-02695-01.5	N	SW8290	METHOD	OCDF	0.54	=J	0.54	NG/KG	J	5.05	FBL
SOI	DIOXIN	25032_002	060204-SOI-02697-00.5	N	SW8290	METHOD	TOTAL HXCDF	24.6	=	24.6	NG/KG	J	2.52	FBL
SOI	DIOXIN	25032_007	060204-SOI-02698-00.5	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	4	=	4	NG/KG	J	2.56	FBL
SOI	DIOXIN	25032_007	060204-SOI-02698-00.5	N	SW8290	METHOD	OCDF	62.4	=	62.4	NG/KG	J	5.1	FBL
SOI	DIOXIN	25027_008	060104-SOI-02687-04.5	N	SW8290	METHOD	OCDD	1300	=	1300	NG/KG	J	4.88	FBL
SOI	DIOXIN	25027_008	060104-SOI-02687-04.5	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	2.13	=J	2.13	NG/KG	J	2.43	FBL
SOI	DIOXIN	25027_002	060104-SOI-02690-02.0	N	SW8290	METHOD	OCDF	2.49	=J	2.49	NG/KG	J	4.75	FBL
SOI	DIOXIN	25027_002	060104-SOI-02690-02.0	N	SW8290	METHOD	TOTAL HXCDF	6.22	=	6.22	NG/KG	J	2.37	FBL
SOI	DIOXIN	25027_001	060104-SOI-02687-00.5-D	FD	SW8290	METHOD	OCDD	97.3	=	97.3	NG/KG	J	4.89	FBL
SOI	DIOXIN	25027_008	060104-SOI-02687-04.5	N	SW8290	METHOD	TOTAL HXCDF	39.6	=	39.6	NG/KG	J	2.43	FBL
SOI	DIOXIN	25027_007	060104-SOI-02688-07.0	N	SW8290	METHOD	OCDD	2.07	=J	2.07	NG/KG	J	4.89	FBL
SOI	DIOXIN	25027_007	060104-SOI-02688-07.0	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	0.127	=J	0.127	NG/KG	J	2.45	FBL
SOI	DIOXIN	25027_013	060104-SOI-02689-00.5	N	SW8290	METHOD	TOTAL HXCDF	8.08	=	8.08	NG/KG	J	2.54	FBL
SOI	DIOXIN	25027_012	060104-SOI-02688-02.0	N	SW8290	METHOD	OCDD	4.24	=J	4.24	NG/KG	J	4.97	FBL
SOI	DIOXIN	25027_012	060104-SOI-02688-02.0	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	0.164	=J	0.164	NG/KG	J	2.49	FBL
SOI	DIOXIN	25027_012	060104-SOI-02688-02.0	N	SW8290	METHOD	OCDF	0.449	=J	0.449	NG/KG	J	4.97	FBL
SOI	DIOXIN	25027_010	060104-SOI-02690-00.5	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	0.216	=J	0.216	NG/KG	J	2.54	FBL
SOI	DIOXIN	25027_010	060104-SOI-02690-00.5	N	SW8290	METHOD	OCDF	1.87	=J	1.87	NG/KG	J	5.08	FBL
SOI	DIOXIN	25027_010	060104-SOI-02690-00.5	N	SW8290	METHOD	TOTAL HXCDF	1.34	=	1.34	NG/KG	J	2.54	FBL
SOI	DIOXIN	25027_005	060104-SOI-02688-00.5	N	SW8290	METHOD	OCDD	5.51	=	5.51	NG/KG	J	5.14	FBL
SOI	DIOXIN	25027_004	060104-SOI-02689-02.0	N	SW8290	METHOD	TOTAL HXCDF	0.172	=	0.172	NG/KG	J	2.47	FBL
SOI	DIOXIN	25027_006	060104-SOI-02689-04.5	N	SW8290	METHOD	OCDD	4.02	=J	4.02	NG/KG	J	4.96	FBL
SOI	DIOXIN	25027_001	060104-SOI-02687-00.5-D	FD	SW8290	METHOD	1,2,3,4,7,8-HXCDF	0.58	=J	0.58	NG/KG	J	2.44	FBL
SOI	DIOXIN	25027_001	060104-SOI-02687-00.5-D	FD	SW8290	METHOD	OCDF	5.66	=	5.66	NG/KG	J	4.89	FBL
SOI	DIOXIN	25027_001	060104-SOI-02687-00.5-D	FD	SW8290	METHOD	TOTAL HXCDF	5.73	=	5.73	NG/KG	J	2.44	FBL
SOI	DIOXIN	25027_005	060104-SOI-02688-00.5	N	SW8290	METHOD	TOTAL HXCDF	0.235	=	0.235	NG/KG	J	2.56	FBL
SOI	DIOXIN	25041_008	060304-SOI-02706-00.5	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	361	=B	361	NG/KG	J	2.42	FBL
SOI	DIOXIN	25041_006	060304-SOI-02703-00.5	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	341	=B	341	NG/KG	J	2.48	FBL
SOI	DIOXIN	25041_003	060304-SOI-02721-00.5	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	132	=B	132	NG/KG	J	2.42	FBL
SOI	DIOXIN	25041_001	060304-SOI-02719-00.5	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	226	=B	226	NG/KG	J	2.49	FBL
SED	DIOXIN	25103_004	062804-SED-02694-00.2	N	SW8290	METHOD	OCDF	0.795	U	0.795	NG/KG	UJ	5.07	ISL
SED	DIOXIN	25103_003	062804-SED-02693-00.2	N	SW8290	METHOD	OCDF	1.79	U	1.79	NG/KG	UJ	5.08	ISL
SED	DIOXIN	25103_001	062804-SED-02691-00.2	N	SW8290	METHOD	OCDF	0.573	U	0.573	NG/KG	UJ	4.62	ISL

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SED	DIOXIN	25103_002	062804-SED-02692-00.2	N	SW8290	METHOD	OCDF	0.495	=J	0.495	NG/KG	J	4.83	ISL
SED	DIOXIN	25104_008	062904-SED-02734-00.2	N	SW8290	METHOD	1,2,3,4,7,8,9-HPCDF	0.66	=J	0.66	NG/KG	J	2.42	ISL
SED	DIOXIN	25104_008	062904-SED-02734-00.2	N	SW8290	METHOD	OCDF	12.5	=	12.5	NG/KG	J	4.85	ISL
SOI	DIOXIN	25040_007	060404-SOI-02728-00.5	N	SW8290	METHOD	OCDD	14600	=BE	14600	NG/KG	J	4.78	LR
SOI	DIOXIN	25040_007	060404-SOI-02728-00.5	N	SW8290	METHOD	2,3,7,8-TCDF	4960	=BE	4960	NG/KG	J	0.478	LR
SOI	DIOXIN	25040_007	060404-SOI-02728-00.5	N	SW8290	METHOD	1,2,3,7,8-PECDF	2440	=E	2440	NG/KG	J	2.4	LR
SOI	DIOXIN	25040_007	060404-SOI-02728-00.5	N	SW8290	METHOD	2,3,4,7,8-PECDF	2300	=E	2300	NG/KG	J	2.4	LR
SOI	DIOXIN	25040_002	060404-SOI-02711-00.5	N	SW8290	METHOD	OCDD	13700	=BE	13700	NG/KG	J	5.04	LR
SOI	DIOXIN	25040_002	060404-SOI-02711-00.5	N	SW8290	METHOD	2,3,7,8-TCDF	3810	=BE	3810	NG/KG	J	0.504	LR
SOI	DIOXIN	25040_002	060404-SOI-02711-00.5	N	SW8290	METHOD	1,2,3,7,8-PECDF	2070	=E	2070	NG/KG	J	2.52	LR
SOI	DIOXIN	25040_002	060404-SOI-02711-00.5	N	SW8290	METHOD	1,2,3,4,6,7,8-HPCDF	2110	=BE	2110	NG/KG	J	2.52	LR
SOI	DIOXIN	25040_002	060404-SOI-02711-00.5	N	SW8290	METHOD	TOTAL TCDF	9030	=BDE	9030	NG/KG	J	0.504	LR
SOI	DIOXIN	25040_002	060404-SOI-02711-00.5	N	SW8290	METHOD	TOTAL PECDF	7210	=DE	7210	NG/KG	J	2.52	LR
SOI	DIOXIN	25040_002	060404-SOI-02711-00.5	N	SW8290	METHOD	TOTAL HPCDF	5040	=BE	5040	NG/KG	J	2.52	LR
SOI	DIOXIN	25040_009	060404-SOI-02730-00.5	N	SW8290	METHOD	1,2,3,7,8-PECDF	3750	=E	3750	NG/KG	J	2.38	LR
SOI	DIOXIN	25040_006	060404-SOI-02727-00.5	N	SW8290	METHOD	TOTAL HPCDD	6330	=BE	6330	NG/KG	J	2.46	LR
SOI	DIOXIN	25040_006	060404-SOI-02727-00.5	N	SW8290	METHOD	TOTAL TCDF	22400	=BDE	22400	NG/KG	J	0.492	LR
SOI	DIOXIN	25040_006	060404-SOI-02727-00.5	N	SW8290	METHOD	TOTAL PECDF	17400	=DE	17400	NG/KG	J	2.46	LR
SOI	DIOXIN	25040_006	060404-SOI-02727-00.5	N	SW8290	METHOD	TOTAL HXCDF	9990	=BDE	9990	NG/KG	J	2.46	LR
SOI	DIOXIN	25040_006	060404-SOI-02727-00.5	N	SW8290	METHOD	TOTAL HPCDF	17700	=BE	17700	NG/KG	J	2.46	LR
SOI	DIOXIN	25040_005	060404-SOI-02714-00.5	N	SW8290	METHOD	1,2,3,4,6,7,8-HPCDD	3940	=E	3940	NG/KG	J	2.42	LR
SOI	DIOXIN	25040_005	060404-SOI-02714-00.5	N	SW8290	METHOD	OCDD	41100	=BE	41100	NG/KG	J	4.84	LR
SOI	DIOXIN	25040_005	060404-SOI-02714-00.5	N	SW8290	METHOD	2,3,7,8-TCDF	2740	=BE	2740	NG/KG	J	0.484	LR
SOI	DIOXIN	25040_010	060404-SOI-02730-00.5-D	FD	SW8290	METHOD	1,2,3,4,6,7,8-HPCDD	2990	=E	2990	NG/KG	J	2.5	LR
SOI	DIOXIN	25040_010	060404-SOI-02730-00.5-D	FD	SW8290	METHOD	OCDD	30600	=BE	30600	NG/KG	J	4.99	LR
SOI	DIOXIN	25040_010	060404-SOI-02730-00.5-D	FD	SW8290	METHOD	2,3,7,8-TCDF	4170	=BE	4170	NG/KG	J	0.499	LR
SOI	DIOXIN	25040_009	060404-SOI-02730-00.5	N	SW8290	METHOD	2,3,4,7,8-PECDF	4440	=E	4440	NG/KG	J	2.38	LR
SOI	DIOXIN	25040_009	060404-SOI-02730-00.5	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	2800	=BE	2800	NG/KG	J	2.38	LR
SOI	DIOXIN	25040_009	060404-SOI-02730-00.5	N	SW8290	METHOD	1,2,3,4,6,7,8-HPCDF	3560	=BE	3560	NG/KG	J	2.38	LR
SOI	DIOXIN	25040_009	060404-SOI-02730-00.5	N	SW8290	METHOD	OCDF	6830	=BE	6830	NG/KG	J	4.77	LR
SOI	DIOXIN	25040_005	060404-SOI-02714-00.5	N	SW8290	METHOD	1,2,3,4,6,7,8-HPCDF	4080	=BE	4080	NG/KG	J	2.42	LR
SOI	DIOXIN	25040_005	060404-SOI-02714-00.5	N	SW8290	METHOD	OCDF	10900	=BE	10900	NG/KG	J	4.84	LR
SOI	DIOXIN	25040_005	060404-SOI-02714-00.5	N	SW8290	METHOD	TOTAL HPCDD	6750	=BE	6750	NG/KG	J	2.42	LR
SOI	DIOXIN	25040_005	060404-SOI-02714-00.5	N	SW8290	METHOD	TOTAL TCDF	7480	=BDE	7480	NG/KG	J	0.484	LR
SOI	DIOXIN	25040_005	060404-SOI-02714-00.5	N	SW8290	METHOD	TOTAL HPCDF	12100	=BE	12100	NG/KG	J	2.42	LR
SOI	DIOXIN	25040_009	060404-SOI-02730-00.5	N	SW8290	METHOD	TOTAL PECDF	17100	=DE	17100	NG/KG	J	2.38	LR
SOI	DIOXIN	25040_009	060404-SOI-02730-00.5	N	SW8290	METHOD	TOTAL HXCDF	6970	=BDE	6970	NG/KG	J	2.38	LR
SOI	DIOXIN	25040_009	060404-SOI-02730-00.5	N	SW8290	METHOD	TOTAL HPCDF	8740	=BE	8740	NG/KG	J	2.38	LR
SOI	DIOXIN	25040_008	060404-SOI-02729-00.5	N	SW8290	METHOD	1,2,3,4,6,7,8-HPCDD	4830	=E	4830	NG/KG	J	2.51	LR
SOI	DIOXIN	25040_008	060404-SOI-02729-00.5	N	SW8290	METHOD	OCDD	51400	=BE	51400	NG/KG	J	5.02	LR
SOI	DIOXIN	25040_008	060404-SOI-02729-00.5	N	SW8290	METHOD	2,3,7,8-TCDF	4300	=BE	4300	NG/KG	J	0.502	LR
SOI	DIOXIN	25040_008	060404-SOI-02729-00.5	N	SW8290	METHOD	1,2,3,7,8-PECDF	2180	=E	2180	NG/KG	J	2.51	LR
SOI	DIOXIN	25040_008	060404-SOI-02729-00.5	N	SW8290	METHOD	2,3,4,7,8-PECDF	2100	=E	2100	NG/KG	J	2.51	LR
SOI	DIOXIN	25040_008	060404-SOI-02729-00.5	N	SW8290	METHOD	1,2,3,4,6,7,8-HPCDF	8550	=BE	8550	NG/KG	J	2.51	LR
SOI	DIOXIN	25040_008	060404-SOI-02729-00.5	N	SW8290	METHOD	OCDF	15800	=BE	15800	NG/KG	J	5.02	LR
SOI	DIOXIN	25040_010	060404-SOI-02730-00.5-D	FD	SW8290	METHOD	1,2,3,4,6,7,8-HPCDF	4240	=BE	4240	NG/KG	J	2.5	LR
SOI	DIOXIN	25040_010	060404-SOI-02730-00.5-D	FD	SW8290	METHOD	OCDF	8620	=BE	8620	NG/KG	J	4.99	LR
SOI	DIOXIN	25040_010	060404-SOI-02730-00.5-D	FD	SW8290	METHOD	TOTAL HPCDD	5080	=BE	5080	NG/KG	J	2.5	LR
SOI	DIOXIN	25040_010	060404-SOI-02730-00.5-D	FD	SW8290	METHOD	TOTAL TCDF	11000	=BDE	11000	NG/KG	J	0.499	LR
SOI	DIOXIN	25040_010	060404-SOI-02730-00.5-D	FD	SW8290	METHOD	TOTAL HPCDF	10700	=BE	10700	NG/KG	J	2.5	LR
SOI	DIOXIN	25040_006	060404-SOI-02727-00.5	N	SW8290	METHOD	1,2,3,4,6,7,8-HPCDD	3660	=E	3660	NG/KG	J	2.46	LR
SOI	DIOXIN	25040_006	060404-SOI-02727-00.5	N	SW8290	METHOD	OCDD	39300	=BE	39300	NG/KG	J	4.92	LR
SOI	DIOXIN	25040_006	060404-SOI-02727-00.5	N	SW8290	METHOD	2,3,7,8-TCDF	9180	=BE	9180	NG/KG	J	0.492	LR
SOI	DIOXIN	25040_006	060404-SOI-02727-00.5	N	SW8290	METHOD	1,2,3,7,8-PECDF	4650	=E	4650	NG/KG	J	2.46	LR
SOI	DIOXIN	25040_006	060404-SOI-02727-00.5	N	SW8290	METHOD	2,3,4,7,8-PECDF	4390	=E	4390	NG/KG	J	2.46	LR
SOI	DIOXIN	25040_006	060404-SOI-02727-00.5	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	3700	=BE	3700	NG/KG	J	2.46	LR
SOI	DIOXIN	25040_006	060404-SOI-02727-00.5	N	SW8290	METHOD	1,2,3,4,6,7,8-HPCDF	8430	=BE	8430	NG/KG	J	2.46	LR
SOI	DIOXIN	25040_006	060404-SOI-02727-00.5	N	SW8290	METHOD	OCDF	12100	=BE	12100	NG/KG	J	4.92	LR
SOI	DIOXIN	25040_003	060404-SOI-02712-00.5	N	SW8290	METHOD	1,2,3,4,6,7,8-HPCDF	1980	=BE	1980	NG/KG	J	2.4	LR
SOI	DIOXIN	25040_003	060404-SOI-02712-00.5	N	SW8290	METHOD	TOTAL HPCDF	4230	=BE	4230	NG/KG	J	2.4	LR
SOI	DIOXIN	25040_004	060404-SOI-02713-00.5	N	SW8290	METHOD	OCDD	12100	=BE	12100	NG/KG	J	5.02	LR
SOI	DIOXIN	25040_004	060404-SOI-02713-00.5	N	SW8290	METHOD	2,3,7,8-TCDF	9350	=BE	9350	NG/KG	J	0.502	LR
SOI	DIOXIN	25040_004	060404-SOI-02713-00.5	N	SW8290	METHOD	1,2,3,7,8-PECDF	4770	=E	4770	NG/KG	J	2.51	LR
SOI	DIOXIN	25040_004	060404-SOI-02713-00.5	N	SW8290	METHOD	2,3,4,7,8-PECDF	4210	=E	4210	NG/KG	J	2.51	LR
SOI	DIOXIN	25040_004	060404-SOI-02713-00.5	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	3260	=BE	3260	NG/KG	J	2.51	LR
SOI	DIOXIN	25040_004	060404-SOI-02713-00.5	N	SW8290	METHOD	1,2,3,4,6,7,8-HPCDF	2110	=BE	2110	NG/KG	J	2.51	LR
SOI	DIOXIN	25040_004	060404-SOI-02713-00.5	N	SW8290	METHOD	TOTAL TCDF	22000	=BDE	22000	NG/KG	J	0.502	LR
SOI	DIOXIN	25040_004	060404-SOI-02713-00.5	N	SW8290	METHOD	TOTAL PECDF	16200	=DE	16200	NG/KG	J	2.51	LR

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SOI	DIOXIN	25040_008	060404-SOI-02729-00.5	N	SW8290	METHOD	TOTAL HPCDD	8350	=BE	8350	NG/KG	J	2.51	LR
SOI	DIOXIN	25040_008	060404-SOI-02729-00.5	N	SW8290	METHOD	TOTAL TCDF	11500	=BDE	11500	NG/KG	J	0.502	LR
SOI	DIOXIN	25040_008	060404-SOI-02729-00.5	N	SW8290	METHOD	TOTAL PECDF	8870	=DE	8870	NG/KG	J	2.51	LR
SOI	DIOXIN	25040_008	060404-SOI-02729-00.5	N	SW8290	METHOD	TOTAL HPCDF	20400	=BE	20400	NG/KG	J	2.51	LR
SOI	DIOXIN	25040_003	060404-SOI-02712-00.5	N	SW8290	METHOD	TOTAL TCDF	7930	=BDE	7930	NG/KG	J	0.479	LR
SOI	DIOXIN	25040_009	060404-SOI-02730-00.5	N	SW8290	METHOD	TOTAL HPCDD	4260	=BE	4260	NG/KG	J	2.38	LR
SOI	DIOXIN	25040_009	060404-SOI-02730-00.5	N	SW8290	METHOD	TOTAL TCDF	27200	=BDE	27200	NG/KG	J	0.477	LR
SOI	DIOXIN	25040_007	060404-SOI-02728-00.5	N	SW8290	METHOD	1,2,3,4,6,7,8-HPCDF	3770	=BE	3770	NG/KG	J	2.4	LR
SOI	DIOXIN	25040_007	060404-SOI-02728-00.5	N	SW8290	METHOD	OCDF	4880	=BE	4880	NG/KG	J	4.78	LR
SOI	DIOXIN	25040_007	060404-SOI-02728-00.5	N	SW8290	METHOD	TOTAL TCDF	11400	=BDE	11400	NG/KG	J	0.478	LR
SOI	DIOXIN	25040_007	060404-SOI-02728-00.5	N	SW8290	METHOD	TOTAL PECDF	8960	=DE	8960	NG/KG	J	2.4	LR
SOI	DIOXIN	25040_007	060404-SOI-02728-00.5	N	SW8290	METHOD	TOTAL HPCDF	7290	=BE	7290	NG/KG	J	2.4	LR
SOI	DIOXIN	25040_004	060404-SOI-02713-00.5	N	SW8290	METHOD	TOTAL HXCDF	6680	=BDE	6680	NG/KG	J	2.51	LR
SOI	DIOXIN	25040_004	060404-SOI-02713-00.5	N	SW8290	METHOD	TOTAL HPCDF	4620	=BE	4620	NG/KG	J	2.51	LR
SOI	DIOXIN	25040_003	060404-SOI-02712-00.5	N	SW8290	METHOD	OCDD	12000	=BE	12000	NG/KG	J	4.79	LR
SOI	DIOXIN	25040_003	060404-SOI-02712-00.5	N	SW8290	METHOD	2,3,7,8-TCDF	3400	=BE	3400	NG/KG	J	0.479	LR
SOI	DIOXIN	25040_009	060404-SOI-02730-00.5	N	SW8290	METHOD	1,2,3,4,6,7,8-HPCDD	2480	=E	2480	NG/KG	J	2.38	LR
SOI	DIOXIN	25040_009	060404-SOI-02730-00.5	N	SW8290	METHOD	OCDD	26000	=BE	26000	NG/KG	J	4.77	LR
SOI	DIOXIN	25040_009	060404-SOI-02730-00.5	N	SW8290	METHOD	2,3,7,8-TCDF	10300	=BE	10300	NG/KG	J	0.477	LR
SED	DIOXIN	25108_012	063004-SED-02725-00.2	N	SW8290	METHOD	1,2,3,4,6,7,8-HPCDD	2080	=E	2080	NG/KG	J	2.5	LR
SED	DIOXIN	25108_012	063004-SED-02725-00.2	N	SW8290	METHOD	1,2,3,4,6,7,8-HPCDF	2180	=E	2180	NG/KG	J	2.5	LR
SED	DIOXIN	25108_005	063004-SED-02710-00.2	N	SW8290	METHOD	OCDD	11200	=BE	11200	NG/KG	J	4.88	LR
SED	DIOXIN	25108_005	063004-SED-02710-00.2	N	SW8290	METHOD	OCDF	4090	=E	4090	NG/KG	J	4.88	LR
SOI	DIOXIN	25041_009	060304-SOI-02704-00.5	N	SW8290	METHOD	1,2,3,4,6,7,8-HPCDD	5350	=BE	5350	NG/KG	J	2.46	LR
SOI	DIOXIN	25041_009	060304-SOI-02704-00.5	N	SW8290	METHOD	OCDD	59300	=BE	59300	NG/KG	J	4.91	LR
SOI	DIOXIN	25041_009DL	060304-SOI-02704-00.5	N	SW8290	METHOD	2,3,7,8-TCDF	12200	=*E	12200	NG/KG	J	4.91	LR
SOI	DIOXIN	25041_009	060304-SOI-02704-00.5	N	SW8290	METHOD	1,2,3,7,8-PECDF	2040	=BE	2040	NG/KG	J	2.46	LR
SOI	DIOXIN	25041_009	060304-SOI-02704-00.5	N	SW8290	METHOD	2,3,4,7,8-PECDF	2940	=BE	2940	NG/KG	J	2.46	LR
SOI	DIOXIN	25041_009	060304-SOI-02704-00.5	N	SW8290	METHOD	1,2,3,4,6,7,8-HPCDF	4250	=BDE	4250	NG/KG	J	2.46	LR
SOI	DIOXIN	25041_009	060304-SOI-02704-00.5	N	SW8290	METHOD	OCDF	16100	=BE	16100	NG/KG	J	4.91	LR
SOI	DIOXIN	25041_008	060304-SOI-02706-00.5	N	SW8290	METHOD	OCDD	12600	=BE	12600	NG/KG	J	4.83	LR
SOI	DIOXIN	25041_008	060304-SOI-02706-00.5	N	SW8290	METHOD	2,3,7,8-TCDF	1200	=E	1200	NG/KG	J	0.483	LR
SOI	DIOXIN	25041_007	060304-SOI-02705-00.5	N	SW8290	METHOD	1,2,3,4,6,7,8-HPCDD	5730	=BE	5730	NG/KG	J	2.39	LR
SOI	DIOXIN	25041_007	060304-SOI-02705-00.5	N	SW8290	METHOD	OCDD	61400	=BE	61400	NG/KG	J	4.77	LR
SOI	DIOXIN	25041_007	060304-SOI-02705-00.5	N	SW8290	METHOD	2,3,7,8-TCDF	4970	=E	4970	NG/KG	J	0.477	LR
SOI	DIOXIN	25041_007	060304-SOI-02705-00.5	N	SW8290	METHOD	1,2,3,4,6,7,8-HPCDF	6270	=BDE	6270	NG/KG	J	2.39	LR
SOI	DIOXIN	25041_007	060304-SOI-02705-00.5	N	SW8290	METHOD	OCDF	16500	=BE	16500	NG/KG	J	4.77	LR
SOI	DIOXIN	25041_006	060304-SOI-02703-00.5	N	SW8290	METHOD	OCDD	14900	=BE	14900	NG/KG	J	4.97	LR
SOI	DIOXIN	25041_006	060304-SOI-02703-00.5	N	SW8290	METHOD	2,3,7,8-TCDF	547	=E	547	NG/KG	J	0.497	LR
SOI	DIOXIN	25041_006	060304-SOI-02703-00.5	N	SW8290	METHOD	OCDF	4400	=BE	4400	NG/KG	J	4.97	LR
SOI	DIOXIN	25041_004	060304-SOI-02722-00.5	N	SW8290	METHOD	OCDD	10800	=BE	10800	NG/KG	J	5.04	LR
SOI	DIOXIN	25041_004	060304-SOI-02722-00.5	N	SW8290	METHOD	2,3,7,8-TCDF	8040	=E	8040	NG/KG	J	0.504	LR
SOI	DIOXIN	25041_004	060304-SOI-02722-00.5	N	SW8290	METHOD	1,2,3,7,8-PECDF	3460	=BE	3460	NG/KG	J	2.51	LR
SOI	DIOXIN	25041_004	060304-SOI-02722-00.5	N	SW8290	METHOD	2,3,4,7,8-PECDF	3440	=BE	3440	NG/KG	J	2.51	LR
SOI	DIOXIN	25041_004	060304-SOI-02722-00.5	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	2390	=BDE	2390	NG/KG	J	2.51	LR
SOI	DIOXIN	25041_004	060304-SOI-02722-00.5	N	SW8290	METHOD	1,2,3,4,6,7,8-HPCDF	2620	=BE	2620	NG/KG	J	2.51	LR
SOI	DIOXIN	25041_003	060304-SOI-02721-00.5	N	SW8290	METHOD	OCDD	6630	=BE	6630	NG/KG	J	4.85	LR
SOI	DIOXIN	25041_002	060304-SOI-02720-00.5	N	SW8290	METHOD	OCDD	12400	=BE	12400	NG/KG	J	4.93	LR
SOI	DIOXIN	25041_002DL	060304-SOI-02720-00.5	N	SW8290	METHOD	2,3,7,8-TCDF	22900	=E	22900	NG/KG	J	9.86	LR
SOI	DIOXIN	25041_002DL	060304-SOI-02720-00.5	N	SW8290	METHOD	1,2,3,7,8-PECDF	10200	=BE*	10200	NG/KG	J	49.3	LR
SOI	DIOXIN	25041_002DL	060304-SOI-02720-00.5	N	SW8290	METHOD	2,3,4,7,8-PECDF	10100	=BE*	10100	NG/KG	J	49.3	LR
SOI	DIOXIN	25041_002	060304-SOI-02720-00.5	N	SW8290	METHOD	1,2,3,4,7,8-HXCDF	6330	=BDE	6330	NG/KG	J	2.47	LR
SOI	DIOXIN	25041_002	060304-SOI-02720-00.5	N	SW8290	METHOD	1,2,3,4,6,7,8-HPCDF	3330	=BE	3330	NG/KG	J	2.47	LR
SOI	DIOXIN	25041_002	060304-SOI-02720-00.5	N	SW8290	METHOD	TOTAL HXCDF	12600	=BDE	12600	NG/KG	J	2.47	LR
SOI	DIOXIN	25041_002	060304-SOI-02720-00.5	N	SW8290	METHOD	TOTAL HPCDF	6490	=BE	6490	NG/KG	J	2.47	LR
SOI	DIOXIN	25041_001	060304-SOI-02719-00.5	N	SW8290	METHOD	OCDD	5740	=BE	5740	NG/KG	J	4.97	LR
SOI	DIOXIN	25041_001	060304-SOI-02719-00.5	N	SW8290	METHOD	2,3,7,8-TCDF	576	=E	576	NG/KG	J	0.497	LR
SOI	DIOXIN	25041_010	060304-SOI-02704-00.5-D	FD	SW8290	METHOD	1,2,3,4,6,7,8-HPCDD	2830	=E	2830	NG/KG	J	2.5	LR
SOI	DIOXIN	25041_010	060304-SOI-02704-00.5-D	FD	SW8290	METHOD	OCDD	26300	=E	26300	NG/KG	J	5.01	LR
SOI	DIOXIN	25041_010	060304-SOI-02704-00.5-D	FD	SW8290	METHOD	2,3,7,8-TCDF	441	=E	441	NG/KG	J	0.501	LR
SOI	DIOXIN	25041_010	060304-SOI-02704-00.5-D	FD	SW8290	METHOD	1,2,3,4,6,7,8-HPCDF	2840	=DE	2840	NG/KG	J	2.5	LR
SOI	DIOXIN	25041_010	060304-SOI-02704-00.5-D	FD	SW8290	METHOD	OCDF	7940	=DE	7940	NG/KG	J	5.01	LR
SED	DIOXIN	25108_012	063004-SED-02725-00.2	N	SW8290	METHOD	OCDF	7520	=E	7520	NG/KG	J	4.99	LR
SED	DIOXIN	25108_012	063004-SED-02725-00.2	N	SW8290	METHOD	TOTAL HPCDD	3380	=E	3380	NG/KG	J	2.5	LR
SED	DIOXIN	25108_012	063004-SED-02725-00.2	N	SW8290	METHOD	OCDD	20700	=BE	20700	NG/KG	J	4.99	LR,ISH
SED	DIOXIN	25108_011DL	063004-SED-02724-00.2	N	SW8290	METHOD	OCDD	150000	=BE*	150000	NG/KG	J	49.8	LR,ISH
SED	DIOXIN	25108_011DL	063004-SED-02724-00.2	N	SW8290	METHOD	OCDF	102000	=E*	102000	NG/KG	J	49.8	LR,ISH
SO	HERB	20406042501	060204-SOI-02695-00.5	N	SW8270C	SW3510C	Dinoseb	425	U	425	UG/KG	UJ	425	ICRSD

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SO	HERB	20406042502	060204-SOI-02696-00.5	N	SW8270C	SW3510C	Dinoseb	463	U	463	UG/KG	UJ	463	ICRSD
SO	HERB	20406042503	060204-SOI-02697-00.5	N	SW8270C	SW3510C	Dinoseb	446	U	446	UG/KG	UJ	446	ICRSD
SO	HERB	20406042504	060204-SOI-02697-00.5-D	FD	SW8270C	SW3510C	Dinoseb	451	U	451	UG/KG	UJ	451	ICRSD
SO	HERB	20406042505	060204-SOI-02698-00.5	N	SW8270C	SW3510C	Dinoseb	442	U	442	UG/KG	UJ	442	ICRSD
SO	HERB	20406042507	060204-SOI-02695-01.5	N	SW8270C	SW3510C	Dinoseb	388	U	388	UG/KG	UJ	388	ICRSD
SO	HERB	20406042508	060204-SOI-02696-04.0	N	SW8270C	SW3510C	Dinoseb	412	U	412	UG/KG	UJ	412	ICRSD
SO	HERB	20406042510	060204-SOI-02697-02.5	N	SW8270C	SW3510C	Dinoseb	383	U	383	UG/KG	UJ	383	ICRSD
SO	HERB	20406042511	060204-SOI-02696-02.0	N	SW8270C	SW3510C	Dinoseb	445	U	445	UG/KG	UJ	445	ICRSD
SED	HERB	20407020801	063004-SED-02707-00.2	N	SW8270C	SW3510C	Dinoseb	391	U	391	UG/KG	UJ	391	ICRSD
SED	HERB	20407020802	063004-SED-02708-00.2	N	SW8270C	SW3510C	Dinoseb	416	U	416	UG/KG	UJ	416	ICRSD
SED	HERB	20407020803	063004-SED-02708-00.2-D	FD	SW8270C	SW3510C	Dinoseb	416	U	416	UG/KG	UJ	416	ICRSD
SED	HERB	20407020806	063004-SED-02709-00.2	N	SW8270C	SW3510C	Dinoseb	388	U	388	UG/KG	UJ	388	ICRSD
SED	HERB	20407020807	063004-SED-02710-00.2	N	SW8270C	SW3510C	Dinoseb	377	U	377	UG/KG	UJ	377	ICRSD
SED	HERB	20407020808	063004-SED-02715-00.2	N	SW8270C	SW3510C	Dinoseb	423	U	423	UG/KG	UJ	423	ICRSD
SED	HERB	20407020809	063004-SED-02716-00.2	N	SW8270C	SW3510C	Dinoseb	378	U	378	UG/KG	UJ	378	ICRSD
SED	HERB	20407020810	063004-SED-02717-00.2	N	SW8270C	SW3510C	Dinoseb	423	U	423	UG/KG	UJ	423	ICRSD
SED	HERB	20407020811	063004-SED-02718-00.2	N	SW8270C	SW3510C	Dinoseb	405	U	405	UG/KG	UJ	405	ICRSD
SED	HERB	20407020812	063004-SED-02723-00.2	N	SW8270C	SW3510C	Dinoseb	391	U	391	UG/KG	UJ	391	ICRSD
SED	HERB	20407020813	063004-SED-02724-00.2	N	SW8270C	SW3510C	Dinoseb	374	U	374	UG/KG	UJ	374	ICRSD
SED	HERB	20407020814	063004-SED-02725-00.2	N	SW8270C	SW3510C	Dinoseb	410	U	410	UG/KG	UJ	410	ICRSD
SED	HERB	20407020815	063004-SED-02726-00.2	N	SW8270C	SW3510C	Dinoseb	398	U	398	UG/KG	UJ	398	ICRSD
SED	HERB	20407020816	063004-SED-02726-00.2-D	FD	SW8270C	SW3510C	Dinoseb	400	U	400	UG/KG	UJ	400	ICRSD
SO	HERB	20406042504	060204-SOI-02697-00.5-D	FD	SW8151A	SW3510C	2,4,5-T	23.2	U	23.2	UG/KG	UJ	23.2	SSL
SO	HERB	20406042504	060204-SOI-02697-00.5-D	FD	SW8151A	SW3510C	2,4,5-TP (Silvex)	23.2	U	23.2	UG/KG	UJ	23.2	SSL
SO	HERB	20406042504	060204-SOI-02697-00.5-D	FD	SW8151A	SW3510C	2,4'-D	23.2	U	23.2	UG/KG	UJ	23.2	SSL
SO	HERB	20406042507	060204-SOI-02695-01.5	N	SW8151A	SW3510C	2,4,5-T	20	U	20	UG/KG	UJ	20	SSL
SO	HERB	20406042507	060204-SOI-02695-01.5	N	SW8151A	SW3510C	2,4,5-TP (Silvex)	20	U	20	UG/KG	UJ	20	SSL
SO	HERB	20406042507	060204-SOI-02695-01.5	N	SW8151A	SW3510C	2,4'-D	20	U	20	UG/KG	UJ	20	SSL
SED	METAL	20406302314	062904-SED-02734-00.2	N	SW6010B	SW3050B	ARSENIC	930	B	0.93	MG/KG	U	1170	CCBL
SED	METAL	20406302314	062904-SED-02734-00.2	N	SW6010B	SW3050B	BERYLLIUM	35.9	B	0.0359	MG/KG	U	234	CCBL
SED	METAL	20406302315	062904-SED-02734-00.2-D	FD	SW6010B	SW3050B	ARSENIC	856	B	0.856	MG/KG	U	1170	CCBL
SED	METAL	20406302315	062904-SED-02734-00.2-D	FD	SW6010B	SW3050B	BERYLLIUM	39.7	B	0.0397	MG/KG	U	233	CCBL
SED	METAL	20406302309	062904-SED-02731-00.2	N	SW6010B	SW3050B	ARSENIC	630	B	0.63	MG/KG	U	1200	CCBL
SED	METAL	20406302309	062904-SED-02731-00.2	N	SW6010B	SW3050B	BERYLLIUM	25.9	B	0.0259	MG/KG	U	239	CCBL
SED	METAL	20406302307	062904-SED-02701-00.2	N	SW6010B	SW3050B	ARSENIC	950	B	0.95	MG/KG	U	1220	CCBL
SED	METAL	20406302306	062904-SED-02700-00.2	N	SW6010B	SW3050B	THALLIUM	1460	=	1460	UG/KG	U	900	CCBL
SOI	METAL	20406042502	060204-SOI-02696-00.5	N	SW6010B	SW3050B	THALLIUM	1420	=	1420	UG/KG	U	1120	CCBL
SOI	METAL	20406042511	060204-SOI-02696-02.0	N	SW6010B	SW3050B	THALLIUM	1800	=	1800	UG/KG	U	1080	CCBL
SOI	METAL	20406050906	060304-SOI-02719-00.5	N	SW6010B	SW3050B	THALLIUM	975	B	975	UG/KG	U	1020	CCBL
SOI	METAL	20406050910	060304-SOI-02721-00.5	N	SW6010B	SW3050B	THALLIUM	937	B	937	UG/KG	U	1050	CCBL
SOI	METAL	20406050912	060404-SOI-02711-00.5	N	SW6010B	SW3050B	THALLIUM	930	B	930	UG/KG	U	1130	CCBL
SOI	METAL	20406050914	060404-SOI-02713-00.5	N	SW6010B	SW3050B	THALLIUM	870	B	870	UG/KG	U	1180	CCBL
SOI	METAL	20406050916	060404-SOI-02727-00.5	N	SW6010B	SW3050B	THALLIUM	1390	=	1390	UG/KG	U	1080	CCBL
SOI	METAL	20406050918	060404-SOI-02729-00.5	N	SW6010B	SW3050B	THALLIUM	1280	=	1280	UG/KG	U	1130	CCBL
SOI	METAL	20406050920	060404-SOI-02730-00.5-D	FD	SW6010B	SW3050B	THALLIUM	989	B	989	UG/KG	U	1030	CCBL
SED	METAL	20407020814RE	063004-SED-02725-00.2	N	SW6010B	SW3050B	Arsenic	1220	B	1.22	MG/KG	U	1230	CCBL
SED	METAL	20407020802RE	063004-SED-02708-00.2	N	SW6010B	SW3050B	Arsenic	591	B	0.591	MG/KG	U	1260	CCBL
SED	METAL	20407020803RE	063004-SED-02708-00.2-D	FD	SW6010B	SW3050B	Arsenic	480	B	0.48	MG/KG	J	1260	CCBL
SED	METAL	20407020808RE	063004-SED-02715-00.2	N	SW6010B	SW3050B	Arsenic	1050	B	1.05	MG/KG	U	1270	CCBL
SED	METAL	20407020807RE	063004-SED-02710-00.2	N	SW6010B	SW3050B	Arsenic	1570	=	1.57	MG/KG	U	1130	CCBL
SED	METAL	20407020811RE	063004-SED-02718-00.2	N	SW6010B	SW3050B	Arsenic	843	B	0.843	MG/KG	U	1230	CCBL
SED	METAL	20407020809RE	063004-SED-02716-00.2	N	SW6010B	SW3050B	Arsenic	1450	=	1.45	MG/KG	U	1140	CCBL
SED	METAL	20406302304	062804-SED-02694-00.2	N	SW6010B	SW3050B	THALLIUM	1170	B	1170	UG/KG	U	1760	CCBL, EBL
SOI	METAL	20406050915	060404-SOI-02714-00.5	N	SW6010B	SW3050B	THALLIUM	764	B	764	UG/KG	U	1080	CCBL, EBL
SED	METAL	20406302315	062904-SED-02734-00.2-D	FD	SW6010B	SW3050B	CADMIUM	61.3	B	0.0613	MG/KG	U	233	CCBL, LBL
SED	METAL	20406302313	062904-SED-02733-00.2	N	SW6010B	SW3050B	ANTIMONY	287	B	0.287	MG/KG	U	2420	CCBL, LBL
SED	METAL	20406302302	062804-SED-02692-00.2	N	SW6010B	SW3050B	ANTIMONY	227	B	0.227	MG/KG	U	2450	CCBL, LBL
SED	METAL	20406302302	062804-SED-02692-00.2	N	SW6010B	SW3050B	CADMIUM	55.5	B	0.0555	MG/KG	U	245	CCBL, LBL
SED	METAL	20406302309	062904-SED-02731-00.2	N	SW6010B	SW3050B	CADMIUM	49.7	B	0.0497	MG/KG	U	239	CCBL, LBL
SED	METAL	20406302301	062804-SED-02691-00.2	N	SW6010B	SW3050B	ANTIMONY	266	B	0.266	MG/KG	U	2340	CCBL, LBL
SOI	METAL	20406042501	060204-SOI-02695-00.5	N	SW6010B	SW3050B	THALLIUM	259	B	259	UG/KG	U	1030	CCBL, LBL
SOI	METAL	20406042508	060204-SOI-02696-04.0	N	SW6010B	SW3050B	THALLIUM	762	B	762	UG/KG	U	1000	CCBL, LBL
SOI	METAL	20406042503	060204-SOI-02697-00.5	N	SW6010B	SW3050B	THALLIUM	369	B	369	UG/KG	U	1070	CCBL, LBL
SOI	METAL	20406042505	060204-SOI-02698-00.5	N	SW6010B	SW3050B	THALLIUM	200	B	200	UG/KG	U	1070	CCBL, LBL
SOI	METAL	20406042504	060204-SOI-02697-00.5-D	FD	SW6010B	SW3050B	THALLIUM	658	B	658	UG/KG	U	1090	CCBL, LBL
SED	METAL	20406302314	062904-SED-02734-00.2	N	SW6010B	SW3050B	THALLIUM	234	B	234	UG/KG	U	937	CCBL, LBL, EBL
SED	METAL	20406302303	062804-SED-02693-00.2	N	SW6010B	SW3050B	THALLIUM	890	B	890	UG/KG	U	948	CCBL, LBL, EBL
SED	METAL	20406302313	062904-SED-02733-00.2	N	SW6010B	SW3050B	THALLIUM	751	B	751	UG/KG	U	967	CCBL, LBL, EBL

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SED	METAL	20406302301	062804-SED-02691-00.2	N	SW6010B	SW3050B	THALLIUM	399	B	399	UG/KG	U	936	CCBL, LBL, EBL
SED	METAL	20406302308	062904-SED-02702-00.2	N	SW6010B	SW3050B	THALLIUM	910	=	910	UG/KG	U	879	CCBL, LBL, EBL
SED	METAL	20406302307	062904-SED-02701-00.2	N	SW6010B	SW3050B	THALLIUM	850	B	850	UG/KG	U	976	CCBL, LBL, EBL
SED	METAL	20406302305	062904-SED-02699-00.2	N	SW6010B	SW3050B	THALLIUM	386	B	386	UG/KG	U	903	CCBL, LBL, EBL
SOI	METAL	20406050913	060404-SOI-02712-00.5	N	SW6010B	SW3050B	THALLIUM	775	B	775	UG/KG	U	1000	CCBL,EBL
SOI	METAL	20406050919	060404-SOI-02730-00.5	N	SW6010B	SW3050B	THALLIUM	806	B	806	UG/KG	U	1040	CCBL,EBL
SED	METAL	20407020815RE	063004-SED-02726-00.2	N	SW6010B	SW3050B	Thallium	356	B	356	UG/KG	U	958	CCBL,EBL
SED	METAL	20407020814RE	063004-SED-02725-00.2	N	SW6010B	SW3050B	Thallium	259	B	259	UG/KG	U	986	CCBL,EBL
SED	METAL	20407020816RE	063004-SED-02726-00.2-D	FD	SW6010B	SW3050B	Thallium	526	B	526	UG/KG	U	970	CCBL,EBL
SED	METAL	20407020812RE	063004-SED-02723-00.2	N	SW6010B	SW3050B	Thallium	336	B	336	UG/KG	U	949	CCBL,EBL
SED	METAL	20407020803RE	063004-SED-02708-00.2-D	FD	SW6010B	SW3050B	Cadmium	36.7	B	0.0367	MG/KG	U	252	CCBL,LBL
SED	METAL	20407020801RE	063004-SED-02707-00.2	N	SW6010B	SW3050B	Cadmium	76.1	B	0.0761	MG/KG	U	235	CCBL,LBL
SED	METAL	20407020814RE	063004-SED-02725-00.2	N	SW6010B	SW3050B	Cadmium	86.4	B	0.0864	MG/KG	U	247	CCBL,LBL
SED	METAL	20407020802RE	063004-SED-02708-00.2	N	SW6010B	SW3050B	Cadmium	47.9	B	0.0479	MG/KG	U	252	CCBL,LBL
SED	METAL	20407020806RE	063004-SED-02709-00.2	N	SW6010B	SW3050B	Cadmium	73.6	B	0.0736	MG/KG	U	235	CCBL,LBL
SED	METAL	20407020807RE	063004-SED-02710-00.2	N	SW6010B	SW3050B	Cadmium	108	B	0.108	MG/KG	U	227	CCBL,LBL
SED	METAL	20407020812RE	063004-SED-02723-00.2	N	SW6010B	SW3050B	Cadmium	95.1	B	0.0951	MG/KG	U	237	CCBL,LBL
SED	METAL	20407020815RE	063004-SED-02726-00.2	N	SW6010B	SW3050B	Cadmium	119	B	0.119	MG/KG	U	240	CCBL,LBL
SED	METAL	20407020813RE	063004-SED-02724-00.2	N	SW6010B	SW3050B	Cadmium	158	B	0.158	MG/KG	U	227	CCBL,LBL
SED	METAL	20407020810RE	063004-SED-02717-00.2	N	SW6010B	SW3050B	Cadmium	92.2	B	0.0922	MG/KG	U	256	CCBL,LBL
SED	METAL	20407020809RE	063004-SED-02716-00.2	N	SW6010B	SW3050B	Cadmium	98.1	B	0.0981	MG/KG	U	227	CCBL,LBL
SED	METAL	20407020811RE	063004-SED-02718-00.2	N	SW6010B	SW3050B	Cadmium	67.1	B	0.0671	MG/KG	U	245	CCBL,LBL
SED	METAL	20407020808RE	063004-SED-02715-00.2	N	SW6010B	SW3050B	Cadmium	45.5	B	0.0455	MG/KG	U	255	CCBL,LBL
SED	METAL	20407020816RE	063004-SED-02726-00.2-D	FD	SW6010B	SW3050B	Cadmium	137	B	0.137	MG/KG	U	243	CCBL,LBL
SOI	METAL	20406050901	060304-SOI-02703-00.5	N	SW6010B	SW3050B	THALLIUM	223	B	223	UG/KG	U	933	CCBL,LBL,EBL
SOI	METAL	20406050904	060304-SOI-02704-00.5	N	SW6010B	SW3050B	THALLIUM	221	B	221	UG/KG	U	948	CCBL,LBL,EBL
SOI	METAL	20406050905	060304-SOI-02704-00.5-D	FD	SW6010B	SW3050B	THALLIUM	488	B	488	UG/KG	U	1050	CCBL,LBL,EBL
SOI	METAL	20406050902	060304-SOI-02705-00.5	N	SW6010B	SW3050B	THALLIUM	234	B	234	UG/KG	U	946	CCBL,LBL,EBL
SOI	METAL	20406050907	060304-SOI-02720-00.5	N	SW6010B	SW3050B	THALLIUM	508	B	508	UG/KG	U	944	CCBL,LBL,EBL
SOI	METAL	20406050911	060304-SOI-02722-00.5	N	SW6010B	SW3050B	THALLIUM	445	B	445	UG/KG	U	939	CCBL,LBL,EBL
SOI	METAL	20406050917	060404-SOI-02728-00.5	N	SW6010B	SW3050B	THALLIUM	331	B	331	UG/KG	U	1010	CCBL,LBL,EBL
SED	METAL	20407020813RE	063004-SED-02724-00.2	N	SW6010B	SW3050B	Copper	1490	=	1490	UG/KG	U	453	EBL
SED	METAL	20407020815RE	063004-SED-02726-00.2	N	SW6010B	SW3050B	Copper	1190	=	1190	UG/KG	U	479	EBL
SED	METAL	20407020816RE	063004-SED-02726-00.2-D	FD	SW6010B	SW3050B	Copper	1460	=	1460	UG/KG	U	485	EBL
SED	METAL	20407020803RE	063004-SED-02708-00.2-D	FD	SW6010B	SW3050B	Copper	985	=	985	UG/KG	U	504	EBL
SED	METAL	20407020807RE	063004-SED-02710-00.2	N	SW6010B	SW3050B	Copper	1330	=	1330	UG/KG	U	453	EBL
SED	METAL	20407020801RE	063004-SED-02707-00.2	N	SW6010B	SW3050B	Copper	1510	=	1510	UG/KG	U	470	EBL
SED	METAL	20407020802RE	063004-SED-02708-00.2	N	SW6010B	SW3050B	Copper	972	=	972	UG/KG	U	504	EBL
SED	METAL	20407020808RE	063004-SED-02715-00.2	N	SW6010B	SW3050B	Copper	972	=	972	UG/KG	U	509	EBL
SED	METAL	20407020810RE	063004-SED-02717-00.2	N	SW6010B	SW3050B	Copper	1210	=	1210	UG/KG	U	513	EBL
SED	METAL	20407020811RE	063004-SED-02718-00.2	N	SW6010B	SW3050B	Copper	843	=	843	UG/KG	U	491	EBL
SED	METAL	20407020812RE	063004-SED-02723-00.2	N	SW6010B	SW3050B	Copper	1460	=	1460	UG/KG	U	474	EBL
SED	METAL	20406302304	062804-SED-02694-00.2	N	SW7471A	METHOD	MERCURY	4.08	B	4.08	UG/KG	J	11.1	IB
SED	METAL	20406302304	062804-SED-02694-00.2	N	SW6010B	SW3050B	LEAD	1140	B	1140	UG/KG	J	1320	IB
SED	METAL	20406302304	062804-SED-02694-00.2	N	SW6010B	SW3050B	LITHIUM	2790	B	2790	UG/KG	J	4400	IB
SED	METAL	20406302304	062804-SED-02694-00.2	N	SW6010B	SW3050B	NICKEL	1810	B	1810	UG/KG	J	2200	IB
SED	METAL	20406302304	062804-SED-02694-00.2	N	SW6010B	SW3050B	ARSENIC	1930	B	1.93	MG/KG	J	2200	IB
SED	METAL	20406302304	062804-SED-02694-00.2	N	SW6010B	SW3050B	BERYLLIUM	152	B	0.152	MG/KG	J	440	IB
SED	METAL	20406302304	062804-SED-02694-00.2	N	SW6010B	SW3050B	VANADIUM	1280	B	1.28	MG/KG	J	1760	IB
SED	METAL	20406302314	062904-SED-02734-00.2	N	SW7471A	METHOD	MERCURY	10.7	B	10.7	UG/KG	J	11.8	IB
SED	METAL	20406302314	062904-SED-02734-00.2	N	SW6010B	SW3050B	LITHIUM	966	B	966	UG/KG	J	2340	IB
SED	METAL	20406302303	062804-SED-02693-00.2	N	SW7471A	METHOD	MERCURY	3.66	B	3.66	UG/KG	J	11.9	IB
SED	METAL	20406302303	062804-SED-02693-00.2	N	SW6010B	SW3050B	BERYLLIUM	182	B	0.182	MG/KG	J	237	IB
SED	METAL	20406302315	062904-SED-02734-00.2-D	FD	SW7471A	METHOD	MERCURY	11.4	B	11.4	UG/KG	J	11.8	IB
SED	METAL	20406302315	062904-SED-02734-00.2-D	FD	SW6010B	SW3050B	LITHIUM	958	B	958	UG/KG	J	2330	IB
SED	METAL	20406302313	062904-SED-02733-00.2	N	SW6010B	SW3050B	LITHIUM	2350	B	2350	UG/KG	J	2420	IB
SED	METAL	20406302313	062904-SED-02733-00.2	N	SW6010B	SW3050B	BERYLLIUM	98.3	B	0.0983	MG/KG	J	242	IB
SED	METAL	20406302302	062804-SED-02692-00.2	N	SW7471A	METHOD	MERCURY	3.58	B	3.58	UG/KG	J	12.2	IB
SED	METAL	20406302302	062804-SED-02692-00.2	N	SW6010B	SW3050B	LITHIUM	1480	B	1480	UG/KG	J	2450	IB
SED	METAL	20406302302	062804-SED-02692-00.2	N	SW6010B	SW3050B	NICKEL	1180	B	1180	UG/KG	J	1220	IB
SED	METAL	20406302302	062804-SED-02692-00.2	N	SW6010B	SW3050B	ARSENIC	1160	B	1.16	MG/KG	J	1220	IB
SED	METAL	20406302302	062804-SED-02692-00.2	N	SW6010B	SW3050B	BERYLLIUM	61.4	B	0.0614	MG/KG	J	245	IB
SED	METAL	20406302309	062904-SED-02731-00.2	N	SW7471A	METHOD	MERCURY	8.32	B	8.32	UG/KG	J	12	IB
SED	METAL	20406302309	062904-SED-02731-00.2	N	SW6010B	SW3050B	LITHIUM	690	B	690	UG/KG	J	2390	IB
SED	METAL	20406302309	062904-SED-02731-00.2	N	SW6010B	SW3050B	NICKEL	1060	B	1060	UG/KG	J	1200	IB
SED	METAL	20406302301	062804-SED-02691-00.2	N	SW7471A	METHOD	MERCURY	3.95	B	3.95	UG/KG	J	11.7	IB
SED	METAL	20406302301	062804-SED-02691-00.2	N	SW6010B	SW3050B	BERYLLIUM	122	B	0.122	MG/KG	J	234	IB
SED	METAL	20406302307	062904-SED-02701-00.2	N	SW9012A	METHOD	CYANIDE, TOTAL	0.1708	B	0.1708	MG/KG	J	0.305	IB

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SED	METAL	20406302308	062904-SED-02702-00.2	N	SW7471A	METHOD	MERCURY	3.69	B	3.69	UG/KG	J	11.1	IB
SED	METAL	20406302308	062904-SED-02702-00.2	N	SW6010B	SW3050B	LITHIUM	1710	B	1710	UG/KG	J	2200	IB
SED	METAL	20406302308	062904-SED-02702-00.2	N	SW6010B	SW3050B	BERYLLIUM	102	B	0.102	MG/KG	J	220	IB
SED	METAL	20406302307	062904-SED-02701-00.2	N	SW7471A	METHOD	MERCURY	3.42	B	3.42	UG/KG	J	12.2	IB
SED	METAL	20406302307	062904-SED-02701-00.2	N	SW6010B	SW3050B	LITHIUM	1810	B	1810	UG/KG	J	2440	IB
SED	METAL	20406302307	062904-SED-02701-00.2	N	SW6010B	SW3050B	BERYLLIUM	104	B	0.104	MG/KG	J	244	IB
SED	METAL	20406302306	062904-SED-02700-00.2	N	SW7471A	METHOD	MERCURY	2.82	B	2.82	UG/KG	J	11.2	IB
SED	METAL	20406302306	062904-SED-02700-00.2	N	SW6010B	SW3050B	ARSENIC	1020	B	1.02	MG/KG	J	1130	IB
SED	METAL	20406302306	062904-SED-02700-00.2	N	SW6010B	SW3050B	BERYLLIUM	135	B	0.135	MG/KG	J	225	IB
SED	METAL	20406302312	062904-SED-02732-00.2	N	SW6010B	SW3050B	LITHIUM	1300	B	1300	UG/KG	J	2530	IB
SED	METAL	20406302312	062904-SED-02732-00.2	N	SW6010B	SW3050B	ARSENIC	1020	B	1.02	MG/KG	J	1260	IB
SED	METAL	20406302312	062904-SED-02732-00.2	N	SW6010B	SW3050B	BERYLLIUM	50	B	0.05	MG/KG	J	253	IB
SED	METAL	20406302305	062904-SED-02699-00.2	N	SW7471A	METHOD	MERCURY	4.14	B	4.14	UG/KG	J	11.4	IB
SED	METAL	20406302305	062904-SED-02699-00.2	N	SW6010B	SW3050B	LITHIUM	1570	B	1570	UG/KG	J	2260	IB
SED	METAL	20406302305	062904-SED-02699-00.2	N	SW6010B	SW3050B	ARSENIC	1040	B	1.04	MG/KG	J	1130	IB
SED	METAL	20406302305	062904-SED-02699-00.2	N	SW6010B	SW3050B	BERYLLIUM	69.3	B	0.0693	MG/KG	J	226	IB
SOI	METAL	20406042511	060204-SOI-02696-02.0	N	SW9012A	METHOD	CYANIDE, TOTAL	0.115	B	0.115	MG/KG	J	0.337	IB
SOI	METAL	20406042502	060204-SOI-02696-00.5	N	SW9012A	METHOD	CYANIDE, TOTAL	0.175	B	0.175	MG/KG	J	0.351	IB
SOI	METAL	20406042510	060204-SOI-02697-02.5	N	SW9012A	METHOD	CYANIDE, TOTAL	0.122	B	0.122	MG/KG	J	0.291	IB
SOI	METAL	20406042503	060204-SOI-02697-00.5	N	SW9012A	METHOD	CYANIDE, TOTAL	0.162	B	0.162	MG/KG	J	0.338	IB
SOI	METAL	20406042505	060204-SOI-02698-00.5	N	SW9012A	METHOD	CYANIDE, TOTAL	0.248	B	0.248	MG/KG	J	0.335	IB
SOI	METAL	20406032401	060104-SOI-02687-02.0	N	SW6010B	SW3050B	NICKEL	1120	B	1120	UG/KG	J	1170	IB
SOI	METAL	20406032401	060104-SOI-02687-02.0	N	SW6010B	SW3050B	COBALT	273	B	0.273	MG/KG	J	467	IB
SOI	METAL	20406032412	060104-SOI-02687-00.5-D	FD	SW6010B	SW3050B	COBALT	464	B	0.464	MG/KG	J	466	IB
SOI	METAL	20406032407	060104-SOI-02687-04.5	N	SW9012A	METHOD	CYANIDE, TOTAL	0.112	B	0.112	MG/KG	J	0.312	IB
SOI	METAL	20406032416	060104-SOI-02688-00.5	N	SW9012A	METHOD	CYANIDE, TOTAL	0.112	B	0.112	MG/KG	J	0.267	IB
SOI	METAL	20406032406	060104-SOI-02688-07.0	N	SW7471A	METHOD	MERCURY	10.6	B	10.6	UG/KG	J	11.2	IB
SOI	METAL	20406032409	060104-SOI-02690-00.5	N	SW9012A	METHOD	CYANIDE, TOTAL	0.088	B	0.088	MG/KG	J	0.293	IB
SOI	METAL	20406050901	060304-SOI-02703-00.5	N	SW6010B	SW3050B	TIN	1790	B	1.79	MG/KG	J	4670	IB
SOI	METAL	20406050901	060304-SOI-02703-00.5	N	SW9012A	METHOD	CYANIDE, TOTAL	0.0882	B	0.0882	MG/KG	J	0.294	IB
SOI	METAL	20406050903	060304-SOI-02706-00.5	N	SW6010B	SW3050B	LITHIUM	1540	B	1540	UG/KG	J	2150	IB
SOI	METAL	20406050905	060304-SOI-02704-00.5-D	FD	SW9012A	METHOD	CYANIDE, TOTAL	0.0923	B	0.0923	MG/KG	J	0.3295	IB
SOI	METAL	20406050906	060304-SOI-02719-00.5	N	SW9012A	METHOD	CYANIDE, TOTAL	0.146	B	0.146	MG/KG	J	0.3173	IB
SOI	METAL	20406050907	060304-SOI-02720-00.5	N	SW9012A	METHOD	CYANIDE, TOTAL	0.0708	B	0.0708	MG/KG	J	0.2951	IB
SOI	METAL	20406050910	060304-SOI-02721-00.5	N	SW9012A	METHOD	CYANIDE, TOTAL	0.2377	B	0.2377	MG/KG	J	0.3301	IB
SOI	METAL	20406050911	060304-SOI-02722-00.5	N	SW9012A	METHOD	CYANIDE, TOTAL	0.0822	B	0.0822	MG/KG	J	0.2935	IB
SOI	METAL	20406050917	060404-SOI-02728-00.5	N	SW9012A	METHOD	CYANIDE, TOTAL	0.1658	B	0.1658	MG/KG	J	0.3188	IB
SED	METAL	20407020802RE	063004-SED-02708-00.2	N	SW6010B	SW3050B	Nickel	1110	B	1110	UG/KG	J	1260	IB
SED	METAL	20407020803RE	063004-SED-02708-00.2-D	FD	SW6010B	SW3050B	Lithium	849	B	849	UG/KG	J	2520	IB
SED	METAL	20407020816RE	063004-SED-02726-00.2-D	FD	SW6010B	SW3050B	Beryllium	108	B	0.108	MG/KG	J	243	IB
SED	METAL	20407020802RE	063004-SED-02708-00.2	N	SW6010B	SW3050B	Lithium	863	B	863	UG/KG	J	2520	IB
SED	METAL	20407020815RE	063004-SED-02726-00.2	N	SW6010B	SW3050B	Lithium	1860	B	1860	UG/KG	J	2400	IB
SED	METAL	20407020801RE	063004-SED-02707-00.2	N	SW6010B	SW3050B	Lithium	1440	B	1440	UG/KG	J	2350	IB
SED	METAL	20407020814RE	063004-SED-02725-00.2	N	SW6010B	SW3050B	Lithium	1700	B	1700	UG/KG	J	2470	IB
SED	METAL	20407020807RE	063004-SED-02710-00.2	N	SW6010B	SW3050B	Lithium	1710	B	1710	UG/KG	J	2270	IB
SED	METAL	20407020801RE	063004-SED-02707-00.2	N	SW6010B	SW3050B	Beryllium	58.1	B	0.0581	MG/KG	J	235	IB
SED	METAL	20407020802RE	063004-SED-02708-00.2	N	SW6010B	SW3050B	Beryllium	27.9	B	0.0279	MG/KG	J	252	IB
SED	METAL	20407020814RE	063004-SED-02725-00.2	N	SW6010B	SW3050B	Beryllium	70.2	B	0.0702	MG/KG	J	247	IB
SED	METAL	20407020815RE	063004-SED-02726-00.2	N	SW6010B	SW3050B	Beryllium	85.6	B	0.0856	MG/KG	J	240	IB
SED	METAL	20407020803RE	063004-SED-02708-00.2-D	FD	SW6010B	SW3050B	Nickel	1090	B	1090	UG/KG	J	1260	IB
SED	METAL	20407020806RE	063004-SED-02709-00.2	N	SW6010B	SW3050B	Beryllium	69.9	B	0.0699	MG/KG	J	235	IB
SED	METAL	20407020803RE	063004-SED-02708-00.2-D	FD	SW6010B	SW3050B	Beryllium	28.4	B	0.0284	MG/KG	J	252	IB
SED	METAL	20407020808RE	063004-SED-02715-00.2	N	SW6010B	SW3050B	Beryllium	45.7	B	0.0457	MG/KG	J	255	IB
SED	METAL	20407020811RE	063004-SED-02718-00.2	N	SW6010B	SW3050B	Beryllium	69.4	B	0.0694	MG/KG	J	245	IB
SED	METAL	20407020810RE	063004-SED-02717-00.2	N	SW6010B	SW3050B	Beryllium	60.8	B	0.0608	MG/KG	J	256	IB
SED	METAL	20407020812RE	063004-SED-02723-00.2	N	SW6010B	SW3050B	Beryllium	100	B	0.1	MG/KG	J	237	IB
SED	METAL	20407020813RE	063004-SED-02724-00.2	N	SW6010B	SW3050B	Beryllium	164	B	0.164	MG/KG	J	227	IB
SED	METAL	20407020808RE	063004-SED-02715-00.2	N	SW6010B	SW3050B	Lithium	1420	B	1420	UG/KG	J	2550	IB
SED	METAL	20407020809RE	063004-SED-02716-00.2	N	SW6010B	SW3050B	Lithium	2260	B	2260	UG/KG	J	2270	IB
SED	METAL	20407020810RE	063004-SED-02717-00.2	N	SW6010B	SW3050B	Lithium	1350	B	1350	UG/KG	J	2560	IB
SED	METAL	20407020811RE	063004-SED-02718-00.2	N	SW6010B	SW3050B	Lithium	2060	B	2060	UG/KG	J	2450	IB
SED	METAL	20407020812RE	063004-SED-02723-00.2	N	SW6010B	SW3050B	Lithium	2280	B	2280	UG/KG	J	2370	IB
SED	METAL	20407020807RE	063004-SED-02710-00.2	N	SW6010B	SW3050B	Beryllium	67.2	B	0.0672	MG/KG	J	227	IB
SED	METAL	20407020809RE	063004-SED-02716-00.2	N	SW6010B	SW3050B	Beryllium	75.7	B	0.0757	MG/KG	J	227	IB
SED	METAL	20407020810	063004-SED-02717-00.2	N	SW9012A	METHOD	CYANIDE, TOTAL	0.2948	B	0.2948	MG/KG	J	0.3205	IB
SED	METAL	20406302304	062804-SED-02694-00.2	N	SW6010B	SW3050B	TIN	1950	B	1.95	MG/KG	U	8800	LBL
SED	METAL	20406302304	062804-SED-02694-00.2	N	SW6010B	SW3050B	CADMIUM	175	B	0.175	MG/KG	U	440	LBL
SED	METAL	20406302314	062904-SED-02734-00.2	N	SW6010B	SW3050B	TIN	2430	B	2.43	MG/KG	U	4690	LBL

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SED	METAL	20406302314	062904-SED-02734-00.2	N	SW6010B	SW3050B	CADMIUM	74.5	B	0.0745	MG/KG	U	234	LBL
SED	METAL	20406302303	062804-SED-02693-00.2	N	SW6010B	SW3050B	TIN	1380	B	1.38	MG/KG	U	4740	LBL
SED	METAL	20406302303	062804-SED-02693-00.2	N	SW6010B	SW3050B	CADMIUM	173	B	0.173	MG/KG	U	237	LBL
SED	METAL	20406302315	062904-SED-02734-00.2-D	FD	SW6010B	SW3050B	TIN	2110	B	2.11	MG/KG	U	4670	LBL
SED	METAL	20406302302	062804-SED-02692-00.2	N	SW6010B	SW3050B	TIN	1210	B	1.21	MG/KG	U	4900	LBL
SED	METAL	20406302309	062904-SED-02731-00.2	N	SW6010B	SW3050B	TIN	1150	B	1.15	MG/KG	U	4790	LBL
SED	METAL	20406302301	062804-SED-02691-00.2	N	SW6010B	SW3050B	TIN	1630	B	1.63	MG/KG	U	4680	LBL
SED	METAL	20406302301	062804-SED-02691-00.2	N	SW6010B	SW3050B	CADMIUM	139	B	0.139	MG/KG	U	234	LBL
SED	METAL	20406302308	062904-SED-02702-00.2	N	SW6010B	SW3050B	TIN	1980	B	1.98	MG/KG	U	4400	LBL
SED	METAL	20406302308	062904-SED-02702-00.2	N	SW6010B	SW3050B	CADMIUM	128	B	0.128	MG/KG	U	220	LBL
SED	METAL	20406302307	062904-SED-02701-00.2	N	SW6010B	SW3050B	TIN	1790	B	1.79	MG/KG	U	4880	LBL
SED	METAL	20406302307	062904-SED-02701-00.2	N	SW6010B	SW3050B	CADMIUM	146	B	0.146	MG/KG	U	244	LBL
SOI	METAL	20406042501	060204-SOI-02695-00.5	N	SW6010B	SW3050B	TIN	1570	B	1.57	MG/KG	U	5150	LBL
SED	METAL	20406302306	062904-SED-02700-00.2	N	SW6010B	SW3050B	TIN	1760	B	1.76	MG/KG	U	4500	LBL
SED	METAL	20406302306	062904-SED-02700-00.2	N	SW6010B	SW3050B	CADMIUM	141	B	0.141	MG/KG	U	225	LBL
SED	METAL	20406302312	062904-SED-02732-00.2	N	SW6010B	SW3050B	TIN	1440	B	1.44	MG/KG	U	5060	LBL
SOI	METAL	20406042507	060204-SOI-02695-01.5	N	SW6010B	SW3050B	TIN	1420	B	1.42	MG/KG	U	4710	LBL
SED	METAL	20406302305	062904-SED-02699-00.2	N	SW6010B	SW3050B	TIN	1030	B	1.03	MG/KG	U	4520	LBL
SED	METAL	20406302305	062904-SED-02699-00.2	N	SW6010B	SW3050B	CADMIUM	93.9	B	0.0939	MG/KG	U	226	LBL
SOI	METAL	20406042502	060204-SOI-02696-00.5	N	SW6010B	SW3050B	TIN	2310	B	2.31	MG/KG	U	5610	LBL
SOI	METAL	20406042508	060204-SOI-02696-04.0	N	SW6010B	SW3050B	TIN	1440	B	1.44	MG/KG	U	5000	LBL
SOI	METAL	20406042511	060204-SOI-02696-02.0	N	SW6010B	SW3050B	TIN	1900	B	1.9	MG/KG	U	5400	LBL
SOI	METAL	20406042503	060204-SOI-02697-00.5	N	SW6010B	SW3050B	TIN	2220	B	2.22	MG/KG	U	5360	LBL
SOI	METAL	20406042505	060204-SOI-02698-00.5	N	SW6010B	SW3050B	TIN	1970	B	1.97	MG/KG	U	5360	LBL
SOI	METAL	20406042510	060204-SOI-02697-02.5	N	SW6010B	SW3050B	TIN	1280	B	1.28	MG/KG	U	4650	LBL
SOI	METAL	20406042504	060204-SOI-02697-00.5-D	FD	SW6010B	SW3050B	TIN	1670	B	1.67	MG/KG	U	5430	LBL
SOI	METAL	20406050904	060304-SOI-02704-00.5	N	SW6010B	SW3050B	TIN	1860	B	1.86	MG/KG	U	4740	LBL
SOI	METAL	20406050905	060304-SOI-02704-00.5-D	FD	SW6010B	SW3050B	TIN	2070	B	2.07	MG/KG	U	5270	LBL
SOI	METAL	20406050903	060304-SOI-02706-00.5	N	SW6010B	SW3050B	TIN	1580	B	1.58	MG/KG	U	4310	LBL
SOI	METAL	20406050902	060304-SOI-02705-00.5	N	SW6010B	SW3050B	TIN	1890	B	1.89	MG/KG	U	4730	LBL
SOI	METAL	20406050906	060304-SOI-02719-00.5	N	SW6010B	SW3050B	TIN	1730	B	1.73	MG/KG	U	5080	LBL
SOI	METAL	20406050907	060304-SOI-02720-00.5	N	SW6010B	SW3050B	TIN	1750	B	1.75	MG/KG	U	4720	LBL
SOI	METAL	20406050910	060304-SOI-02721-00.5	N	SW6010B	SW3050B	TIN	2150	B	2.15	MG/KG	U	5240	LBL
SOI	METAL	20406050911	060304-SOI-02722-00.5	N	SW6010B	SW3050B	TIN	1880	B	1.88	MG/KG	U	4700	LBL
SOI	METAL	20406050912	060404-SOI-02711-00.5	N	SW6010B	SW3050B	TIN	3020	B	3.02	MG/KG	U	5640	LBL
SOI	METAL	20406050913	060404-SOI-02712-00.5	N	SW6010B	SW3050B	TIN	2220	B	2.22	MG/KG	U	5000	LBL
SOI	METAL	20406050914	060404-SOI-02713-00.5	N	SW6010B	SW3050B	TIN	2590	B	2.59	MG/KG	U	5920	LBL
SOI	METAL	20406050915	060404-SOI-02714-00.5	N	SW6010B	SW3050B	TIN	2780	B	2.78	MG/KG	U	5390	LBL
SOI	METAL	20406050916	060404-SOI-02727-00.5	N	SW6010B	SW3050B	TIN	3030	B	3.03	MG/KG	U	5410	LBL
SOI	METAL	20406050917	060404-SOI-02728-00.5	N	SW6010B	SW3050B	TIN	1640	B	1.64	MG/KG	U	5060	LBL
SOI	METAL	20406050918	060404-SOI-02729-00.5	N	SW6010B	SW3050B	TIN	3440	B	3.44	MG/KG	U	5670	LBL
SOI	METAL	20406050919	060404-SOI-02730-00.5	N	SW6010B	SW3050B	TIN	2580	B	2.58	MG/KG	U	5180	LBL
SOI	METAL	20406050920	060404-SOI-02730-00.5-D	FD	SW6010B	SW3050B	TIN	2820	B	2.82	MG/KG	U	5160	LBL
SED	METAL	20407020806	063004-SED-02709-00.2	N	SW7471A	METHOD	Mercury	4.01	B	4.01	UG/KG	U	11.8	LBL
SED	METAL	20407020801RE	063004-SED-02707-00.2	N	SW6010B	SW3050B	Tin	1240	B	1.24	MG/KG	U	4700	LBL
SED	METAL	20407020814RE	063004-SED-02725-00.2	N	SW6010B	SW3050B	Tin	1120	B	1.12	MG/KG	U	4930	LBL
SED	METAL	20407020814	063004-SED-02725-00.2	N	SW7471A	METHOD	Mercury	6.78	B	6.78	UG/KG	U	12.2	LBL
SED	METAL	20407020803RE	063004-SED-02708-00.2-D	FD	SW6010B	SW3050B	Tin	3250	B	3.25	MG/KG	U	5040	LBL
SED	METAL	20407020815	063004-SED-02726-00.2	N	SW7471A	METHOD	Mercury	3.88	B	3.88	UG/KG	U	11.9	LBL
SED	METAL	20407020816	063004-SED-02726-00.2-D	FD	SW7471A	METHOD	Mercury	4.52	B	4.52	UG/KG	U	11.9	LBL
SED	METAL	20407020816RE	063004-SED-02726-00.2-D	FD	SW6010B	SW3050B	Tin	1220	B	1.22	MG/KG	U	4850	LBL
SED	METAL	20407020802RE	063004-SED-02708-00.2	N	SW6010B	SW3050B	Tin	1010	B	1.01	MG/KG	U	5040	LBL
SED	METAL	20407020815RE	063004-SED-02726-00.2	N	SW6010B	SW3050B	Tin	1560	B	1.56	MG/KG	U	4790	LBL
SED	METAL	20407020806RE	063004-SED-02709-00.2	N	SW6010B	SW3050B	Tin	1220	B	1.22	MG/KG	U	4700	LBL
SED	METAL	20407020807RE	063004-SED-02710-00.2	N	SW6010B	SW3050B	Tin	1170	B	1.17	MG/KG	U	4530	LBL
SED	METAL	20407020811	063004-SED-02718-00.2	N	SW7471A	METHOD	Mercury	8.28	B	8.28	UG/KG	U	12.1	LBL
SED	METAL	20407020811RE	063004-SED-02718-00.2	N	SW6010B	SW3050B	Tin	1380	B	1.38	MG/KG	U	4910	LBL
SED	METAL	20407020810RE	063004-SED-02717-00.2	N	SW6010B	SW3050B	Tin	956	B	0.956	MG/KG	U	5130	LBL
SED	METAL	20407020812RE	063004-SED-02723-00.2	N	SW6010B	SW3050B	Tin	1800	B	1.8	MG/KG	U	4740	LBL
SED	METAL	20407020812	063004-SED-02723-00.2	N	SW7471A	METHOD	Mercury	4.36	B	4.36	UG/KG	U	11.7	LBL
SED	METAL	20407020813RE	063004-SED-02724-00.2	N	SW6010B	SW3050B	Tin	1930	B	1.93	MG/KG	U	4530	LBL
SED	METAL	20407020808RE	063004-SED-02715-00.2	N	SW6010B	SW3050B	Tin	1700	B	1.7	MG/KG	U	5090	LBL
SED	METAL	20407020809RE	063004-SED-02716-00.2	N	SW6010B	SW3050B	Tin	1630	B	1.63	MG/KG	U	4550	LBL
SOI	METAL	20406042501	060204-SOI-02695-00.5	N	SW6010B	SW3050B	ANTIMONY	176	U	0.176	MG/KG	R	2570	MSL, MSDL
SOI	METAL	20406042507	060204-SOI-02695-01.5	N	SW6010B	SW3050B	ANTIMONY	161	U	0.161	MG/KG	R	2350	MSL, MSDL
SOI	METAL	20406042502	060204-SOI-02696-00.5	N	SW6010B	SW3050B	ANTIMONY	192	U	0.192	MG/KG	R	2800	MSL, MSDL
SOI	METAL	20406042508	060204-SOI-02696-04.0	N	SW6010B	SW3050B	ANTIMONY	171	U	0.171	MG/KG	R	2500	MSL, MSDL
SOI	METAL	20406042511	060204-SOI-02696-02.0	N	SW6010B	SW3050B	ANTIMONY	185	U	0.185	MG/KG	R	2700	MSL, MSDL

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SOI	METAL	20406042503	060204-SOI-02697-00.5	N	SW6010B	SW3050B	ANTIMONY	184	U	0.184	MG/KG	R	2680	MSL, MSDL
SOI	METAL	20406042505	060204-SOI-02698-00.5	N	SW6010B	SW3050B	ANTIMONY	184	U	0.184	MG/KG	R	2680	MSL, MSDL
SOI	METAL	20406042510	060204-SOI-02697-02.5	N	SW6010B	SW3050B	ANTIMONY	159	U	0.159	MG/KG	R	2320	MSL, MSDL
SOI	METAL	20406042504	060204-SOI-02697-00.5-D	FD	SW6010B	SW3050B	ANTIMONY	186	U	0.186	MG/KG	R	2710	MSL, MSDL
SOI	METAL	20406032401	060104-SOI-02687-02.0	N	SW6010B	SW3050B	ANTIMONY	160	U	0.16	MG/KG	UJ	2330	MSL,MSDL
SOI	METAL	20406032412	060104-SOI-02687-00.5-D	FD	SW6010B	SW3050B	ANTIMONY	160	U	0.16	MG/KG	UJ	2330	MSL,MSDL
SOI	METAL	20406032407	060104-SOI-02687-04.5	N	SW6010B	SW3050B	ANTIMONY	170	U	0.17	MG/KG	UJ	2480	MSL,MSDL
SOI	METAL	20406032416	060104-SOI-02688-00.5	N	SW6010B	SW3050B	ANTIMONY	147	U	0.147	MG/KG	UJ	2140	MSL,MSDL
SOI	METAL	20406032402	060104-SOI-02688-02.0	N	SW6010B	SW3050B	ANTIMONY	149	U	0.149	MG/KG	UJ	2170	MSL,MSDL
SOI	METAL	20406032404	060104-SOI-02688-04.0	N	SW6010B	SW3050B	ANTIMONY	154	U	0.154	MG/KG	UJ	2250	MSL,MSDL
SOI	METAL	20406032408	060104-SOI-02688-06.0	N	SW6010B	SW3050B	ANTIMONY	151	U	0.151	MG/KG	UJ	2210	MSL,MSDL
SOI	METAL	20406032406	060104-SOI-02688-07.0	N	SW6010B	SW3050B	ANTIMONY	154	U	0.154	MG/KG	UJ	2250	MSL,MSDL
SOI	METAL	20406032403	060104-SOI-02689-00.5	N	SW6010B	SW3050B	ANTIMONY	165	U	0.165	MG/KG	UJ	2410	MSL,MSDL
SOI	METAL	20406032415	060104-SOI-02689-02.0	N	SW6010B	SW3050B	ANTIMONY	155	U	0.155	MG/KG	UJ	2260	MSL,MSDL
SOI	METAL	20406032405	060104-SOI-02689-04.5	N	SW6010B	SW3050B	ANTIMONY	163	U	0.163	MG/KG	UJ	2380	MSL,MSDL
SOI	METAL	20406032409	060104-SOI-02690-00.5	N	SW6010B	SW3050B	ANTIMONY	161	U	0.161	MG/KG	UJ	2350	MSL,MSDL
SOI	METAL	20406032413	060104-SOI-02690-02.0	N	SW6010B	SW3050B	ANTIMONY	158	U	0.158	MG/KG	UJ	2310	MSL,MSDL
SOI	METAL	20406050901	060304-SOI-02703-00.5	N	SW6010B	SW3050B	ANTIMONY	160	U	0.16	MG/KG	R	2330	MSL,MSDL
SOI	METAL	20406050904	060304-SOI-02704-00.5	N	SW6010B	SW3050B	ANTIMONY	162	U	0.162	MG/KG	R	2370	MSL,MSDL
SOI	METAL	20406050905	060304-SOI-02704-00.5-D	FD	SW6010B	SW3050B	ANTIMONY	212	B	0.212	MG/KG	J	2640	MSL,MSDL
SOI	METAL	20406050903	060304-SOI-02706-00.5	N	SW6010B	SW3050B	ANTIMONY	147	U	0.147	MG/KG	R	2150	MSL,MSDL
SOI	METAL	20406050902	060304-SOI-02705-00.5	N	SW6010B	SW3050B	ANTIMONY	162	U	0.162	MG/KG	R	2370	MSL,MSDL
SOI	METAL	20406050906	060304-SOI-02719-00.5	N	SW6010B	SW3050B	ANTIMONY	174	U	0.174	MG/KG	R	2540	MSL,MSDL
SOI	METAL	20406050907	060304-SOI-02720-00.5	N	SW6010B	SW3050B	ANTIMONY	162	U	0.162	MG/KG	R	2360	MSL,MSDL
SOI	METAL	20406050910	060304-SOI-02721-00.5	N	SW6010B	SW3050B	ANTIMONY	179	U	0.179	MG/KG	R	2620	MSL,MSDL
SOI	METAL	20406050911	060304-SOI-02722-00.5	N	SW6010B	SW3050B	ANTIMONY	161	U	0.161	MG/KG	R	2350	MSL,MSDL
SOI	METAL	20406050912	060404-SOI-02711-00.5	N	SW6010B	SW3050B	ANTIMONY	193	U	0.193	MG/KG	R	2820	MSL,MSDL
SOI	METAL	20406050913	060404-SOI-02712-00.5	N	SW6010B	SW3050B	ANTIMONY	171	U	0.171	MG/KG	R	2500	MSL,MSDL
SOI	METAL	20406050914	060404-SOI-02713-00.5	N	SW6010B	SW3050B	ANTIMONY	203	U	0.203	MG/KG	R	2960	MSL,MSDL
SOI	METAL	20406050915	060404-SOI-02714-00.5	N	SW6010B	SW3050B	ANTIMONY	185	U	0.185	MG/KG	R	2700	MSL,MSDL
SOI	METAL	20406050916	060404-SOI-02727-00.5	N	SW6010B	SW3050B	ANTIMONY	187	B	0.187	MG/KG	J	2700	MSL,MSDL
SOI	METAL	20406050917	060404-SOI-02728-00.5	N	SW6010B	SW3050B	ANTIMONY	173	U	0.173	MG/KG	R	2530	MSL,MSDL
SOI	METAL	20406050918	060404-SOI-02729-00.5	N	SW6010B	SW3050B	ANTIMONY	194	U	0.194	MG/KG	R	2830	MSL,MSDL
SOI	METAL	20406050919	060404-SOI-02730-00.5	N	SW6010B	SW3050B	ANTIMONY	178	U	0.178	MG/KG	R	2590	MSL,MSDL
SOI	METAL	20406050920	060404-SOI-02730-00.5-D	FD	SW6010B	SW3050B	ANTIMONY	177	U	0.177	MG/KG	R	2580	MSL,MSDL
SOI	METAL	20406032414	060104-SOI-02687-00.5	N	SW6010B	SW3050B	ANTIMONY	162	U	0.162	MG/KG	UJ	2370	MSL,MSDL
SOI	METAL	20406042501	060204-SOI-02695-00.5	N	SW6010B	SW3050B	LEAD	9170	=	9170	UG/KG	J	772	SDIL
SOI	METAL	20406042501	060204-SOI-02695-00.5	N	SW6010B	SW3050B	NICKEL	6690	=	6690	UG/KG	J	1290	SDIL
SOI	METAL	20406042501	060204-SOI-02695-00.5	N	SW6010B	SW3050B	BARIUM	33200	=	33.2	MG/KG	J	515	SDIL
SOI	METAL	20406042501	060204-SOI-02695-00.5	N	SW6010B	SW3050B	BERYLLIUM	290	=	0.29	MG/KG	J	257	SDIL
SOI	METAL	20406042501	060204-SOI-02695-00.5	N	SW6010B	SW3050B	CADMIUM	331	=	0.331	MG/KG	J	257	SDIL
SOI	METAL	20406042501	060204-SOI-02695-00.5	N	SW6010B	SW3050B	COBALT	3370	=	3.37	MG/KG	J	515	SDIL
SOI	METAL	20406042501	060204-SOI-02695-00.5	N	SW6010B	SW3050B	VANADIUM	10600	=	10.6	MG/KG	J	1030	SDIL
SOI	METAL	20406042501	060204-SOI-02695-00.5	N	SW6010B	SW3050B	ZINC	24800	=	24800	UG/KG	J	1030	SDIL
SOI	METAL	20406042507	060204-SOI-02695-01.5	N	SW6010B	SW3050B	LEAD	4600	=	4600	UG/KG	J	706	SDIL
SOI	METAL	20406042507	060204-SOI-02695-01.5	N	SW6010B	SW3050B	NICKEL	6790	=	6790	UG/KG	J	1180	SDIL
SOI	METAL	20406042507	060204-SOI-02695-01.5	N	SW6010B	SW3050B	BARIUM	21600	=	21.6	MG/KG	J	471	SDIL
SOI	METAL	20406042507	060204-SOI-02695-01.5	N	SW6010B	SW3050B	BERYLLIUM	234	B	0.234	MG/KG	J	235	SDIL
SOI	METAL	20406042507	060204-SOI-02695-01.5	N	SW6010B	SW3050B	CADMIUM	233	B	0.233	MG/KG	J	235	SDIL
SOI	METAL	20406042507	060204-SOI-02695-01.5	N	SW6010B	SW3050B	COBALT	4580	=	4.58	MG/KG	J	471	SDIL
SOI	METAL	20406042507	060204-SOI-02695-01.5	N	SW6010B	SW3050B	VANADIUM	10700	=	10.7	MG/KG	J	941	SDIL
SOI	METAL	20406042507	060204-SOI-02695-01.5	N	SW6010B	SW3050B	ZINC	16100	=	16100	UG/KG	J	941	SDIL
SOI	METAL	20406042502	060204-SOI-02696-00.5	N	SW6010B	SW3050B	VANADIUM	13300	=	13.3	MG/KG	J	1120	SDIL
SOI	METAL	20406042502	060204-SOI-02696-00.5	N	SW6010B	SW3050B	ZINC	48700	=	48700	UG/KG	J	1120	SDIL
SOI	METAL	20406042502	060204-SOI-02696-00.5	N	SW6010B	SW3050B	LEAD	15000	=	15000	UG/KG	J	841	SDIL
SOI	METAL	20406042502	060204-SOI-02696-00.5	N	SW6010B	SW3050B	NICKEL	13200	=	13200	UG/KG	J	1400	SDIL
SOI	METAL	20406042502	060204-SOI-02696-00.5	N	SW6010B	SW3050B	BARIUM	68800	=	68.8	MG/KG	J	561	SDIL
SOI	METAL	20406042502	060204-SOI-02696-00.5	N	SW6010B	SW3050B	BERYLLIUM	434	=	0.434	MG/KG	J	280	SDIL
SOI	METAL	20406042502	060204-SOI-02696-00.5	N	SW6010B	SW3050B	CADMIUM	533	=	0.533	MG/KG	J	280	SDIL
SOI	METAL	20406042502	060204-SOI-02696-00.5	N	SW6010B	SW3050B	COBALT	5390	=	5.39	MG/KG	J	561	SDIL
SOI	METAL	20406042508	060204-SOI-02696-04.0	N	SW6010B	SW3050B	LEAD	5300	=	5300	UG/KG	J	750	SDIL
SOI	METAL	20406042508	060204-SOI-02696-04.0	N	SW6010B	SW3050B	NICKEL	12000	=	12000	UG/KG	J	1250	SDIL
SOI	METAL	20406042508	060204-SOI-02696-04.0	N	SW6010B	SW3050B	BARIUM	51200	=	51.2	MG/KG	J	500	SDIL
SOI	METAL	20406042508	060204-SOI-02696-04.0	N	SW6010B	SW3050B	BERYLLIUM	347	=	0.347	MG/KG	J	250	SDIL
SOI	METAL	20406042508	060204-SOI-02696-04.0	N	SW6010B	SW3050B	CADMIUM	382	=	0.382	MG/KG	J	250	SDIL
SOI	METAL	20406042508	060204-SOI-02696-04.0	N	SW6010B	SW3050B	COBALT	4520	=	4.52	MG/KG	J	500	SDIL
SOI	METAL	20406042508	060204-SOI-02696-04.0	N	SW6010B	SW3050B	VANADIUM	12000	=	12	MG/KG	J	1000	SDIL
SOI	METAL	20406042508	060204-SOI-02696-04.0	N	SW6010B	SW3050B	ZINC	29200	=	29200	UG/KG	J	1000	SDIL

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SOI	METAL	20406042511	060204-SOI-02696-02.0	N	SW6010B	SW3050B	LEAD	6020	=	6020	UG/KG	J	809	SDIL
SOI	METAL	20406042511	060204-SOI-02696-02.0	N	SW6010B	SW3050B	NICKEL	12700	=	12700	UG/KG	J	1350	SDIL
SOI	METAL	20406042511	060204-SOI-02696-02.0	N	SW6010B	SW3050B	BARIUM	78500	=	78.5	MG/KG	J	540	SDIL
SOI	METAL	20406042511	060204-SOI-02696-02.0	N	SW6010B	SW3050B	BERYLLIUM	430	=	0.43	MG/KG	J	270	SDIL
SOI	METAL	20406042511	060204-SOI-02696-02.0	N	SW6010B	SW3050B	CADMIUM	533	=	0.533	MG/KG	J	270	SDIL
SOI	METAL	20406042511	060204-SOI-02696-02.0	N	SW6010B	SW3050B	COBALT	5320	=	5.32	MG/KG	J	540	SDIL
SOI	METAL	20406042511	060204-SOI-02696-02.0	N	SW6010B	SW3050B	VANADIUM	12900	=	12.9	MG/KG	J	1080	SDIL
SOI	METAL	20406042511	060204-SOI-02696-02.0	N	SW6010B	SW3050B	ZINC	37700	=	37700	UG/KG	J	1080	SDIL
SOI	METAL	20406042503	060204-SOI-02697-00.5	N	SW6010B	SW3050B	LEAD	11600	=	11600	UG/KG	J	804	SDIL
SOI	METAL	20406042503	060204-SOI-02697-00.5	N	SW6010B	SW3050B	NICKEL	8550	=	8550	UG/KG	J	1340	SDIL
SOI	METAL	20406042503	060204-SOI-02697-00.5	N	SW6010B	SW3050B	BARIUM	51400	=	51.4	MG/KG	J	536	SDIL
SOI	METAL	20406042503	060204-SOI-02697-00.5	N	SW6010B	SW3050B	BERYLLIUM	414	=	0.414	MG/KG	J	268	SDIL
SOI	METAL	20406042503	060204-SOI-02697-00.5	N	SW6010B	SW3050B	CADMIUM	405	=	0.405	MG/KG	J	268	SDIL
SOI	METAL	20406042503	060204-SOI-02697-00.5	N	SW6010B	SW3050B	COBALT	4460	=	4.46	MG/KG	J	536	SDIL
SOI	METAL	20406042503	060204-SOI-02697-00.5	N	SW6010B	SW3050B	VANADIUM	13800	=	13.8	MG/KG	J	1070	SDIL
SOI	METAL	20406042503	060204-SOI-02697-00.5	N	SW6010B	SW3050B	ZINC	32600	=	32600	UG/KG	J	1070	SDIL
SOI	METAL	20406042505	060204-SOI-02698-00.5	N	SW6010B	SW3050B	LEAD	11700	=	11700	UG/KG	J	804	SDIL
SOI	METAL	20406042505	060204-SOI-02698-00.5	N	SW6010B	SW3050B	NICKEL	6610	=	6610	UG/KG	J	1340	SDIL
SOI	METAL	20406042505	060204-SOI-02698-00.5	N	SW6010B	SW3050B	BARIUM	59300	=	59.3	MG/KG	J	536	SDIL
SOI	METAL	20406042510	060204-SOI-02697-02.5	N	SW6010B	SW3050B	LEAD	3590	=	3590	UG/KG	J	697	SDIL
SOI	METAL	20406042510	060204-SOI-02697-02.5	N	SW6010B	SW3050B	NICKEL	5810	=	5810	UG/KG	J	1160	SDIL
SOI	METAL	20406042510	060204-SOI-02697-02.5	N	SW6010B	SW3050B	BARIUM	16700	=	16.7	MG/KG	J	465	SDIL
SOI	METAL	20406042510	060204-SOI-02697-02.5	N	SW6010B	SW3050B	BERYLLIUM	206	B	0.206	MG/KG	J	232	SDIL
SOI	METAL	20406042510	060204-SOI-02697-02.5	N	SW6010B	SW3050B	CADMIUM	158	B	0.158	MG/KG	J	232	SDIL
SOI	METAL	20406042510	060204-SOI-02697-02.5	N	SW6010B	SW3050B	COBALT	2530	=	2.53	MG/KG	J	465	SDIL
SOI	METAL	20406042510	060204-SOI-02697-02.5	N	SW6010B	SW3050B	VANADIUM	9630	=	9.63	MG/KG	J	930	SDIL
SOI	METAL	20406042510	060204-SOI-02697-02.5	N	SW6010B	SW3050B	ZINC	12400	=	12400	UG/KG	J	930	SDIL
SOI	METAL	20406042504	060204-SOI-02697-00.5-D	FD	SW6010B	SW3050B	LEAD	11500	=	11500	UG/KG	J	814	SDIL
SOI	METAL	20406042504	060204-SOI-02697-00.5-D	FD	SW6010B	SW3050B	NICKEL	8660	=	8660	UG/KG	J	1360	SDIL
SOI	METAL	20406042504	060204-SOI-02697-00.5-D	FD	SW6010B	SW3050B	BARIUM	50300	=	50.3	MG/KG	J	543	SDIL
SOI	METAL	20406042504	060204-SOI-02697-00.5-D	FD	SW6010B	SW3050B	BERYLLIUM	434	=	0.434	MG/KG	J	271	SDIL
SOI	METAL	20406042504	060204-SOI-02697-00.5-D	FD	SW6010B	SW3050B	CADMIUM	399	=	0.399	MG/KG	J	271	SDIL
SOI	METAL	20406042504	060204-SOI-02697-00.5-D	FD	SW6010B	SW3050B	COBALT	4370	=	4.37	MG/KG	J	543	SDIL
SOI	METAL	20406042504	060204-SOI-02697-00.5-D	FD	SW6010B	SW3050B	VANADIUM	14000	=	14	MG/KG	J	1090	SDIL
SOI	METAL	20406042504	060204-SOI-02697-00.5-D	FD	SW6010B	SW3050B	ZINC	31400	=	31400	UG/KG	J	1090	SDIL
SOI	METAL	20406032412	060104-SOI-02687-00.5-D	FD	SW6010B	SW3050B	LITHIUM	1240	B	1240	UG/KG	J	2330	SDIL
SOI	METAL	20406032401	060104-SOI-02687-02.0	N	SW6010B	SW3050B	LITHIUM	791	B	791	UG/KG	J	2330	SDIL
SOI	METAL	20406032401	060104-SOI-02687-02.0	N	SW6010B	SW3050B	ARSENIC	457	B	0.457	MG/KG	J	1170	SDIL
SOI	METAL	20406032412	060104-SOI-02687-00.5-D	FD	SW6010B	SW3050B	ARSENIC	509	B	0.509	MG/KG	J	1170	SDIL
SOI	METAL	20406032412	060104-SOI-02687-00.5-D	FD	SW6010B	SW3050B	BERYLLIUM	169	B	0.169	MG/KG	J	233	SDIL
SOI	METAL	20406032407	060104-SOI-02687-04.5	N	SW6010B	SW3050B	LITHIUM	1900	B	1900	UG/KG	J	2480	SDIL
SOI	METAL	20406032407	060104-SOI-02687-04.5	N	SW6010B	SW3050B	ARSENIC	4250	=	4.25	MG/KG	J	1240	SDIL
SOI	METAL	20406032416	060104-SOI-02688-00.5	N	SW6010B	SW3050B	LITHIUM	1650	B	1650	UG/KG	J	2140	SDIL
SOI	METAL	20406032416	060104-SOI-02688-00.5	N	SW6010B	SW3050B	ARSENIC	1370	=	1.37	MG/KG	J	1070	SDIL
SOI	METAL	20406032402	060104-SOI-02688-02.0	N	SW6010B	SW3050B	LITHIUM	2720	=	2720	UG/KG	J	2170	SDIL
SOI	METAL	20406032402	060104-SOI-02688-02.0	N	SW6010B	SW3050B	ARSENIC	1850	=	1.85	MG/KG	J	1090	SDIL
SOI	METAL	20406032404	060104-SOI-02688-04.0	N	SW6010B	SW3050B	LITHIUM	4640	=	4640	UG/KG	J	2250	SDIL
SOI	METAL	20406032404	060104-SOI-02688-04.0	N	SW6010B	SW3050B	ARSENIC	3910	=	3.91	MG/KG	J	1130	SDIL
SOI	METAL	20406032404	060104-SOI-02688-04.0	N	SW6010B	SW3050B	BERYLLIUM	253	=	0.253	MG/KG	J	225	SDIL
SOI	METAL	20406032408	060104-SOI-02688-06.0	N	SW6010B	SW3050B	LITHIUM	4620	=	4620	UG/KG	J	2210	SDIL
SOI	METAL	20406032408	060104-SOI-02688-06.0	N	SW6010B	SW3050B	ARSENIC	3610	=	3.61	MG/KG	J	1100	SDIL
SOI	METAL	20406032408	060104-SOI-02688-06.0	N	SW6010B	SW3050B	BERYLLIUM	199	B	0.199	MG/KG	J	221	SDIL
SOI	METAL	20406032406	060104-SOI-02688-07.0	N	SW6010B	SW3050B	LITHIUM	4230	=	4230	UG/KG	J	2250	SDIL
SOI	METAL	20406032406	060104-SOI-02688-07.0	N	SW6010B	SW3050B	ARSENIC	3430	=	3.43	MG/KG	J	1120	SDIL
SOI	METAL	20406032406	060104-SOI-02688-07.0	N	SW6010B	SW3050B	BERYLLIUM	170	B	0.17	MG/KG	J	225	SDIL
SOI	METAL	20406032403	060104-SOI-02689-00.5	N	SW6010B	SW3050B	LITHIUM	3900	=	3900	UG/KG	J	2410	SDIL
SOI	METAL	20406032403	060104-SOI-02689-00.5	N	SW6010B	SW3050B	ARSENIC	2730	=	2.73	MG/KG	J	1200	SDIL
SOI	METAL	20406032403	060104-SOI-02689-00.5	N	SW6010B	SW3050B	BERYLLIUM	165	B	0.165	MG/KG	J	241	SDIL
SOI	METAL	20406032415	060104-SOI-02689-02.0	N	SW6010B	SW3050B	LITHIUM	4850	=	4850	UG/KG	J	2260	SDIL
SOI	METAL	20406032415	060104-SOI-02689-02.0	N	SW6010B	SW3050B	ARSENIC	3900	=	3.9	MG/KG	J	1130	SDIL
SOI	METAL	20406032415	060104-SOI-02689-02.0	N	SW6010B	SW3050B	BERYLLIUM	208	B	0.208	MG/KG	J	226	SDIL
SOI	METAL	20406032405	060104-SOI-02689-04.5	N	SW6010B	SW3050B	LITHIUM	6780	=	6780	UG/KG	J	2380	SDIL
SOI	METAL	20406032405	060104-SOI-02689-04.5	N	SW6010B	SW3050B	ARSENIC	6450	=	6.45	MG/KG	J	1190	SDIL
SOI	METAL	20406032405	060104-SOI-02689-04.5	N	SW6010B	SW3050B	BERYLLIUM	299	=	0.299	MG/KG	J	238	SDIL
SOI	METAL	20406032409	060104-SOI-02690-00.5	N	SW6010B	SW3050B	LITHIUM	4830	=	4830	UG/KG	J	2350	SDIL
SOI	METAL	20406032409	060104-SOI-02690-00.5	N	SW6010B	SW3050B	ARSENIC	3020	=	3.02	MG/KG	J	1170	SDIL
SOI	METAL	20406032409	060104-SOI-02690-00.5	N	SW6010B	SW3050B	BERYLLIUM	219	B	0.219	MG/KG	J	235	SDIL
SOI	METAL	20406032413	060104-SOI-02690-02.0	N	SW6010B	SW3050B	LITHIUM	4200	=	4200	UG/KG	J	2310	SDIL

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SOI	METAL	20406032413	060104-SOI-02690-02.0	N	SW6010B	SW3050B	ARSENIC	3480	=	3.48	MG/KG	J	1150	SDIL
SOI	METAL	20406032413	060104-SOI-02690-02.0	N	SW6010B	SW3050B	BERYLLIUM	242	=	0.242	MG/KG	J	231	SDIL
SOI	METAL	20406050901	060304-SOI-02703-00.5	N	SW6010B	SW3050B	ARSENIC	2350	=	2.35	MG/KG	J	1170	SDIL
SOI	METAL	20406050901	060304-SOI-02703-00.5	N	SW6010B	SW3050B	BERYLLIUM	139	B	0.139	MG/KG	J	233	SDIL
SOI	METAL	20406050901	060304-SOI-02703-00.5	N	SW6010B	SW3050B	CADMIUM	247	=	0.247	MG/KG	J	233	SDIL
SOI	METAL	20406050901	060304-SOI-02703-00.5	N	SW6010B	SW3050B	VANADIUM	4180	=	4.18	MG/KG	J	933	SDIL
SOI	METAL	20406050904	060304-SOI-02704-00.5	N	SW6010B	SW3050B	ARSENIC	2850	=	2.85	MG/KG	J	1180	SDIL
SOI	METAL	20406050904	060304-SOI-02704-00.5	N	SW6010B	SW3050B	BERYLLIUM	128	B	0.128	MG/KG	J	237	SDIL
SOI	METAL	20406050904	060304-SOI-02704-00.5	N	SW6010B	SW3050B	CADMIUM	297	=	0.297	MG/KG	J	237	SDIL
SOI	METAL	20406050904	060304-SOI-02704-00.5	N	SW6010B	SW3050B	VANADIUM	3790	=	3.79	MG/KG	J	948	SDIL
SOI	METAL	20406050905	060304-SOI-02704-00.5-D	FD	SW6010B	SW3050B	ARSENIC	3910	=	3.91	MG/KG	J	1320	SDIL
SOI	METAL	20406050905	060304-SOI-02704-00.5-D	FD	SW6010B	SW3050B	BERYLLIUM	181	B	0.181	MG/KG	J	264	SDIL
SOI	METAL	20406050905	060304-SOI-02704-00.5-D	FD	SW6010B	SW3050B	CADMIUM	862	=	0.862	MG/KG	J	264	SDIL
SOI	METAL	20406050905	060304-SOI-02704-00.5-D	FD	SW6010B	SW3050B	VANADIUM	5300	=	5.3	MG/KG	J	1050	SDIL
SOI	METAL	20406050903	060304-SOI-02706-00.5	N	SW6010B	SW3050B	VANADIUM	1940	=	1.94	MG/KG	J	861	SDIL
SOI	METAL	20406050902	060304-SOI-02705-00.5	N	SW6010B	SW3050B	ARSENIC	2980	=	2.98	MG/KG	J	1180	SDIL
SOI	METAL	20406050902	060304-SOI-02705-00.5	N	SW6010B	SW3050B	BERYLLIUM	138	B	0.138	MG/KG	J	237	SDIL
SOI	METAL	20406050902	060304-SOI-02705-00.5	N	SW6010B	SW3050B	CADMIUM	313	=	0.313	MG/KG	J	237	SDIL
SOI	METAL	20406050902	060304-SOI-02705-00.5	N	SW6010B	SW3050B	VANADIUM	4060	=	4.06	MG/KG	J	946	SDIL
SOI	METAL	20406050906	060304-SOI-02719-00.5	N	SW6010B	SW3050B	ARSENIC	4390	=	4.39	MG/KG	J	1270	SDIL
SOI	METAL	20406050906	060304-SOI-02719-00.5	N	SW6010B	SW3050B	BERYLLIUM	280	=	0.28	MG/KG	J	254	SDIL
SOI	METAL	20406050906	060304-SOI-02719-00.5	N	SW6010B	SW3050B	CADMIUM	349	=	0.349	MG/KG	J	254	SDIL
SOI	METAL	20406050906	060304-SOI-02719-00.5	N	SW6010B	SW3050B	VANADIUM	7940	=	7.94	MG/KG	J	1020	SDIL
SOI	METAL	20406050907	060304-SOI-02720-00.5	N	SW6010B	SW3050B	ARSENIC	5820	=	5.82	MG/KG	J	1180	SDIL
SOI	METAL	20406050907	060304-SOI-02720-00.5	N	SW6010B	SW3050B	BERYLLIUM	231	B	0.231	MG/KG	J	236	SDIL
SOI	METAL	20406050907	060304-SOI-02720-00.5	N	SW6010B	SW3050B	CADMIUM	340	=	0.34	MG/KG	J	236	SDIL
SOI	METAL	20406050910	060304-SOI-02721-00.5	N	SW6010B	SW3050B	ARSENIC	3070	=	3.07	MG/KG	J	1310	SDIL
SOI	METAL	20406050910	060304-SOI-02721-00.5	N	SW6010B	SW3050B	BERYLLIUM	348	=	0.348	MG/KG	J	262	SDIL
SOI	METAL	20406050910	060304-SOI-02721-00.5	N	SW6010B	SW3050B	CADMIUM	678	=	0.678	MG/KG	J	262	SDIL
SOI	METAL	20406050910	060304-SOI-02721-00.5	N	SW6010B	SW3050B	VANADIUM	9080	=	9.08	MG/KG	J	1050	SDIL
SOI	METAL	20406050907	060304-SOI-02720-00.5	N	SW6010B	SW3050B	VANADIUM	6660	=	6.66	MG/KG	J	944	SDIL
SOI	METAL	20406050911	060304-SOI-02722-00.5	N	SW6010B	SW3050B	ARSENIC	5260	=	5.26	MG/KG	J	1170	SDIL
SOI	METAL	20406050911	060304-SOI-02722-00.5	N	SW6010B	SW3050B	BERYLLIUM	217	B	0.217	MG/KG	J	235	SDIL
SOI	METAL	20406050911	060304-SOI-02722-00.5	N	SW6010B	SW3050B	CADMIUM	431	=	0.431	MG/KG	J	235	SDIL
SOI	METAL	20406050911	060304-SOI-02722-00.5	N	SW6010B	SW3050B	VANADIUM	6380	=	6.38	MG/KG	J	939	SDIL
SOI	METAL	20406050912	060404-SOI-02711-00.5	N	SW6010B	SW3050B	ARSENIC	8910	=	8.91	MG/KG	J	1410	SDIL
SOI	METAL	20406050912	060404-SOI-02711-00.5	N	SW6010B	SW3050B	BERYLLIUM	439	=	0.439	MG/KG	J	282	SDIL
SOI	METAL	20406050912	060404-SOI-02711-00.5	N	SW6010B	SW3050B	CADMIUM	594	=	0.594	MG/KG	J	282	SDIL
SOI	METAL	20406050912	060404-SOI-02711-00.5	N	SW6010B	SW3050B	VANADIUM	13400	=	13.4	MG/KG	J	1130	SDIL
SOI	METAL	20406050913	060404-SOI-02712-00.5	N	SW6010B	SW3050B	ARSENIC	6540	=	6.54	MG/KG	J	1250	SDIL
SOI	METAL	20406050913	060404-SOI-02712-00.5	N	SW6010B	SW3050B	BERYLLIUM	364	=	0.364	MG/KG	J	250	SDIL
SOI	METAL	20406050913	060404-SOI-02712-00.5	N	SW6010B	SW3050B	CADMIUM	479	=	0.479	MG/KG	J	250	SDIL
SOI	METAL	20406050913	060404-SOI-02712-00.5	N	SW6010B	SW3050B	VANADIUM	11100	=	11.1	MG/KG	J	1000	SDIL
SOI	METAL	20406050914	060404-SOI-02713-00.5	N	SW6010B	SW3050B	ARSENIC	7140	=	7.14	MG/KG	J	1480	SDIL
SOI	METAL	20406050914	060404-SOI-02713-00.5	N	SW6010B	SW3050B	BERYLLIUM	438	=	0.438	MG/KG	J	296	SDIL
SOI	METAL	20406050914	060404-SOI-02713-00.5	N	SW6010B	SW3050B	CADMIUM	610	=	0.61	MG/KG	J	296	SDIL
SOI	METAL	20406050915	060404-SOI-02714-00.5	N	SW6010B	SW3050B	ARSENIC	5920	=	5.92	MG/KG	J	1350	SDIL
SOI	METAL	20406050915	060404-SOI-02714-00.5	N	SW6010B	SW3050B	BERYLLIUM	363	=	0.363	MG/KG	J	270	SDIL
SOI	METAL	20406050915	060404-SOI-02714-00.5	N	SW6010B	SW3050B	CADMIUM	578	=	0.578	MG/KG	J	270	SDIL
SOI	METAL	20406050915	060404-SOI-02714-00.5	N	SW6010B	SW3050B	VANADIUM	10900	=	10.9	MG/KG	J	1080	SDIL
SOI	METAL	20406050914	060404-SOI-02713-00.5	N	SW6010B	SW3050B	VANADIUM	13600	=	13.6	MG/KG	J	1180	SDIL
SOI	METAL	20406050916	060404-SOI-02727-00.5	N	SW6010B	SW3050B	ARSENIC	14200	=	14.2	MG/KG	J	1350	SDIL
SOI	METAL	20406050916	060404-SOI-02727-00.5	N	SW6010B	SW3050B	BERYLLIUM	516	=	0.516	MG/KG	J	270	SDIL
SOI	METAL	20406050916	060404-SOI-02727-00.5	N	SW6010B	SW3050B	CADMIUM	847	=	0.847	MG/KG	J	270	SDIL
SOI	METAL	20406050916	060404-SOI-02727-00.5	N	SW6010B	SW3050B	VANADIUM	15700	=	15.7	MG/KG	J	1080	SDIL
SOI	METAL	20406050917	060404-SOI-02728-00.5	N	SW6010B	SW3050B	ARSENIC	4560	=	4.56	MG/KG	J	1270	SDIL
SOI	METAL	20406050917	060404-SOI-02728-00.5	N	SW6010B	SW3050B	BERYLLIUM	149	B	0.149	MG/KG	J	253	SDIL
SOI	METAL	20406050917	060404-SOI-02728-00.5	N	SW6010B	SW3050B	CADMIUM	196	B	0.196	MG/KG	J	253	SDIL
SOI	METAL	20406050917	060404-SOI-02728-00.5	N	SW6010B	SW3050B	VANADIUM	4110	=	4.11	MG/KG	J	1010	SDIL
SOI	METAL	20406050918	060404-SOI-02729-00.5	N	SW6010B	SW3050B	ARSENIC	12300	=	12.3	MG/KG	J	1420	SDIL
SOI	METAL	20406050918	060404-SOI-02729-00.5	N	SW6010B	SW3050B	BERYLLIUM	527	=	0.527	MG/KG	J	283	SDIL
SOI	METAL	20406050918	060404-SOI-02729-00.5	N	SW6010B	SW3050B	CADMIUM	897	=	0.897	MG/KG	J	283	SDIL
SOI	METAL	20406050918	060404-SOI-02729-00.5	N	SW6010B	SW3050B	VANADIUM	16100	=	16.1	MG/KG	J	1130	SDIL
SOI	METAL	20406050919	060404-SOI-02730-00.5	N	SW6010B	SW3050B	ARSENIC	6130	=	6.13	MG/KG	J	1300	SDIL
SOI	METAL	20406050919	060404-SOI-02730-00.5	N	SW6010B	SW3050B	BERYLLIUM	318	=	0.318	MG/KG	J	259	SDIL
SOI	METAL	20406050919	060404-SOI-02730-00.5	N	SW6010B	SW3050B	CADMIUM	502	=	0.502	MG/KG	J	259	SDIL
SOI	METAL	20406050919	060404-SOI-02730-00.5	N	SW6010B	SW3050B	VANADIUM	9780	=	9.78	MG/KG	J	1040	SDIL
SOI	METAL	20406050920	060404-SOI-02730-00.5-D	FD	SW6010B	SW3050B	ARSENIC	6490	=	6.49	MG/KG	J	1290	SDIL

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SOI	METAL	20406050920	060404-SOI-02730-00.5-D	FD	SW6010B	SW3050B	BERYLLIUM	320	=	0.32	MG/KG	J	258	SDIL
SOI	METAL	20406050920	060404-SOI-02730-00.5-D	FD	SW6010B	SW3050B	CADMIUM	512	=	0.512	MG/KG	J	258	SDIL
SOI	METAL	20406050920	060404-SOI-02730-00.5-D	FD	SW6010B	SW3050B	VANADIUM	9710	=	9.71	MG/KG	J	1030	SDIL
SOI	METAL	20406032414	060104-SOI-02687-00.5	N	SW6010B	SW3050B	LITHIUM	1260	B	1260	UG/KG	J	2370	SDIL
SOI	METAL	20406032414	060104-SOI-02687-00.5	N	SW6010B	SW3050B	ARSENIC	531	B	0.531	MG/KG	J	1180	SDIL
SOI	METAL	20406032414	060104-SOI-02687-00.5	N	SW6010B	SW3050B	BERYLLIUM	169	B	0.169	MG/KG	J	237	SDIL
SOI	METAL	20406042505	060204-SOI-02698-00.5	N	SW6010B	SW3050B	BERYLLIUM	407	=	0.407	MG/KG	J	268	SDIL
SOI	METAL	20406042505	060204-SOI-02698-00.5	N	SW6010B	SW3050B	CADMIUM	426	=	0.426	MG/KG	J	268	SDIL
SOI	METAL	20406042505	060204-SOI-02698-00.5	N	SW6010B	SW3050B	COBALT	3900	=	3.9	MG/KG	J	536	SDIL
SOI	METAL	20406042505	060204-SOI-02698-00.5	N	SW6010B	SW3050B	VANADIUM	14700	=	14.7	MG/KG	J	1070	SDIL
SOI	METAL	20406042505	060204-SOI-02698-00.5	N	SW6010B	SW3050B	ZINC	34700	=	34700	UG/KG	J	1070	SDIL
SOI	METAL	20406032401	060104-SOI-02687-02.0	N	SW6010B	SW3050B	BERYLLIUM	84.7	B	0.0847	MG/KG	UJ	233	SDIL,CCBL
SOI	METAL	20406032407	060104-SOI-02687-04.5	N	SW6010B	SW3050B	BERYLLIUM	152	B	0.152	MG/KG	UJ	248	SDIL,CCBL
SOI	METAL	20406032407	060104-SOI-02687-04.5	N	SW6010B	SW3050B	CADMIUM	283	=	0.283	MG/KG	UJ	248	SDIL,CCBL
SOI	METAL	20406032416	060104-SOI-02688-00.5	N	SW6010B	SW3050B	BERYLLIUM	65.3	B	0.0653	MG/KG	UJ	214	SDIL,CCBL
SOI	METAL	20406032402	060104-SOI-02688-02.0	N	SW6010B	SW3050B	BERYLLIUM	122	B	0.122	MG/KG	UJ	217	SDIL,CCBL
SOI	METAL	20406032404	060104-SOI-02688-04.0	N	SW6010B	SW3050B	CADMIUM	254	=	0.254	MG/KG	UJ	225	SDIL,CCBL
SOI	METAL	20406032408	060104-SOI-02688-06.0	N	SW6010B	SW3050B	CADMIUM	200	B	0.2	MG/KG	UJ	221	SDIL,CCBL
SOI	METAL	20406032403	060104-SOI-02689-00.5	N	SW6010B	SW3050B	CADMIUM	221	B	0.221	MG/KG	UJ	241	SDIL,CCBL
SOI	METAL	20406032415	060104-SOI-02689-02.0	N	SW6010B	SW3050B	CADMIUM	219	B	0.219	MG/KG	UJ	226	SDIL,CCBL
SOI	METAL	20406032405	060104-SOI-02689-04.5	N	SW6010B	SW3050B	CADMIUM	299	=	0.299	MG/KG	UJ	238	SDIL,CCBL
SOI	METAL	20406032409	060104-SOI-02690-00.5	N	SW6010B	SW3050B	CADMIUM	235	=	0.235	MG/KG	UJ	235	SDIL,CCBL
SOI	METAL	20406032413	060104-SOI-02690-02.0	N	SW6010B	SW3050B	CADMIUM	221	B	0.221	MG/KG	UJ	231	SDIL,CCBL
SOI	METAL	20406050903	060304-SOI-02706-00.5	N	SW6010B	SW3050B	ARSENIC	1470	=	1.47	MG/KG	UJ	1080	SDIL,CCBL
SOI	METAL	20406050903	060304-SOI-02706-00.5	N	SW6010B	SW3050B	BERYLLIUM	71.8	B	0.0718	MG/KG	UJ	215	SDIL,CCBL
SOI	METAL	20406050903	060304-SOI-02706-00.5	N	SW6010B	SW3050B	CADMIUM	124	B	0.124	MG/KG	UJ	215	SDIL,CCBL
SOI	METAL	20406032401	060104-SOI-02687-02.0	N	SW6010B	SW3050B	CADMIUM	89.2	B	0.0892	MG/KG	UJ	233	SDIL,CCBL,LBL
SOI	METAL	20406032412	060104-SOI-02687-00.5-D	FD	SW6010B	SW3050B	CADMIUM	130	B	0.13	MG/KG	UJ	233	SDIL,CCBL,LBL
SOI	METAL	20406032416	060104-SOI-02688-00.5	N	SW6010B	SW3050B	CADMIUM	87.4	B	0.0874	MG/KG	UJ	214	SDIL,CCBL,LBL
SOI	METAL	20406032402	060104-SOI-02688-02.0	N	SW6010B	SW3050B	CADMIUM	136	B	0.136	MG/KG	UJ	217	SDIL,CCBL,LBL
SOI	METAL	20406032406	060104-SOI-02688-07.0	N	SW6010B	SW3050B	CADMIUM	177	B	0.177	MG/KG	UJ	225	SDIL,CCBL,LBL
SOI	METAL	20406032414	060104-SOI-02687-00.5	N	SW6010B	SW3050B	CADMIUM	133	B	0.133	MG/KG	UJ	237	SDIL,CCBL,LBL
SOI	METAL	20406032401	060104-SOI-02687-02.0	N	SW6010B	SW3050B	TIN	1690	B	1.69	MG/KG	UJ	4670	SDIL,LBL
SOI	METAL	20406032412	060104-SOI-02687-00.5-D	FD	SW6010B	SW3050B	TIN	1290	B	1.29	MG/KG	UJ	4660	SDIL,LBL
SOI	METAL	20406032407	060104-SOI-02687-04.5	N	SW6010B	SW3050B	TIN	1950	B	1.95	MG/KG	UJ	4960	SDIL,LBL
SOI	METAL	20406032416	060104-SOI-02688-00.5	N	SW6010B	SW3050B	TIN	1440	B	1.44	MG/KG	UJ	4280	SDIL,LBL
SOI	METAL	20406032402	060104-SOI-02688-02.0	N	SW6010B	SW3050B	TIN	1020	B	1.02	MG/KG	UJ	4340	SDIL,LBL
SOI	METAL	20406032404	060104-SOI-02688-04.0	N	SW6010B	SW3050B	TIN	1170	B	1.17	MG/KG	UJ	4500	SDIL,LBL
SOI	METAL	20406032408	060104-SOI-02688-06.0	N	SW6010B	SW3050B	TIN	1100	B	1.1	MG/KG	UJ	4420	SDIL,LBL
SOI	METAL	20406032406	060104-SOI-02688-07.0	N	SW6010B	SW3050B	TIN	1290	B	1.29	MG/KG	UJ	4500	SDIL,LBL
SOI	METAL	20406032403	060104-SOI-02689-00.5	N	SW6010B	SW3050B	TIN	1510	B	1.51	MG/KG	UJ	4820	SDIL,LBL
SOI	METAL	20406032415	060104-SOI-02689-02.0	N	SW6010B	SW3050B	TIN	1410	B	1.41	MG/KG	UJ	4530	SDIL,LBL
SOI	METAL	20406032405	060104-SOI-02689-04.5	N	SW6010B	SW3050B	TIN	1390	B	1.39	MG/KG	UJ	4750	SDIL,LBL
SOI	METAL	20406032409	060104-SOI-02690-00.5	N	SW6010B	SW3050B	TIN	1150	B	1.15	MG/KG	UJ	4690	SDIL,LBL
SOI	METAL	20406032413	060104-SOI-02690-02.0	N	SW6010B	SW3050B	TIN	1370	B	1.37	MG/KG	UJ	4610	SDIL,LBL
SOI	METAL	20406032414	060104-SOI-02687-00.5	N	SW6010B	SW3050B	TIN	1360	B	1.36	MG/KG	UJ	4730	SDIL,LBL
SO	PEST	20406050904	060304-SOI-02704-00.5	N	SW8081A	SW3510C	Endrin	12.2	=	12.2	UG/KG	J	11.8	CCVH
SO	PEST	20406050911	060304-SOI-02722-00.5	N	SW8081A	SW3510C	4,4'-DDD	13.6	=	13.6	UG/KG	J	11.7	CCVH
SO	PEST	20406050914	060404-SOI-02713-00.5	N	SW8081A	SW3510C	4,4'-DDT	258	=	258	UG/KG	J	74	CCVH, SSH
SO	PEST	20406050916	060404-SOI-02727-00.5	N	SW8081A	SW3510C	4,4'-DDT	129	=	129	UG/KG	J	67.6	CCVH, SSH
SO	PEST	20406050918	060404-SOI-02729-00.5	N	SW8081A	SW3510C	4,4'-DDT	156	=	156	UG/KG	J	70.8	CCVH, SSH
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8081A	SW3510C	Endrin	19.9	=	19.9	UG/KG	J	13.2	CCVH, SSL
SO	PEST	20406032401	060104-SOI-02687-02.0	N	SW8141	SW3510C	Famphur	29.2	U	29.2	UG/KG	UJ	29.2	CCVL
SO	PEST	20406032402	060104-SOI-02688-02.0	N	SW8141	SW3510C	Famphur	27.3	U	27.3	UG/KG	UJ	27.3	CCVL
SO	PEST	20406032403	060104-SOI-02689-00.5	N	SW8141	SW3510C	Famphur	30.1	U	30.1	UG/KG	UJ	30.1	CCVL
SO	PEST	20406032404	060104-SOI-02688-04.0	N	SW8141	SW3510C	Famphur	28.1	U	28.1	UG/KG	UJ	28.1	CCVL
SO	PEST	20406032405	060104-SOI-02689-04.5	N	SW8141	SW3510C	Famphur	30	U	30	UG/KG	UJ	30	CCVL
SO	PEST	20406032406	060104-SOI-02688-07.0	N	SW8141	SW3510C	Famphur	28.1	U	28.1	UG/KG	UJ	28.1	CCVL
SO	PEST	20406032407	060104-SOI-02687-04.5	N	SW8141	SW3510C	Famphur	31.2	U	31.2	UG/KG	UJ	31.2	CCVL
SO	PEST	20406032408	060104-SOI-02688-06.0	N	SW8081A	SW3510C	Endosulfan I	11.1	U	11.1	UG/KG	UJ	11.1	CCVL
SO	PEST	20406032408	060104-SOI-02688-06.0	N	SW8141	SW3510C	Famphur	27.8	U	27.8	UG/KG	UJ	27.8	CCVL
SO	PEST	20406032408	060104-SOI-02688-06.0	N	SW8081A	SW3510C	Heptachlor	11.1	U	11.1	UG/KG	UJ	11.1	CCVL
SO	PEST	20406032409	060104-SOI-02690-00.5	N	SW8141	SW3510C	Famphur	29.3	U	29.3	UG/KG	UJ	29.3	CCVL
SO	PEST	20406032413	060104-SOI-02690-02.0	N	SW8141	SW3510C	Famphur	28.8	U	28.8	UG/KG	UJ	28.8	CCVL
SO	PEST	20406032414	060104-SOI-02687-00.5	N	SW8141	SW3510C	Famphur	29.6	U	29.6	UG/KG	UJ	29.6	CCVL
SO	PEST	20406032415	060104-SOI-02689-02.0	N	SW8141	SW3510C	Famphur	28.5	U	28.5	UG/KG	UJ	28.5	CCVL
SO	PEST	20406032416	060104-SOI-02688-00.5	N	SW8141	SW3510C	Famphur	26.7	U	26.7	UG/KG	UJ	26.7	CCVL
SO	PEST	20406042501	060204-SOI-02695-00.5	N	SW8141	SW3510C	Famphur	32.2	U	32.2	UG/KG	UJ	32.2	CCVL

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SO	PEST	20406042502	060204-SOI-02696-00.5	N	SW8141	SW3510C	Famphur	35.1	U	35.1	UG/KG	UJ	35.1	CCVL
SO	PEST	20406042503	060204-SOI-02697-00.5	N	SW8141	SW3510C	Famphur	33.8	U	33.8	UG/KG	UJ	33.8	CCVL
SO	PEST	20406042504	060204-SOI-02697-00.5-D	FD	SW8141	SW3510C	Famphur	34.2	U	34.2	UG/KG	UJ	34.2	CCVL
SO	PEST	20406042505	060204-SOI-02698-00.5	N	SW8141	SW3510C	Famphur	33.5	U	33.5	UG/KG	UJ	33.5	CCVL
SO	PEST	20406042507	060204-SOI-02695-01.5	N	SW8141	SW3510C	Famphur	29.4	U	29.4	UG/KG	UJ	29.4	CCVL
SO	PEST	20406042508	060204-SOI-02696-04.0	N	SW8141	SW3510C	Famphur	31.2	U	31.2	UG/KG	UJ	31.2	CCVL
SO	PEST	20406042510	060204-SOI-02697-02.5	N	SW8141	SW3510C	Famphur	29.1	U	29.1	UG/KG	UJ	29.1	CCVL
SO	PEST	20406042510	060204-SOI-02697-02.5	N	SW8141	SW3510C	Thionazine	40.7	U	40.7	UG/KG	UJ	40.7	CCVL
SO	PEST	20406042511	060204-SOI-02696-02.0	N	SW8141	SW3510C	Famphur	33.7	U	33.7	UG/KG	UJ	33.7	CCVL
SO	PEST	20406042511	060204-SOI-02696-02.0	N	SW8141	SW3510C	Thionazine	47.2	U	47.2	UG/KG	UJ	47.2	CCVL
SO	PEST	20406050901	060304-SOI-02703-00.5	N	SW8141	SW3510C	Famphur	29.4	U	29.4	UG/KG	UJ	29.4	CCVL
SO	PEST	20406050901	060304-SOI-02703-00.5	N	SW8141	SW3510C	Thionazine	41.2	U	41.2	UG/KG	UJ	41.2	CCVL
SO	PEST	20406050904	060304-SOI-02704-00.5	N	SW8141	SW3510C	Famphur	29.6	U	29.6	UG/KG	UJ	29.6	CCVL
SO	PEST	20406050904	060304-SOI-02704-00.5	N	SW8141	SW3510C	Thionazine	41.5	U	41.5	UG/KG	UJ	41.5	CCVL
SO	PEST	20406050907	060304-SOI-02720-00.5	N	SW8141	SW3510C	Thionazine	41.3	U	41.3	UG/KG	UJ	41.3	CCVL
SO	PEST	20406050910	060304-SOI-02721-00.5	N	SW8141	SW3510C	Famphur	33	U	33	UG/KG	UJ	33	CCVL
SO	PEST	20406050911	060304-SOI-02722-00.5	N	SW8141	SW3510C	Famphur	29.4	U	29.4	UG/KG	UJ	29.4	CCVL
SO	PEST	20406050912	060404-SOI-02711-00.5	N	SW8141	SW3510C	Famphur	35.3	U	35.3	UG/KG	UJ	35.3	CCVL
SO	PEST	20406050913	060404-SOI-02712-00.5	N	SW8141	SW3510C	Famphur	31.3	U	31.3	UG/KG	UJ	31.3	CCVL
SO	PEST	20406050914	060404-SOI-02713-00.5	N	SW8141	SW3510C	Famphur	37	U	37	UG/KG	UJ	37	CCVL
SO	PEST	20406050915	060404-SOI-02714-00.5	N	SW8141	SW3510C	Famphur	33.7	U	33.7	UG/KG	UJ	33.7	CCVL
SO	PEST	20406050916	060404-SOI-02727-00.5	N	SW8141	SW3510C	Famphur	33.8	U	33.8	UG/KG	UJ	33.8	CCVL
SO	PEST	20406050917	060404-SOI-02728-00.5	N	SW8081A	SW3510C	BP-6(PBB)	63.8	U	63.8	UG/KG	UJ	63.8	CCVL
SO	PEST	20406050917	060404-SOI-02728-00.5	N	SW8141	SW3510C	Famphur	31.9	U	31.9	UG/KG	UJ	31.9	CCVL
SO	PEST	20406050918	060404-SOI-02729-00.5	N	SW8141	SW3510C	Famphur	35.4	U	35.4	UG/KG	UJ	35.4	CCVL
SO	PEST	20406050919	060404-SOI-02730-00.5	N	SW8141	SW3510C	Famphur	32.4	U	32.4	UG/KG	UJ	32.4	CCVL
SO	PEST	20406050920	060404-SOI-02730-00.5-D	FD	SW8141	SW3510C	Famphur	32.3	U	32.3	UG/KG	UJ	32.3	CCVL
SED	PEST	20406302301	062804-SED-02691-00.2	N	SW8081A	SW3510C	4,4'-DDT	11.7	U	11.7	UG/KG	UJ	11.7	CCVL
SED	PEST	20406302301	062804-SED-02691-00.2	N	SW8081A	SW3510C	Methoxychlor	29.3	U	29.3	UG/KG	UJ	29.3	CCVL
SED	PEST	20406302302	062804-SED-02692-00.2	N	SW8081A	SW3510C	4,4'-DDT	12.2	U	12.2	UG/KG	UJ	12.2	CCVL
SED	PEST	20406302302	062804-SED-02692-00.2	N	SW8081A	SW3510C	Methoxychlor	30.6	U	30.6	UG/KG	UJ	30.6	CCVL
SED	PEST	20406302303	062804-SED-02693-00.2	N	SW8141	SW3510C	0,0,0-Triethylphosphorothioate	41.5	U	41.5	UG/KG	UJ	41.5	CCVL
SED	PEST	20406302303	062804-SED-02693-00.2	N	SW8081A	SW3510C	4,4'-DDT	11.9	U	11.9	UG/KG	UJ	11.9	CCVL
SED	PEST	20406302303	062804-SED-02693-00.2	N	SW8141	SW3510C	Disulfoton	29.6	U	29.6	UG/KG	UJ	29.6	CCVL
SED	PEST	20406302303	062804-SED-02693-00.2	N	SW8081A	SW3510C	Methoxychlor	29.6	U	29.6	UG/KG	UJ	29.6	CCVL
SED	PEST	20406302303	062804-SED-02693-00.2	N	SW8141	SW3510C	Phorate	29.6	U	29.6	UG/KG	UJ	29.6	CCVL
SED	PEST	20406302303	062804-SED-02693-00.2	N	SW8141	SW3510C	Sulfotep	41.5	U	41.5	UG/KG	UJ	41.5	CCVL
SED	PEST	20406302303	062804-SED-02693-00.2	N	SW8141	SW3510C	Thionazine	41.5	U	41.5	UG/KG	UJ	41.5	CCVL
SED	PEST	20406302304	062804-SED-02694-00.2	N	SW8141	SW3510C	0,0,0-Triethylphosphorothioate	38.8	U	38.8	UG/KG	UJ	38.8	CCVL
SED	PEST	20406302304	062804-SED-02694-00.2	N	SW8081A	SW3510C	4,4'-DDT	11.1	U	11.1	UG/KG	UJ	11.1	CCVL
SED	PEST	20406302304	062804-SED-02694-00.2	N	SW8141	SW3510C	Disulfoton	27.7	U	27.7	UG/KG	UJ	27.7	CCVL
SED	PEST	20406302304	062804-SED-02694-00.2	N	SW8081A	SW3510C	Methoxychlor	27.7	U	27.7	UG/KG	UJ	27.7	CCVL
SED	PEST	20406302304	062804-SED-02694-00.2	N	SW8141	SW3510C	Phorate	27.7	U	27.7	UG/KG	UJ	27.7	CCVL
SED	PEST	20406302304	062804-SED-02694-00.2	N	SW8141	SW3510C	Sulfotep	38.8	U	38.8	UG/KG	UJ	38.8	CCVL
SED	PEST	20406302304	062804-SED-02694-00.2	N	SW8141	SW3510C	Thionazine	38.8	U	38.8	UG/KG	UJ	38.8	CCVL
SED	PEST	20406302305	062904-SED-02699-00.2	N	SW8141	SW3510C	0,0,0-Triethylphosphorothioate	39.8	U	39.8	UG/KG	UJ	39.8	CCVL
SED	PEST	20406302305	062904-SED-02699-00.2	N	SW8081A	SW3510C	4,4'-DDT	15.5	=	15.5	UG/KG	J	11.4	CCVL
SED	PEST	20406302305	062904-SED-02699-00.2	N	SW8141	SW3510C	Disulfoton	28.5	U	28.5	UG/KG	UJ	28.5	CCVL
SED	PEST	20406302305	062904-SED-02699-00.2	N	SW8081A	SW3510C	Methoxychlor	28.5	U	28.5	UG/KG	UJ	28.5	CCVL
SED	PEST	20406302305	062904-SED-02699-00.2	N	SW8141	SW3510C	Phorate	28.5	U	28.5	UG/KG	UJ	28.5	CCVL
SED	PEST	20406302305	062904-SED-02699-00.2	N	SW8141	SW3510C	Sulfotep	39.8	U	39.8	UG/KG	UJ	39.8	CCVL
SED	PEST	20406302305	062904-SED-02699-00.2	N	SW8141	SW3510C	Thionazine	39.8	U	39.8	UG/KG	UJ	39.8	CCVL
SED	PEST	20406302306	062904-SED-02700-00.2	N	SW8141	SW3510C	0,0,0-Triethylphosphorothioate	39.7	U	39.7	UG/KG	UJ	39.7	CCVL
SED	PEST	20406302306	062904-SED-02700-00.2	N	SW8081A	SW3510C	4,4'-DDT	11.3	U	11.3	UG/KG	UJ	11.3	CCVL
SED	PEST	20406302306	062904-SED-02700-00.2	N	SW8141	SW3510C	Disulfoton	28.4	U	28.4	UG/KG	UJ	28.4	CCVL
SED	PEST	20406302306	062904-SED-02700-00.2	N	SW8081A	SW3510C	Methoxychlor	28.4	U	28.4	UG/KG	UJ	28.4	CCVL
SED	PEST	20406302306	062904-SED-02700-00.2	N	SW8141	SW3510C	Phorate	28.4	U	28.4	UG/KG	UJ	28.4	CCVL
SED	PEST	20406302306	062904-SED-02700-00.2	N	SW8141	SW3510C	Sulfotep	39.7	U	39.7	UG/KG	UJ	39.7	CCVL
SED	PEST	20406302306	062904-SED-02700-00.2	N	SW8141	SW3510C	Thionazine	39.7	U	39.7	UG/KG	UJ	39.7	CCVL
SED	PEST	20406302307	062904-SED-02701-00.2	N	SW8141	SW3510C	0,0,0-Triethylphosphorothioate	42.7	U	42.7	UG/KG	UJ	42.7	CCVL
SED	PEST	20406302307	062904-SED-02701-00.2	N	SW8141	SW3510C	Disulfoton	30.5	U	30.5	UG/KG	UJ	30.5	CCVL
SED	PEST	20406302307	062904-SED-02701-00.2	N	SW8081A	SW3510C	Methoxychlor	30.5	U	30.5	UG/KG	UJ	30.5	CCVL
SED	PEST	20406302307	062904-SED-02701-00.2	N	SW8141	SW3510C	Phorate	30.5	U	30.5	UG/KG	UJ	30.5	CCVL
SED	PEST	20406302307	062904-SED-02701-00.2	N	SW8141	SW3510C	Sulfotep	42.7	U	42.7	UG/KG	UJ	42.7	CCVL
SED	PEST	20406302307	062904-SED-02701-00.2	N	SW8141	SW3510C	Thionazine	42.7	U	42.7	UG/KG	UJ	42.7	CCVL
SED	PEST	20406302308	062904-SED-02702-00.2	N	SW8141	SW3510C	0,0,0-Triethylphosphorothioate	38.8	U	38.8	UG/KG	UJ	38.8	CCVL
SED	PEST	20406302308	062904-SED-02702-00.2	N	SW8081A	SW3510C	4,4'-DDT	11.1	U	11.1	UG/KG	UJ	11.1	CCVL
SED	PEST	20406302308	062904-SED-02702-00.2	N	SW8141	SW3510C	Disulfoton	27.7	U	27.7	UG/KG	UJ	27.7	CCVL

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SED	PEST	20406302308	062904-SED-02702-00.2	N	SW8081A	SW3510C	Methoxychlor	27.7	U	27.7	UG/KG	UJ	27.7	CCVL
SED	PEST	20406302308	062904-SED-02702-00.2	N	SW8141	SW3510C	Phorate	27.7	U	27.7	UG/KG	UJ	27.7	CCVL
SED	PEST	20406302308	062904-SED-02702-00.2	N	SW8141	SW3510C	Sulfotep	38.8	U	38.8	UG/KG	UJ	38.8	CCVL
SED	PEST	20406302308	062904-SED-02702-00.2	N	SW8141	SW3510C	Thionazine	38.8	U	38.8	UG/KG	UJ	38.8	CCVL
SED	PEST	20406302309	062904-SED-02731-00.2	N	SW8141	SW3510C	0,0,0-Triethylphosphorothioate	41.9	U	41.9	UG/KG	UJ	41.9	CCVL
SED	PEST	20406302309	062904-SED-02731-00.2	N	SW8081A	SW3510C	4,4'-DDT	12	U	12	UG/KG	UJ	12	CCVL
SED	PEST	20406302309	062904-SED-02731-00.2	N	SW8141	SW3510C	Disulfoton	29.9	U	29.9	UG/KG	UJ	29.9	CCVL
SED	PEST	20406302309	062904-SED-02731-00.2	N	SW8081A	SW3510C	Methoxychlor	29.9	U	29.9	UG/KG	UJ	29.9	CCVL
SED	PEST	20406302309	062904-SED-02731-00.2	N	SW8141	SW3510C	Phorate	29.9	U	29.9	UG/KG	UJ	29.9	CCVL
SED	PEST	20406302309	062904-SED-02731-00.2	N	SW8141	SW3510C	Sulfotep	41.9	U	41.9	UG/KG	UJ	41.9	CCVL
SED	PEST	20406302309	062904-SED-02731-00.2	N	SW8141	SW3510C	Thionazine	41.9	U	41.9	UG/KG	UJ	41.9	CCVL
SED	PEST	20406302312	062904-SED-02732-00.2	N	SW8141	SW3510C	0,0,0-Triethylphosphorothioate	44.2	U	44.2	UG/KG	UJ	44.2	CCVL
SED	PEST	20406302312	062904-SED-02732-00.2	N	SW8081A	SW3510C	4,4'-DDT	12.6	U	12.6	UG/KG	UJ	12.6	CCVL
SED	PEST	20406302312	062904-SED-02732-00.2	N	SW8141	SW3510C	Disulfoton	31.6	U	31.6	UG/KG	UJ	31.6	CCVL
SED	PEST	20406302312	062904-SED-02732-00.2	N	SW8081A	SW3510C	Methoxychlor	31.6	U	31.6	UG/KG	UJ	31.6	CCVL
SED	PEST	20406302312	062904-SED-02732-00.2	N	SW8141	SW3510C	Phorate	31.6	U	31.6	UG/KG	UJ	31.6	CCVL
SED	PEST	20406302312	062904-SED-02732-00.2	N	SW8141	SW3510C	Sulfotep	44.2	U	44.2	UG/KG	UJ	44.2	CCVL
SED	PEST	20406302312	062904-SED-02732-00.2	N	SW8141	SW3510C	Thionazine	44.2	U	44.2	UG/KG	UJ	44.2	CCVL
SED	PEST	20406302313	062904-SED-02733-00.2	N	SW8081A	SW3510C	4,4'-DDT	12.1	U	12.1	UG/KG	UJ	12.1	CCVL
SED	PEST	20406302313	062904-SED-02733-00.2	N	SW8081A	SW3510C	Methoxychlor	30.2	U	30.2	UG/KG	UJ	30.2	CCVL
SED	PEST	20406302313	062904-SED-02733-00.2	N	SW8141	SW3510C	Phorate	30.2	U	30.2	UG/KG	UJ	30.2	CCVL
SED	PEST	20406302314	062904-SED-02734-00.2	N	SW8081A	SW3510C	4,4'-DDT	11.8	U	11.8	UG/KG	UJ	11.8	CCVL
SED	PEST	20406302314	062904-SED-02734-00.2	N	SW8081A	SW3510C	Methoxychlor	29.5	U	29.5	UG/KG	UJ	29.5	CCVL
SED	PEST	20406302314	062904-SED-02734-00.2	N	SW8141	SW3510C	Phorate	29.5	U	29.5	UG/KG	UJ	29.5	CCVL
SED	PEST	20406302315	062904-SED-02734-00.2-D	FD	SW8081A	SW3510C	4,4'-DDT	11.8	U	11.8	UG/KG	UJ	11.8	CCVL
SED	PEST	20406302315	062904-SED-02734-00.2-D	FD	SW8081A	SW3510C	Methoxychlor	29.4	U	29.4	UG/KG	UJ	29.4	CCVL
SED	PEST	20406302315	062904-SED-02734-00.2-D	FD	SW8141	SW3510C	Phorate	29.4	U	29.4	UG/KG	UJ	29.4	CCVL
SED	PEST	20407020808	063004-SED-02715-00.2	N	SW8141	SW3510C	Phorate	32.1	U	32.1	UG/KG	UJ	32.1	CCVL
SED	PEST	20407020809	063004-SED-02716-00.2	N	SW8141	SW3510C	Phorate	28.7	U	28.7	UG/KG	UJ	28.7	CCVL
SED	PEST	20407020810	063004-SED-02717-00.2	N	SW8141	SW3510C	Phorate	32	U	32	UG/KG	UJ	32	CCVL
SED	PEST	20407020811	063004-SED-02718-00.2	N	SW8141	SW3510C	Phorate	30.7	U	30.7	UG/KG	UJ	30.7	CCVL
SED	PEST	20407020812	063004-SED-02723-00.2	N	SW8141	SW3510C	Phorate	29.6	U	29.6	UG/KG	UJ	29.6	CCVL
SED	PEST	20407020813	063004-SED-02724-00.2	N	SW8141	SW3510C	Phorate	28.3	U	28.3	UG/KG	UJ	28.3	CCVL
SED	PEST	20407020814	063004-SED-02725-00.2	N	SW8141	SW3510C	Phorate	31.1	U	31.1	UG/KG	UJ	31.1	CCVL
SED	PEST	20407020815	063004-SED-02726-00.2	N	SW8141	SW3510C	Phorate	30.2	U	30.2	UG/KG	UJ	30.2	CCVL
SED	PEST	20407020816	063004-SED-02726-00.2-D	FD	SW8141	SW3510C	Phorate	30.3	U	30.3	UG/KG	UJ	30.3	CCVL
SO	PEST	20406050907	060304-SOI-02720-00.5	N	SW8141	SW3510C	Famphur	29.5	U	29.5	UG/KG	UJ	29.5	CCVL, MSL
SO	PEST	20406032409	060104-SOI-02690-00.5	N	SW8081A	SW3510C	Endosulfan I	23.5	U	23.5	UG/KG	UJ	23.5	CCVL, SSL
SO	PEST	20406032409	060104-SOI-02690-00.5	N	SW8081A	SW3510C	Heptachlor	23.5	U	23.5	UG/KG	UJ	23.5	CCVL, SSL
SO	PEST	20406032412	060104-SOI-02687-00.5-D	FD	SW8141	SW3510C	Famphur	29.4	U	29.4	UG/KG	UJ	29.4	CCVL, SSL
SO	PEST	20406032413	060104-SOI-02690-02.0	N	SW8081A	SW3510C	Endosulfan I	11.5	U	11.5	UG/KG	UJ	11.5	CCVL, SSL
SO	PEST	20406032413	060104-SOI-02690-02.0	N	SW8081A	SW3510C	Heptachlor	11.5	U	11.5	UG/KG	UJ	11.5	CCVL, SSL
SO	PEST	20406050902	060304-SOI-02705-00.5	N	SW8141	SW3510C	Famphur	29.6	U	29.6	UG/KG	UJ	29.6	CCVL, SSL
SO	PEST	20406050902	060304-SOI-02705-00.5	N	SW8141	SW3510C	Thionazine	41.4	U	41.4	UG/KG	UJ	41.4	CCVL, SSL
SO	PEST	20406050903	060304-SOI-02706-00.5	N	SW8141	SW3510C	Famphur	27.1	U	27.1	UG/KG	UJ	27.1	CCVL, SSL
SO	PEST	20406050903	060304-SOI-02706-00.5	N	SW8141	SW3510C	Thionazine	38	U	38	UG/KG	UJ	38	CCVL, SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8141	SW3510C	Famphur	33	U	33	UG/KG	UJ	33	CCVL, SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8141	SW3510C	Thionazine	46.1	U	46.1	UG/KG	UJ	46.1	CCVL, SSL
SO	PEST	20406050906	060304-SOI-02719-00.5	N	SW8141	SW3510C	Famphur	31.7	U	31.7	UG/KG	UJ	31.7	CCVL, SSL
SO	PEST	20406050906	060304-SOI-02719-00.5	N	SW8141	SW3510C	Thionazine	44.4	U	44.4	UG/KG	UJ	44.4	CCVL, SSL
SED	PEST	20406302301	062804-SED-02691-00.2	N	SW8081A	SW3510C	alpha-BHC	11.7	U	11.7	UG/KG	UJ	11.7	ICRSD
SED	PEST	20406302302	062804-SED-02692-00.2	N	SW8081A	SW3510C	alpha-BHC	12.2	U	12.2	UG/KG	UJ	12.2	ICRSD
SED	PEST	20406302303	062804-SED-02693-00.2	N	SW8081A	SW3510C	alpha-BHC	11.9	U	11.9	UG/KG	UJ	11.9	ICRSD
SED	PEST	20406302304	062804-SED-02694-00.2	N	SW8081A	SW3510C	alpha-BHC	11.1	U	11.1	UG/KG	UJ	11.1	ICRSD
SED	PEST	20406302305	062904-SED-02699-00.2	N	SW8081A	SW3510C	alpha-BHC	11.4	U	11.4	UG/KG	UJ	11.4	ICRSD
SED	PEST	20406302306	062904-SED-02700-00.2	N	SW8081A	SW3510C	alpha-BHC	11.3	U	11.3	UG/KG	UJ	11.3	ICRSD
SED	PEST	20406302307	062904-SED-02701-00.2	N	SW8081A	SW3510C	alpha-BHC	12.2	U	12.2	UG/KG	UJ	12.2	ICRSD
SED	PEST	20406302308	062904-SED-02702-00.2	N	SW8081A	SW3510C	alpha-BHC	11.1	U	11.1	UG/KG	UJ	11.1	ICRSD
SED	PEST	20406302309	062904-SED-02731-00.2	N	SW8081A	SW3510C	alpha-BHC	12	U	12	UG/KG	UJ	12	ICRSD
SED	PEST	20406302312	062904-SED-02732-00.2	N	SW8081A	SW3510C	alpha-BHC	12.6	U	12.6	UG/KG	UJ	12.6	ICRSD
SED	PEST	20406302313	062904-SED-02733-00.2	N	SW8081A	SW3510C	alpha-BHC	12.1	U	12.1	UG/KG	UJ	12.1	ICRSD
SED	PEST	20406302314	062904-SED-02734-00.2	N	SW8081A	SW3510C	alpha-BHC	11.8	U	11.8	UG/KG	UJ	11.8	ICRSD
SED	PEST	20406302315	062904-SED-02734-00.2-D	FD	SW8081A	SW3510C	alpha-BHC	11.8	U	11.8	UG/KG	UJ	11.8	ICRSD
SED	PEST	20407020802	063004-SED-02708-00.2	N	SW8081A	SW3510C	alpha-BHC	63	U	63	UG/KG	UJ	63	ICRSD
SED	PEST	20407020802	063004-SED-02708-00.2	N	SW8081A	SW3510C	delta-BHC	63	U	63	UG/KG	UJ	63	ICRSD
SED	PEST	20407020803	063004-SED-02708-00.2-D	FD	SW8081A	SW3510C	alpha-BHC	63.1	U	63.1	UG/KG	UJ	63.1	ICRSD
SED	PEST	20407020803	063004-SED-02708-00.2-D	FD	SW8081A	SW3510C	delta-BHC	63.1	U	63.1	UG/KG	UJ	63.1	ICRSD
SED	PEST	20407020806	063004-SED-02709-00.2	N	SW8081A	SW3510C	alpha-BHC	58.8	U	58.8	UG/KG	UJ	58.8	ICRSD

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SED	PEST	20407020806	063004-SED-02709-00.2	N	SW8081A	SW3510C	delta-BHC	58.8	U	58.8	UG/KG	UJ	58.8	ICRSD
SED	PEST	20407020807	063004-SED-02710-00.2	N	SW8081A	SW3510C	alpha-BHC	57.1	U	57.1	UG/KG	UJ	57.1	ICRSD
SED	PEST	20407020808	063004-SED-02715-00.2	N	SW8081A	SW3510C	alpha-BHC	64.2	U	64.2	UG/KG	UJ	64.2	ICRSD
SED	PEST	20407020808	063004-SED-02715-00.2	N	SW8081A	SW3510C	delta-BHC	64.2	U	64.2	UG/KG	UJ	64.2	ICRSD
SED	PEST	20407020809	063004-SED-02716-00.2	N	SW8081A	SW3510C	alpha-BHC	57.3	U	57.3	UG/KG	UJ	57.3	ICRSD
SED	PEST	20407020809	063004-SED-02716-00.2	N	SW8081A	SW3510C	delta-BHC	57.3	U	57.3	UG/KG	UJ	57.3	ICRSD
SED	PEST	20407020810	063004-SED-02717-00.2	N	SW8081A	SW3510C	alpha-BHC	64.1	U	64.1	UG/KG	UJ	64.1	ICRSD
SED	PEST	20407020810	063004-SED-02717-00.2	N	SW8081A	SW3510C	delta-BHC	64.1	U	64.1	UG/KG	UJ	64.1	ICRSD
SED	PEST	20407020811	063004-SED-02718-00.2	N	SW8081A	SW3510C	alpha-BHC	61.4	U	61.4	UG/KG	UJ	61.4	ICRSD
SED	PEST	20407020811	063004-SED-02718-00.2	N	SW8081A	SW3510C	delta-BHC	61.4	U	61.4	UG/KG	UJ	61.4	ICRSD
SED	PEST	20407020812	063004-SED-02723-00.2	N	SW8081A	SW3510C	alpha-BHC	59.3	U	59.3	UG/KG	UJ	59.3	ICRSD
SED	PEST	20407020812	063004-SED-02723-00.2	N	SW8081A	SW3510C	delta-BHC	59.3	U	59.3	UG/KG	UJ	59.3	ICRSD
SED	PEST	20407020813	063004-SED-02724-00.2	N	SW8081A	SW3510C	alpha-BHC	56.6	U	56.6	UG/KG	UJ	56.6	ICRSD
SED	PEST	20407020813	063004-SED-02724-00.2	N	SW8081A	SW3510C	delta-BHC	56.6	U	56.6	UG/KG	UJ	56.6	ICRSD
SED	PEST	20407020814	063004-SED-02725-00.2	N	SW8081A	SW3510C	alpha-BHC	62.1	U	62.1	UG/KG	UJ	62.1	ICRSD
SED	PEST	20407020814	063004-SED-02725-00.2	N	SW8081A	SW3510C	delta-BHC	62.1	U	62.1	UG/KG	UJ	62.1	ICRSD
SED	PEST	20407020815	063004-SED-02726-00.2	N	SW8081A	SW3510C	alpha-BHC	60.4	U	60.4	UG/KG	UJ	60.4	ICRSD
SED	PEST	20407020815	063004-SED-02726-00.2	N	SW8081A	SW3510C	delta-BHC	60.4	U	60.4	UG/KG	UJ	60.4	ICRSD
SED	PEST	20407020816	063004-SED-02726-00.2-D	FD	SW8081A	SW3510C	alpha-BHC	60.6	U	60.6	UG/KG	UJ	60.6	ICRSD
SED	PEST	20407020816	063004-SED-02726-00.2-D	FD	SW8081A	SW3510C	delta-BHC	60.6	U	60.6	UG/KG	UJ	60.6	ICRSD
SO	PEST	20406042503	060204-SOI-02697-00.5	LR	SW8260B	NONE	1,2-Dibromo-3-chloropropane	446	U	446	UG/KG	UJ	446	ISL
SO	PEST	20406042504	060204-SOI-02697-00.5-D	LR	SW8260B	NONE	1,2-Dibromo-3-chloropropane	292	U	292	UG/KG	UJ	292	ISL
SO	PEST	20406050907	060304-SOI-02720-00.5	N	SW8081A	SW3510C	Endrin	12.7	=	12.7	UG/KG	J	11.8	MSDH
SO	PEST	20406032407	060104-SOI-02687-04.5	N	SW8081A	SW3510C	Methoxychlor	87	=	87	UG/KG	J	62.5	MSL, MSDL
SO	PEST	20406032409	060104-SOI-02690-00.5	N	SW8081A	SW3510C	Aldrin	23.5	U	23.5	UG/KG	UJ	23.5	MSL, SSL
SO	PEST	20406050914	060404-SOI-02713-00.5	N	SW8081A	SW3510C	4,4'-DDE	130	=	130	UG/KG	J	74	SSH
SO	PEST	20406050916	060404-SOI-02727-00.5	N	SW8081A	SW3510C	4,4'-DDE	125	=	125	UG/KG	J	67.6	SSH
SO	PEST	20406050918	060404-SOI-02729-00.5	N	SW8081A	SW3510C	4,4'-DDE	97.3	=	97.3	UG/KG	J	70.8	SSH
SO	PEST	20406032401	060104-SOI-02687-02.0	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	6.73	U	6.73	UG/KG	UJ	6.73	SSL
SO	PEST	20406032402	060104-SOI-02688-02.0	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	5.37	U	5.37	UG/KG	UJ	5.37	SSL
SO	PEST	20406032403	060104-SOI-02689-00.5	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	5.29	U	5.29	UG/KG	UJ	5.29	SSL
SO	PEST	20406032404	060104-SOI-02688-04.0	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	4.3	U	4.3	UG/KG	UJ	4.3	SSL
SO	PEST	20406032405	060104-SOI-02689-04.5	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	4.78	U	4.78	UG/KG	UJ	4.78	SSL
SO	PEST	20406032405	060104-SOI-02689-04.5	N	SW8081A	SW3510C	4,4'-DDD	12	U	12	UG/KG	UJ	12	SSL
SO	PEST	20406032405	060104-SOI-02689-04.5	N	SW8081A	SW3510C	4,4'-DDE	12	U	12	UG/KG	UJ	12	SSL
SO	PEST	20406032405	060104-SOI-02689-04.5	N	SW8081A	SW3510C	4,4'-DDT	12	U	12	UG/KG	UJ	12	SSL
SO	PEST	20406032405	060104-SOI-02689-04.5	N	SW8081A	SW3510C	Aldrin	12	U	12	UG/KG	UJ	12	SSL
SO	PEST	20406032405	060104-SOI-02689-04.5	N	SW8081A	SW3510C	alpha-BHC	12	U	12	UG/KG	UJ	12	SSL
SO	PEST	20406032405	060104-SOI-02689-04.5	N	SW8081A	SW3510C	alpha-Chlordane	15	U	15	UG/KG	UJ	15	SSL
SO	PEST	20406032405	060104-SOI-02689-04.5	N	SW8081A	SW3510C	beta-BHC	12	U	12	UG/KG	UJ	12	SSL
SO	PEST	20406032405	060104-SOI-02689-04.5	N	SW8081A	SW3510C	BP-6(PBB)	12	U	12	UG/KG	UJ	12	SSL
SO	PEST	20406032405	060104-SOI-02689-04.5	N	SW8081A	SW3510C	Chlordane	15	U	15	UG/KG	UJ	15	SSL
SO	PEST	20406032405	060104-SOI-02689-04.5	N	SW8081A	SW3510C	delta-BHC	12	U	12	UG/KG	UJ	12	SSL
SO	PEST	20406032405	060104-SOI-02689-04.5	N	SW8081A	SW3510C	Dieldrin	12	U	12	UG/KG	UJ	12	SSL
SO	PEST	20406032405	060104-SOI-02689-04.5	N	SW8081A	SW3510C	Endosulfan I	12	U	12	UG/KG	UJ	12	SSL
SO	PEST	20406032405	060104-SOI-02689-04.5	N	SW8081A	SW3510C	Endosulfan II	12	U	12	UG/KG	UJ	12	SSL
SO	PEST	20406032405	060104-SOI-02689-04.5	N	SW8081A	SW3510C	Endosulfan sulfate	12	U	12	UG/KG	UJ	12	SSL
SO	PEST	20406032405	060104-SOI-02689-04.5	N	SW8081A	SW3510C	Endrin	12	U	12	UG/KG	UJ	12	SSL
SO	PEST	20406032405	060104-SOI-02689-04.5	N	SW8081A	SW3510C	Endrin aldehyde	12	U	12	UG/KG	UJ	12	SSL
SO	PEST	20406032405	060104-SOI-02689-04.5	N	SW8081A	SW3510C	Endrin ketone	12	U	12	UG/KG	UJ	12	SSL
SO	PEST	20406032405	060104-SOI-02689-04.5	N	SW8081A	SW3510C	gamma-BHC (Lindane)	12	U	12	UG/KG	UJ	12	SSL
SO	PEST	20406032405	060104-SOI-02689-04.5	N	SW8081A	SW3510C	gamma-Chlordane	15	U	15	UG/KG	UJ	15	SSL
SO	PEST	20406032405	060104-SOI-02689-04.5	N	SW8081A	SW3510C	Heptachlor	12	U	12	UG/KG	UJ	12	SSL
SO	PEST	20406032405	060104-SOI-02689-04.5	N	SW8081A	SW3510C	Heptachlor epoxide	12	U	12	UG/KG	UJ	12	SSL
SO	PEST	20406032405	060104-SOI-02689-04.5	N	SW8081A	SW3510C	Methoxychlor	30	U	30	UG/KG	UJ	30	SSL
SO	PEST	20406032405	060104-SOI-02689-04.5	N	SW8081A	SW3510C	Mirex	30	U	30	UG/KG	UJ	30	SSL
SO	PEST	20406032405	060104-SOI-02689-04.5	N	SW8081A	SW3510C	Toxaphene	102	U	102	UG/KG	UJ	102	SSL
SO	PEST	20406032406	060104-SOI-02688-07.0	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	4.49	U	4.49	UG/KG	UJ	4.49	SSL
SO	PEST	20406032407	060104-SOI-02687-04.5	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	5.06	U	5.06	UG/KG	UJ	5.06	SSL
SO	PEST	20406032408	060104-SOI-02688-06.0	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	4.76	U	4.76	UG/KG	UJ	4.76	SSL
SO	PEST	20406032409	060104-SOI-02690-00.5	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	5.09	U	5.09	UG/KG	UJ	5.09	SSL
SO	PEST	20406032409	060104-SOI-02690-00.5	N	SW8081A	SW3510C	4,4'-DDD	23.5	U	23.5	UG/KG	UJ	23.5	SSL
SO	PEST	20406032409	060104-SOI-02690-00.5	N	SW8081A	SW3510C	4,4'-DDE	23.5	U	23.5	UG/KG	UJ	23.5	SSL
SO	PEST	20406032409	060104-SOI-02690-00.5	N	SW8081A	SW3510C	4,4'-DDT	23.5	U	23.5	UG/KG	UJ	23.5	SSL
SO	PEST	20406032409	060104-SOI-02690-00.5	N	SW8081A	SW3510C	alpha-BHC	23.5	U	23.5	UG/KG	UJ	23.5	SSL
SO	PEST	20406032409	060104-SOI-02690-00.5	N	SW8081A	SW3510C	alpha-Chlordane	29.3	U	29.3	UG/KG	UJ	29.3	SSL
SO	PEST	20406032409	060104-SOI-02690-00.5	N	SW8081A	SW3510C	beta-BHC	23.5	U	23.5	UG/KG	UJ	23.5	SSL
SO	PEST	20406032409	060104-SOI-02690-00.5	N	SW8081A	SW3510C	BP-6(PBB)	23.5	U	23.5	UG/KG	UJ	23.5	SSL

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SO	PEST	20406032409	060104-SOI-02690-00.5	N	SW8081A	SW3510C	Chlordane	29.3	U	29.3	UG/KG	UJ	29.3	SSL
SO	PEST	20406032409	060104-SOI-02690-00.5	N	SW8081A	SW3510C	delta-BHC	23.5	U	23.5	UG/KG	UJ	23.5	SSL
SO	PEST	20406032409	060104-SOI-02690-00.5	N	SW8081A	SW3510C	Dieldrin	23.5	U	23.5	UG/KG	UJ	23.5	SSL
SO	PEST	20406032409	060104-SOI-02690-00.5	N	SW8081A	SW3510C	Endosulfan II	23.5	U	23.5	UG/KG	UJ	23.5	SSL
SO	PEST	20406032409	060104-SOI-02690-00.5	N	SW8081A	SW3510C	Endosulfan sulfate	23.5	U	23.5	UG/KG	UJ	23.5	SSL
SO	PEST	20406032409	060104-SOI-02690-00.5	N	SW8081A	SW3510C	Endrin	23.5	U	23.5	UG/KG	UJ	23.5	SSL
SO	PEST	20406032409	060104-SOI-02690-00.5	N	SW8081A	SW3510C	Endrin aldehyde	23.5	U	23.5	UG/KG	UJ	23.5	SSL
SO	PEST	20406032409	060104-SOI-02690-00.5	N	SW8081A	SW3510C	Endrin ketone	23.5	U	23.5	UG/KG	UJ	23.5	SSL
SO	PEST	20406032409	060104-SOI-02690-00.5	N	SW8081A	SW3510C	gamma-BHC (Lindane)	23.5	U	23.5	UG/KG	UJ	23.5	SSL
SO	PEST	20406032409	060104-SOI-02690-00.5	N	SW8081A	SW3510C	gamma-Chlordane	29.3	U	29.3	UG/KG	UJ	29.3	SSL
SO	PEST	20406032409	060104-SOI-02690-00.5	N	SW8081A	SW3510C	Heptachlor epoxide	23.5	U	23.5	UG/KG	UJ	23.5	SSL
SO	PEST	20406032409	060104-SOI-02690-00.5	N	SW8081A	SW3510C	Methoxychlor	58.7	U	58.7	UG/KG	UJ	58.7	SSL
SO	PEST	20406032409	060104-SOI-02690-00.5	N	SW8081A	SW3510C	Mirex	58.7	U	58.7	UG/KG	UJ	58.7	SSL
SO	PEST	20406032409	060104-SOI-02690-00.5	N	SW8081A	SW3510C	Toxaphene	199	U	199	UG/KG	UJ	199	SSL
SO	PEST	20406032412	060104-SOI-02687-00.5-D	FD	SW8141	SW3510C	0,0,0-Triethylphosphorothioate	41.1	U	41.1	UG/KG	UJ	41.1	SSL
SO	PEST	20406032412	060104-SOI-02687-00.5-D	FD	SW8260B	NONE	1,2-Dibromo-3-chloropropane	6.07	U	6.07	UG/KG	UJ	6.07	SSL
SO	PEST	20406032412	060104-SOI-02687-00.5-D	FD	SW8141	SW3510C	Dimethoate	29.4	U	29.4	UG/KG	UJ	29.4	SSL
SO	PEST	20406032412	060104-SOI-02687-00.5-D	FD	SW8141	SW3510C	Disulfoton	29.4	U	29.4	UG/KG	UJ	29.4	SSL
SO	PEST	20406032412	060104-SOI-02687-00.5-D	FD	SW8141	SW3510C	Ethyl Parathion	29.4	U	29.4	UG/KG	UJ	29.4	SSL
SO	PEST	20406032412	060104-SOI-02687-00.5-D	FD	SW8141	SW3510C	Methyl Parathion	29.4	U	29.4	UG/KG	UJ	29.4	SSL
SO	PEST	20406032412	060104-SOI-02687-00.5-D	FD	SW8141	SW3510C	Phorate	29.4	U	29.4	UG/KG	UJ	29.4	SSL
SO	PEST	20406032412	060104-SOI-02687-00.5-D	FD	SW8141	SW3510C	Sulfotep	41.1	U	41.1	UG/KG	UJ	41.1	SSL
SO	PEST	20406032412	060104-SOI-02687-00.5-D	FD	SW8141	SW3510C	Thionazine	41.1	U	41.1	UG/KG	UJ	41.1	SSL
SO	PEST	20406032413	060104-SOI-02690-02.0	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	4.87	U	4.87	UG/KG	UJ	4.87	SSL
SO	PEST	20406032413	060104-SOI-02690-02.0	N	SW8081A	SW3510C	4,4'-DDD	11.5	U	11.5	UG/KG	UJ	11.5	SSL
SO	PEST	20406032413	060104-SOI-02690-02.0	N	SW8081A	SW3510C	4,4'-DDE	11.5	U	11.5	UG/KG	UJ	11.5	SSL
SO	PEST	20406032413	060104-SOI-02690-02.0	N	SW8081A	SW3510C	4,4'-DDT	11.5	U	11.5	UG/KG	UJ	11.5	SSL
SO	PEST	20406032413	060104-SOI-02690-02.0	N	SW8081A	SW3510C	Aldrin	11.5	U	11.5	UG/KG	UJ	11.5	SSL
SO	PEST	20406032413	060104-SOI-02690-02.0	N	SW8081A	SW3510C	alpha-BHC	11.5	U	11.5	UG/KG	UJ	11.5	SSL
SO	PEST	20406032413	060104-SOI-02690-02.0	N	SW8081A	SW3510C	alpha-Chlordane	14.4	U	14.4	UG/KG	UJ	14.4	SSL
SO	PEST	20406032413	060104-SOI-02690-02.0	N	SW8081A	SW3510C	beta-BHC	11.5	U	11.5	UG/KG	UJ	11.5	SSL
SO	PEST	20406032413	060104-SOI-02690-02.0	N	SW8081A	SW3510C	BP-6(PBB)	11.5	U	11.5	UG/KG	UJ	11.5	SSL
SO	PEST	20406032413	060104-SOI-02690-02.0	N	SW8081A	SW3510C	Chlordane	14.4	U	14.4	UG/KG	UJ	14.4	SSL
SO	PEST	20406032413	060104-SOI-02690-02.0	N	SW8081A	SW3510C	delta-BHC	11.5	U	11.5	UG/KG	UJ	11.5	SSL
SO	PEST	20406032413	060104-SOI-02690-02.0	N	SW8081A	SW3510C	Dieldrin	11.5	U	11.5	UG/KG	UJ	11.5	SSL
SO	PEST	20406032413	060104-SOI-02690-02.0	N	SW8081A	SW3510C	Endosulfan II	11.5	U	11.5	UG/KG	UJ	11.5	SSL
SO	PEST	20406032413	060104-SOI-02690-02.0	N	SW8081A	SW3510C	Endosulfan sulfate	11.5	U	11.5	UG/KG	UJ	11.5	SSL
SO	PEST	20406032413	060104-SOI-02690-02.0	N	SW8081A	SW3510C	Endrin	11.5	U	11.5	UG/KG	UJ	11.5	SSL
SO	PEST	20406032413	060104-SOI-02690-02.0	N	SW8081A	SW3510C	Endrin aldehyde	11.5	U	11.5	UG/KG	UJ	11.5	SSL
SO	PEST	20406032413	060104-SOI-02690-02.0	N	SW8081A	SW3510C	Endrin ketone	11.5	U	11.5	UG/KG	UJ	11.5	SSL
SO	PEST	20406032413	060104-SOI-02690-02.0	N	SW8081A	SW3510C	gamma-BHC (Lindane)	11.5	U	11.5	UG/KG	UJ	11.5	SSL
SO	PEST	20406032413	060104-SOI-02690-02.0	N	SW8081A	SW3510C	gamma-Chlordane	14.4	U	14.4	UG/KG	UJ	14.4	SSL
SO	PEST	20406032413	060104-SOI-02690-02.0	N	SW8081A	SW3510C	Heptachlor epoxide	11.5	U	11.5	UG/KG	UJ	11.5	SSL
SO	PEST	20406032413	060104-SOI-02690-02.0	N	SW8081A	SW3510C	Methoxychlor	28.8	U	28.8	UG/KG	UJ	28.8	SSL
SO	PEST	20406032413	060104-SOI-02690-02.0	N	SW8081A	SW3510C	Mirex	28.8	U	28.8	UG/KG	UJ	28.8	SSL
SO	PEST	20406032413	060104-SOI-02690-02.0	N	SW8081A	SW3510C	Toxaphene	98	U	98	UG/KG	UJ	98	SSL
SO	PEST	20406032414	060104-SOI-02687-00.5	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	6.59	U	6.59	UG/KG	UJ	6.59	SSL
SO	PEST	20406032415	060104-SOI-02689-02.0	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	4.9	U	4.9	UG/KG	UJ	4.9	SSL
SO	PEST	20406032416	060104-SOI-02688-00.5	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	5.47	U	5.47	UG/KG	UJ	5.47	SSL
SO	PEST	20406042501	060204-SOI-02695-00.5	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	4.94	U	4.94	UG/KG	UJ	4.94	SSL
SO	PEST	20406042502	060204-SOI-02696-00.5	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	6.18	U	6.18	UG/KG	UJ	6.18	SSL
SO	PEST	20406042505	060204-SOI-02698-00.5	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	6.35	U	6.35	UG/KG	UJ	6.35	SSL
SO	PEST	20406042507	060204-SOI-02695-01.5	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	4.54	U	4.54	UG/KG	UJ	4.54	SSL
SO	PEST	20406042508	060204-SOI-02696-04.0	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	7.6	U	7.6	UG/KG	UJ	7.6	SSL
SO	PEST	20406042510	060204-SOI-02697-02.5	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	5.01	U	5.01	UG/KG	UJ	5.01	SSL
SO	PEST	20406042511	060204-SOI-02696-02.0	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	6.7	U	6.7	UG/KG	UJ	6.7	SSL
SO	PEST	20406050901	060304-SOI-02703-00.5	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	5.78	U	5.78	UG/KG	UJ	5.78	SSL
SO	PEST	20406050902	060304-SOI-02705-00.5	N	SW8141	SW3510C	0,0,0-Triethylphosphorothioate	41.4	U	41.4	UG/KG	UJ	41.4	SSL
SO	PEST	20406050902	060304-SOI-02705-00.5	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	7.11	U	7.11	UG/KG	UJ	7.11	SSL
SO	PEST	20406050902	060304-SOI-02705-00.5	N	SW8141	SW3510C	Dimethoate	29.6	U	29.6	UG/KG	UJ	29.6	SSL
SO	PEST	20406050902	060304-SOI-02705-00.5	N	SW8141	SW3510C	Disulfoton	29.6	U	29.6	UG/KG	UJ	29.6	SSL
SO	PEST	20406050902	060304-SOI-02705-00.5	N	SW8141	SW3510C	Ethyl Parathion	29.6	U	29.6	UG/KG	UJ	29.6	SSL
SO	PEST	20406050902	060304-SOI-02705-00.5	N	SW8141	SW3510C	Methyl Parathion	29.6	U	29.6	UG/KG	UJ	29.6	SSL
SO	PEST	20406050902	060304-SOI-02705-00.5	N	SW8141	SW3510C	Phorate	29.6	U	29.6	UG/KG	UJ	29.6	SSL
SO	PEST	20406050902	060304-SOI-02705-00.5	N	SW8141	SW3510C	Sulfotep	41.4	U	41.4	UG/KG	UJ	41.4	SSL
SO	PEST	20406050903	060304-SOI-02706-00.5	N	SW8141	SW3510C	0,0,0-Triethylphosphorothioate	38	U	38	UG/KG	UJ	38	SSL
SO	PEST	20406050903	060304-SOI-02706-00.5	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	5.36	U	5.36	UG/KG	UJ	5.36	SSL

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SO	PEST	20406050903	060304-SOI-02706-00.5	N	SW8141	SW3510C	Dimethoate	27.1	U	27.1	UG/KG	UJ	27.1	SSL
SO	PEST	20406050903	060304-SOI-02706-00.5	N	SW8141	SW3510C	Disulfoton	27.1	U	27.1	UG/KG	UJ	27.1	SSL
SO	PEST	20406050903	060304-SOI-02706-00.5	N	SW8141	SW3510C	Ethyl Parathion	27.1	U	27.1	UG/KG	UJ	27.1	SSL
SO	PEST	20406050903	060304-SOI-02706-00.5	N	SW8141	SW3510C	Methyl Parathion	27.1	U	27.1	UG/KG	UJ	27.1	SSL
SO	PEST	20406050903	060304-SOI-02706-00.5	N	SW8141	SW3510C	Phorate	27.1	U	27.1	UG/KG	UJ	27.1	SSL
SO	PEST	20406050903	060304-SOI-02706-00.5	N	SW8141	SW3510C	Sulfotep	38	U	38	UG/KG	UJ	38	SSL
SO	PEST	20406050904	060304-SOI-02704-00.5	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	10.2	U	10.2	UG/KG	UJ	10.2	SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8141	SW3510C	0,0,0-Triethylphosphorothioate	46.1	U	46.1	UG/KG	UJ	46.1	SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8260B	NONE	1,2-Dibromo-3-chloropropane	7.52	U	7.52	UG/KG	UJ	7.52	SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8081A	SW3510C	4,4'-DDD	13.2	U	13.2	UG/KG	UJ	13.2	SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8081A	SW3510C	4,4'-DDE	13.2	U	13.2	UG/KG	UJ	13.2	SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8081A	SW3510C	4,4'-DDT	34.1	=	34.1	UG/KG	J	13.2	SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8081A	SW3510C	Aldrin	13.2	U	13.2	UG/KG	UJ	13.2	SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8081A	SW3510C	alpha-BHC	13.2	U	13.2	UG/KG	UJ	13.2	SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8081A	SW3510C	alpha-Chlordane	16.5	U	16.5	UG/KG	UJ	16.5	SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8081A	SW3510C	beta-BHC	13.2	U	13.2	UG/KG	UJ	13.2	SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8081A	SW3510C	BP-6(PBB)	13.2	U	13.2	UG/KG	UJ	13.2	SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8081A	SW3510C	Chlordane	16.5	U	16.5	UG/KG	UJ	16.5	SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8081A	SW3510C	delta-BHC	13.2	U	13.2	UG/KG	UJ	13.2	SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8081A	SW3510C	Dieldrin	13.2	U	13.2	UG/KG	UJ	13.2	SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8141	SW3510C	Dimethoate	33	U	33	UG/KG	UJ	33	SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8141	SW3510C	Disulfoton	33	U	33	UG/KG	UJ	33	SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8081A	SW3510C	Endosulfan I	13.2	U	13.2	UG/KG	UJ	13.2	SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8081A	SW3510C	Endosulfan II	13.2	U	13.2	UG/KG	UJ	13.2	SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8081A	SW3510C	Endosulfan sulfate	13.2	U	13.2	UG/KG	UJ	13.2	SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8081A	SW3510C	Endrin aldehyde	13.2	U	13.2	UG/KG	UJ	13.2	SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8081A	SW3510C	Endrin ketone	13.2	U	13.2	UG/KG	UJ	13.2	SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8141	SW3510C	Ethyl Parathion	33	U	33	UG/KG	UJ	33	SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8081A	SW3510C	gamma-BHC (Lindane)	13.2	U	13.2	UG/KG	UJ	13.2	SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8081A	SW3510C	gamma-Chlordane	16.5	U	16.5	UG/KG	UJ	16.5	SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8081A	SW3510C	Heptachlor	13.2	U	13.2	UG/KG	UJ	13.2	SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8081A	SW3510C	Methoxychlor	33	U	33	UG/KG	UJ	33	SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8141	SW3510C	Methyl Parathion	33	U	33	UG/KG	UJ	33	SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8081A	SW3510C	Mirex	33	U	33	UG/KG	UJ	33	SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8141	SW3510C	Phorate	33	U	33	UG/KG	UJ	33	SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8141	SW3510C	Sulfotep	46.1	U	46.1	UG/KG	UJ	46.1	SSL
SO	PEST	20406050905	060304-SOI-02704-00.5-D	FD	SW8081A	SW3510C	Toxaphene	112	U	112	UG/KG	UJ	112	SSL
SO	PEST	20406050906	060304-SOI-02719-00.5	N	SW8141	SW3510C	0,0,0-Triethylphosphorothioate	44.4	U	44.4	UG/KG	UJ	44.4	SSL
SO	PEST	20406050906	060304-SOI-02719-00.5	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	6.4	U	6.4	UG/KG	UJ	6.4	SSL
SO	PEST	20406050906	060304-SOI-02719-00.5	N	SW8141	SW3510C	Dimethoate	31.7	U	31.7	UG/KG	UJ	31.7	SSL
SO	PEST	20406050906	060304-SOI-02719-00.5	N	SW8141	SW3510C	Disulfoton	31.7	U	31.7	UG/KG	UJ	31.7	SSL
SO	PEST	20406050906	060304-SOI-02719-00.5	N	SW8141	SW3510C	Ethyl Parathion	31.7	U	31.7	UG/KG	UJ	31.7	SSL
SO	PEST	20406050906	060304-SOI-02719-00.5	N	SW8141	SW3510C	Methyl Parathion	31.7	U	31.7	UG/KG	UJ	31.7	SSL
SO	PEST	20406050906	060304-SOI-02719-00.5	N	SW8141	SW3510C	Phorate	31.7	U	31.7	UG/KG	UJ	31.7	SSL
SO	PEST	20406050906	060304-SOI-02719-00.5	N	SW8141	SW3510C	Sulfotep	44.4	U	44.4	UG/KG	UJ	44.4	SSL
SO	PEST	20406050907	060304-SOI-02720-00.5	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	5.89	U	5.89	UG/KG	UJ	5.89	SSL
SO	PEST	20406050910	060304-SOI-02721-00.5	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	5.48	U	5.48	UG/KG	UJ	5.48	SSL
SO	PEST	20406050911	060304-SOI-02722-00.5	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	5.1	U	5.1	UG/KG	UJ	5.1	SSL
SO	PEST	20406050912	060404-SOI-02711-00.5	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	6.14	U	6.14	UG/KG	UJ	6.14	SSL
SO	PEST	20406050912	060404-SOI-02711-00.5	N	SW8081A	SW3510C	4,4'-DDD	14.1	U	14.1	UG/KG	UJ	14.1	SSL
SO	PEST	20406050912	060404-SOI-02711-00.5	N	SW8081A	SW3510C	Aldrin	14.1	U	14.1	UG/KG	UJ	14.1	SSL
SO	PEST	20406050912	060404-SOI-02711-00.5	N	SW8081A	SW3510C	alpha-BHC	14.1	U	14.1	UG/KG	UJ	14.1	SSL
SO	PEST	20406050912	060404-SOI-02711-00.5	N	SW8081A	SW3510C	alpha-Chlordane	17.6	U	17.6	UG/KG	UJ	17.6	SSL
SO	PEST	20406050912	060404-SOI-02711-00.5	N	SW8081A	SW3510C	beta-BHC	14.1	U	14.1	UG/KG	UJ	14.1	SSL
SO	PEST	20406050912	060404-SOI-02711-00.5	N	SW8081A	SW3510C	BP-6(PBB)	14.1	U	14.1	UG/KG	UJ	14.1	SSL
SO	PEST	20406050912	060404-SOI-02711-00.5	N	SW8081A	SW3510C	Chlordane	17.6	U	17.6	UG/KG	UJ	17.6	SSL
SO	PEST	20406050912	060404-SOI-02711-00.5	N	SW8081A	SW3510C	delta-BHC	14.1	U	14.1	UG/KG	UJ	14.1	SSL
SO	PEST	20406050912	060404-SOI-02711-00.5	N	SW8081A	SW3510C	Dieldrin	14.1	U	14.1	UG/KG	UJ	14.1	SSL
SO	PEST	20406050912	060404-SOI-02711-00.5	N	SW8081A	SW3510C	Endosulfan I	14.1	U	14.1	UG/KG	UJ	14.1	SSL
SO	PEST	20406050912	060404-SOI-02711-00.5	N	SW8081A	SW3510C	Endosulfan II	14.1	U	14.1	UG/KG	UJ	14.1	SSL
SO	PEST	20406050912	060404-SOI-02711-00.5	N	SW8081A	SW3510C	Endosulfan sulfate	14.1	U	14.1	UG/KG	UJ	14.1	SSL
SO	PEST	20406050912	060404-SOI-02711-00.5	N	SW8081A	SW3510C	Endrin	14.1	U	14.1	UG/KG	UJ	14.1	SSL
SO	PEST	20406050912	060404-SOI-02711-00.5	N	SW8081A	SW3510C	Endrin aldehyde	14.1	U	14.1	UG/KG	UJ	14.1	SSL
SO	PEST	20406050912	060404-SOI-02711-00.5	N	SW8081A	SW3510C	Endrin ketone	14.1	U	14.1	UG/KG	UJ	14.1	SSL

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SO	PEST	20406050912	060404-SOI-02711-00.5	N	SW8081A	SW3510C	gamma-BHC (Lindane)	14.1	U	14.1	UG/KG	UJ	14.1	SSL
SO	PEST	20406050912	060404-SOI-02711-00.5	N	SW8081A	SW3510C	gamma-Chlordane	17.6	U	17.6	UG/KG	UJ	17.6	SSL
SO	PEST	20406050912	060404-SOI-02711-00.5	N	SW8081A	SW3510C	Heptachlor	14.1	U	14.1	UG/KG	UJ	14.1	SSL
SO	PEST	20406050912	060404-SOI-02711-00.5	N	SW8081A	SW3510C	Heptachlor epoxide	14.1	U	14.1	UG/KG	UJ	14.1	SSL
SO	PEST	20406050912	060404-SOI-02711-00.5	N	SW8081A	SW3510C	Mirex	35.3	U	35.3	UG/KG	UJ	35.3	SSL
SO	PEST	20406050912	060404-SOI-02711-00.5	N	SW8081A	SW3510C	Toxaphene	120	U	120	UG/KG	UJ	120	SSL
SO	PEST	20406050913	060404-SOI-02712-00.5	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	5.09	U	5.09	UG/KG	UJ	5.09	SSL
SO	PEST	20406050914	060404-SOI-02713-00.5	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	8.43	U	8.43	UG/KG	UJ	8.43	SSL
SO	PEST	20406050915	060404-SOI-02714-00.5	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	6.06	U	6.06	UG/KG	UJ	6.06	SSL
SO	PEST	20406050916	060404-SOI-02727-00.5	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	6.2	U	6.2	UG/KG	UJ	6.2	SSL
SO	PEST	20406050917	060404-SOI-02728-00.5	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	6.23	U	6.23	UG/KG	UJ	6.23	SSL
SO	PEST	20406050918	060404-SOI-02729-00.5	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	8.53	U	8.53	UG/KG	UJ	8.53	SSL
SO	PEST	20406050919	060404-SOI-02730-00.5	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	10.8	U	10.8	UG/KG	UJ	10.8	SSL
SO	PEST	20406050920	060404-SOI-02730-00.5-D	FD	SW8260B	NONE	1,2-Dibromo-3-chloropropane	8.08	U	8.08	UG/KG	UJ	8.08	SSL
SED	PEST	20407020801	063004-SED-02707-00.2	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	4.38	U	4.38	UG/KG	UJ	4.38	SSL
SED	PEST	20407020808	063004-SED-02715-00.2	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	5.9	U	5.9	UG/KG	UJ	5.9	SSL
SED	PEST	20407020815	063004-SED-02726-00.2	N	SW8260B	NONE	1,2-Dibromo-3-chloropropane	4.62	U	4.62	UG/KG	UJ	4.62	SSL
SO	SVOC	20406032401	060104-SOI-02687-02.0	N	SW8270C	SW3510C	Hexachlorophene	1540	U	1540	UG/KG	UJ	1540	CCRRF, ICRSD, CCVL
SO	SVOC	20406032401	060104-SOI-02687-02.0	N	SW8270C	SW3510C	1,4 Dioxane	770	U	770	UG/KG	UJ	770	CCVL
SO	SVOC	20406032401	060104-SOI-02687-02.0	N	SW8081A	SW3510C	Isodrin	58.3	U	58.3	UG/KG	UJ	58.3	CCVL
SO	SVOC	20406032401	060104-SOI-02687-02.0	N	SW8270C	SW3510C	Isosafrole	770	U	770	UG/KG	UJ	770	CCVL
SO	SVOC	20406032402	060104-SOI-02688-02.0	N	SW8270C	SW3510C	1,4-Benzenediamine	361	U	361	UG/KG	UJ	361	CCVL
SO	SVOC	20406032402	060104-SOI-02688-02.0	N	SW8270C	SW3510C	1-Naphthylamine	361	U	361	UG/KG	UJ	361	CCVL
SO	SVOC	20406032402	060104-SOI-02688-02.0	N	SW8270C	SW3510C	5-Nitro-o-toluidine	361	U	361	UG/KG	UJ	361	CCVL
SO	SVOC	20406032402	060104-SOI-02688-02.0	N	SW8081A	SW3510C	Isodrin	27.3	U	27.3	UG/KG	UJ	27.3	CCVL
SO	SVOC	20406032402	060104-SOI-02688-02.0	N	SW8270C	SW3510C	Phenacetin	361	U	361	UG/KG	UJ	361	CCVL
SO	SVOC	20406032403	060104-SOI-02689-00.5	N	SW8270C	SW3510C	1,4-Benzenediamine	397	U	397	UG/KG	UJ	397	CCVL
SO	SVOC	20406032403	060104-SOI-02689-00.5	N	SW8270C	SW3510C	1-Naphthylamine	397	U	397	UG/KG	UJ	397	CCVL
SO	SVOC	20406032403	060104-SOI-02689-00.5	N	SW8270C	SW3510C	5-Nitro-o-toluidine	397	U	397	UG/KG	UJ	397	CCVL
SO	SVOC	20406032403	060104-SOI-02689-00.5	N	SW8081A	SW3510C	Isodrin	30.1	U	30.1	UG/KG	UJ	30.1	CCVL
SO	SVOC	20406032403	060104-SOI-02689-00.5	N	SW8270C	SW3510C	Phenacetin	397	U	397	UG/KG	UJ	397	CCVL
SO	SVOC	20406032404	060104-SOI-02688-04.0	N	SW8270C	SW3510C	1,4-Benzenediamine	371	U	371	UG/KG	UJ	371	CCVL
SO	SVOC	20406032404	060104-SOI-02688-04.0	N	SW8270C	SW3510C	1-Naphthylamine	371	U	371	UG/KG	UJ	371	CCVL
SO	SVOC	20406032404	060104-SOI-02688-04.0	N	SW8270C	SW3510C	5-Nitro-o-toluidine	371	U	371	UG/KG	UJ	371	CCVL
SO	SVOC	20406032404	060104-SOI-02688-04.0	N	SW8081A	SW3510C	Isodrin	56.3	U	56.3	UG/KG	UJ	56.3	CCVL
SO	SVOC	20406032404	060104-SOI-02688-04.0	N	SW8270C	SW3510C	Phenacetin	371	U	371	UG/KG	UJ	371	CCVL
SO	SVOC	20406032405	060104-SOI-02689-04.5	N	SW8270C	SW3510C	1,4-Benzenediamine	395	U	395	UG/KG	UJ	395	CCVL
SO	SVOC	20406032405	060104-SOI-02689-04.5	N	SW8270C	SW3510C	1-Naphthylamine	395	U	395	UG/KG	UJ	395	CCVL
SO	SVOC	20406032405	060104-SOI-02689-04.5	N	SW8270C	SW3510C	5-Nitro-o-toluidine	395	U	395	UG/KG	UJ	395	CCVL
SO	SVOC	20406032405	060104-SOI-02689-04.5	N	SW8270C	SW3510C	Phenacetin	395	U	395	UG/KG	UJ	395	CCVL
SO	SVOC	20406032406	060104-SOI-02688-07.0	N	SW8270C	SW3510C	1,4-Benzenediamine	371	U	371	UG/KG	UJ	371	CCVL
SO	SVOC	20406032406	060104-SOI-02688-07.0	N	SW8270C	SW3510C	1-Naphthylamine	371	U	371	UG/KG	UJ	371	CCVL
SO	SVOC	20406032406	060104-SOI-02688-07.0	N	SW8270C	SW3510C	5-Nitro-o-toluidine	371	U	371	UG/KG	UJ	371	CCVL
SO	SVOC	20406032406	060104-SOI-02688-07.0	N	SW8270C	SW3510C	Phenacetin	371	U	371	UG/KG	UJ	371	CCVL
SO	SVOC	20406032407	060104-SOI-02687-04.5	N	SW8270C	SW3510C	1,4 Dioxane	825	U	825	UG/KG	UJ	825	CCVL
SO	SVOC	20406032407	060104-SOI-02687-04.5	N	SW8270C	SW3510C	Isosafrole	825	U	825	UG/KG	UJ	825	CCVL
SO	SVOC	20406032408	060104-SOI-02688-06.0	N	SW8270C	SW3510C	1,4-Benzenediamine	367	U	367	UG/KG	UJ	367	CCVL
SO	SVOC	20406032408	060104-SOI-02688-06.0	N	SW8270C	SW3510C	1-Naphthylamine	367	U	367	UG/KG	UJ	367	CCVL
SO	SVOC	20406032408	060104-SOI-02688-06.0	N	SW8270C	SW3510C	5-Nitro-o-toluidine	367	U	367	UG/KG	UJ	367	CCVL
SO	SVOC	20406032408	060104-SOI-02688-06.0	N	SW8081A	SW3510C	Isodrin	27.8	U	27.8	UG/KG	UJ	27.8	CCVL
SO	SVOC	20406032408	060104-SOI-02688-06.0	N	SW8270C	SW3510C	Phenacetin	367	U	367	UG/KG	UJ	367	CCVL
SO	SVOC	20406032409	060104-SOI-02690-00.5	N	SW8270C	SW3510C	1,4 Dioxane	387	U	387	UG/KG	UJ	387	CCVL
SO	SVOC	20406032409	060104-SOI-02690-00.5	N	SW8270C	SW3510C	Isosafrole	387	U	387	UG/KG	UJ	387	CCVL
SO	SVOC	20406032412	060104-SOI-02687-00.5-D	FD	SW8270C	SW3510C	1,4-Benzenediamine	388	U	388	UG/KG	UJ	388	CCVL
SO	SVOC	20406032412	060104-SOI-02687-00.5-D	FD	SW8270C	SW3510C	1-Naphthylamine	388	U	388	UG/KG	UJ	388	CCVL
SO	SVOC	20406032412	060104-SOI-02687-00.5-D	FD	SW8270C	SW3510C	5-Nitro-o-toluidine	388	U	388	UG/KG	UJ	388	CCVL
SO	SVOC	20406032412	060104-SOI-02687-00.5-D	FD	SW8270C	SW3510C	Phenacetin	388	U	388	UG/KG	UJ	388	CCVL
SO	SVOC	20406032413	060104-SOI-02690-02.0	N	SW8270C	SW3510C	1,4-Benzenediamine	380	U	380	UG/KG	UJ	380	CCVL
SO	SVOC	20406032413	060104-SOI-02690-02.0	N	SW8270C	SW3510C	1-Naphthylamine	380	U	380	UG/KG	UJ	380	CCVL
SO	SVOC	20406032413	060104-SOI-02690-02.0	N	SW8270C	SW3510C	5-Nitro-o-toluidine	380	U	380	UG/KG	UJ	380	CCVL
SO	SVOC	20406032413	060104-SOI-02690-02.0	N	SW8270C	SW3510C	Phenacetin	380	U	380	UG/KG	UJ	380	CCVL
SO	SVOC	20406032414	060104-SOI-02687-00.5	N	SW8270C	SW3510C	1,4-Benzenediamine	390	U	390	UG/KG	UJ	390	CCVL
SO	SVOC	20406032414	060104-SOI-02687-00.5	N	SW8270C	SW3510C	1-Naphthylamine	390	U	390	UG/KG	UJ	390	CCVL
SO	SVOC	20406032414	060104-SOI-02687-00.5	N	SW8270C	SW3510C	5-Nitro-o-toluidine	390	U	390	UG/KG	UJ	390	CCVL

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SO	SVOC	20406032414	060104-SOI-02687-00.5	N	SW8081A	SW3510C	Isodrin	29.6	U	29.6	UG/KG	UJ	29.6	CCVL
SO	SVOC	20406032414	060104-SOI-02687-00.5	N	SW8270C	SW3510C	Phenacetin	390	U	390	UG/KG	UJ	390	CCVL
SO	SVOC	20406032415	060104-SOI-02689-02.0	N	SW8270C	SW3510C	1,4-Benzenediamine	376	U	376	UG/KG	UJ	376	CCVL
SO	SVOC	20406032415	060104-SOI-02689-02.0	N	SW8270C	SW3510C	1-Naphthylamine	376	U	376	UG/KG	UJ	376	CCVL
SO	SVOC	20406032415	060104-SOI-02689-02.0	N	SW8270C	SW3510C	5-Nitro-o-toluidine	376	U	376	UG/KG	UJ	376	CCVL
SO	SVOC	20406032415	060104-SOI-02689-02.0	N	SW8270C	SW3510C	Phenacetin	376	U	376	UG/KG	UJ	376	CCVL
SO	SVOC	20406032416	060104-SOI-02688-00.5	N	SW8270C	SW3510C	1,4-Benzenediamine	1210	=	1210	UG/KG	J	353	CCVL
SO	SVOC	20406032416	060104-SOI-02688-00.5	N	SW8270C	SW3510C	1-Naphthylamine	353	U	353	UG/KG	UJ	353	CCVL
SO	SVOC	20406032416	060104-SOI-02688-00.5	N	SW8270C	SW3510C	5-Nitro-o-toluidine	353	U	353	UG/KG	UJ	353	CCVL
SO	SVOC	20406032416	060104-SOI-02688-00.5	N	SW8081A	SW3510C	Isodrin	26.7	U	26.7	UG/KG	UJ	26.7	CCVL
SO	SVOC	20406032416	060104-SOI-02688-00.5	N	SW8270C	SW3510C	Phenacetin	353	U	353	UG/KG	UJ	353	CCVL
SO	SVOC	20406042510	060204-SOI-02697-02.5	N	SW8270C	SW3510C	1,4-Benzenediamine	383	U	383	UG/KG	UJ	383	CCVL
SO	SVOC	20406042510	060204-SOI-02697-02.5	N	SW8270C	SW3510C	a,a-Dimethylphenethylamine	383	U	383	UG/KG	UJ	383	CCVL
SO	SVOC	20406042510	060204-SOI-02697-02.5	N	SW8270C	SW3510C	Isosafrole	383	U	383	UG/KG	UJ	383	CCVL
SO	SVOC	20406042511	060204-SOI-02696-02.0	N	SW8270C	SW3510C	1,4-Benzenediamine	445	U	445	UG/KG	UJ	445	CCVL
SO	SVOC	20406042511	060204-SOI-02696-02.0	N	SW8270C	SW3510C	a,a-Dimethylphenethylamine	445	U	445	UG/KG	UJ	445	CCVL
SO	SVOC	20406042511	060204-SOI-02696-02.0	N	SW8270C	SW3510C	Isosafrole	445	U	445	UG/KG	UJ	445	CCVL
SED	SVOC	20406302301	062804-SED-02691-00.2	N	SW8081A	SW3510C	Isodrin	29.3	U	29.3	UG/KG	UJ	29.3	CCVL
SED	SVOC	20406302302	062804-SED-02692-00.2	N	SW8081A	SW3510C	Isodrin	30.6	U	30.6	UG/KG	UJ	30.6	CCVL
SED	SVOC	20406302303	062804-SED-02693-00.2	N	SW8081A	SW3510C	Isodrin	29.6	U	29.6	UG/KG	UJ	29.6	CCVL
SED	SVOC	20406302304	062804-SED-02694-00.2	N	SW8081A	SW3510C	Isodrin	27.7	U	27.7	UG/KG	UJ	27.7	CCVL
SED	SVOC	20406302305	062904-SED-02699-00.2	N	SW8081A	SW3510C	Isodrin	28.5	U	28.5	UG/KG	UJ	28.5	CCVL
SED	SVOC	20406302306	062904-SED-02700-00.2	N	SW8081A	SW3510C	Isodrin	28.4	U	28.4	UG/KG	UJ	28.4	CCVL
SED	SVOC	20406302307	062904-SED-02701-00.2	N	SW8081A	SW3510C	Isodrin	30.5	U	30.5	UG/KG	UJ	30.5	CCVL
SO	SVOC	20406032401	060104-SOI-02687-02.0	N	SW8270C	SW3510C	1,4-Benzenediamine	770	U	770	UG/KG	UJ	770	CCVL, CCRRF
SO	SVOC	20406032403	060104-SOI-02689-00.5	N	SW8270C	SW3510C	Isosafrole	397	U	397	UG/KG	UJ	397	CCVL, CCRRF
SO	SVOC	20406032404	060104-SOI-02688-04.0	N	SW8270C	SW3510C	Isosafrole	371	U	371	UG/KG	UJ	371	CCVL, CCRRF
SO	SVOC	20406032405	060104-SOI-02689-04.5	N	SW8270C	SW3510C	Isosafrole	395	U	395	UG/KG	UJ	395	CCVL, CCRRF
SO	SVOC	20406032406	060104-SOI-02688-07.0	N	SW8270C	SW3510C	Isosafrole	371	U	371	UG/KG	UJ	371	CCVL, CCRRF
SO	SVOC	20406032407	060104-SOI-02687-04.5	N	SW8270C	SW3510C	1,4-Benzenediamine	825	U	825	UG/KG	UJ	825	CCVL, CCRRF
SO	SVOC	20406032408	060104-SOI-02688-06.0	N	SW8270C	SW3510C	Isophorone	367	U	367	UG/KG	UJ	367	CCVL, CCRRF
SO	SVOC	20406032409	060104-SOI-02690-00.5	N	SW8270C	SW3510C	1,4-Benzenediamine	387	U	387	UG/KG	UJ	387	CCVL, CCRRF
SO	SVOC	20406032412	060104-SOI-02687-00.5-D	FD	SW8270C	SW3510C	Isosafrole	388	U	388	UG/KG	UJ	388	CCVL, CCRRF
SO	SVOC	20406032413	060104-SOI-02690-02.0	N	SW8270C	SW3510C	Isosafrole	380	U	380	UG/KG	UJ	380	CCVL, CCRRF
SO	SVOC	20406032414	060104-SOI-02687-00.5	N	SW8270C	SW3510C	Isosafrole	390	U	390	UG/KG	UJ	390	CCVL, CCRRF
SO	SVOC	20406032415	060104-SOI-02689-02.0	N	SW8270C	SW3510C	Isosafrole	376	U	376	UG/KG	UJ	376	CCVL, CCRRF
SO	SVOC	20406032416	060104-SOI-02688-00.5	N	SW8270C	SW3510C	Isosafrole	353	U	353	UG/KG	UJ	353	CCVL, CCRRF
SO	SVOC	20406050901	060304-SOI-02703-00.5	N	SW8270C	SW3510C	Isosafrole	388	U	388	UG/KG	UJ	388	CCVL, CCRRF
SO	SVOC	20406050902	060304-SOI-02705-00.5	N	SW8270C	SW3510C	Isosafrole	390	U	390	UG/KG	UJ	390	CCVL, CCRRF
SO	SVOC	20406050903	060304-SOI-02706-00.5	N	SW8270C	SW3510C	Isosafrole	358	U	358	UG/KG	UJ	358	CCVL, CCRRF
SO	SVOC	20406050904	060304-SOI-02704-00.5	N	SW8270C	SW3510C	Isosafrole	391	U	391	UG/KG	UJ	391	CCVL, CCRRF
SO	SVOC	20406050905	060304-SOI-02704-00.5-D	FD	SW8270C	SW3510C	Isosafrole	435	U	435	UG/KG	UJ	435	CCVL, CCRRF
SO	SVOC	20406050906	060304-SOI-02719-00.5	N	SW8270C	SW3510C	Isosafrole	419	U	419	UG/KG	UJ	419	CCVL, CCRRF
SO	SVOC	20406050907	060304-SOI-02720-00.5	N	SW8270C	SW3510C	Isosafrole	389	U	389	UG/KG	UJ	389	CCVL, CCRRF
SO	SVOC	20406050910	060304-SOI-02721-00.5	N	SW8270C	SW3510C	Isosafrole	436	U	436	UG/KG	UJ	436	CCVL, CCRRF
SO	SVOC	20406050911	060304-SOI-02722-00.5	N	SW8270C	SW3510C	Isosafrole	387	U	387	UG/KG	UJ	387	CCVL, CCRRF
SO	SVOC	20406050912	060404-SOI-02711-00.5	N	SW8270C	SW3510C	Isosafrole	466	U	466	UG/KG	UJ	466	CCVL, CCRRF
SO	SVOC	20406050913	060404-SOI-02712-00.5	N	SW8270C	SW3510C	Isosafrole	413	U	413	UG/KG	UJ	413	CCVL, CCRRF
SO	SVOC	20406050914	060404-SOI-02713-00.5	N	SW8270C	SW3510C	Isosafrole	489	U	489	UG/KG	UJ	489	CCVL, CCRRF
SO	SVOC	20406050915	060404-SOI-02714-00.5	N	SW8270C	SW3510C	Isosafrole	445	U	445	UG/KG	UJ	445	CCVL, CCRRF
SO	SVOC	20406050916	060404-SOI-02727-00.5	N	SW8270C	SW3510C	Isosafrole	446	U	446	UG/KG	UJ	446	CCVL, CCRRF
SO	SVOC	20406050917	060404-SOI-02728-00.5	N	SW8270C	SW3510C	Isosafrole	421	U	421	UG/KG	UJ	421	CCVL, CCRRF
SO	SVOC	20406050918	060404-SOI-02729-00.5	N	SW8270C	SW3510C	Isosafrole	467	U	467	UG/KG	UJ	467	CCVL, CCRRF
SO	SVOC	20406050919	060404-SOI-02730-00.5	N	SW8270C	SW3510C	Isosafrole	428	U	428	UG/KG	UJ	428	CCVL, CCRRF
SO	SVOC	20406050920	060404-SOI-02730-00.5-D	FD	SW8270C	SW3510C	Isosafrole	426	U	426	UG/KG	UJ	426	CCVL, CCRRF
SO	SVOC	20406032402	060104-SOI-02688-02.0	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	361	U	361	UG/KG	UJ	361	CCVL, ICRSD, CCRRF
SO	SVOC	20406032402	060104-SOI-02688-02.0	N	SW8270C	SW3510C	Hexachlorophene	722	U	722	UG/KG	UJ	722	CCVL, ICRSD, CCRRF
SO	SVOC	20406032403	060104-SOI-02689-00.5	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	397	U	397	UG/KG	UJ	397	CCVL, ICRSD, CCRRF
SO	SVOC	20406032403	060104-SOI-02689-00.5	N	SW8270C	SW3510C	Hexachlorophene	795	U	795	UG/KG	UJ	795	CCVL, ICRSD, CCRRF
SO	SVOC	20406032404	060104-SOI-02688-04.0	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	371	U	371	UG/KG	UJ	371	CCVL, ICRSD, CCRRF
SO	SVOC	20406032404	060104-SOI-02688-04.0	N	SW8270C	SW3510C	Hexachlorophene	743	U	743	UG/KG	UJ	743	CCVL, ICRSD, CCRRF
SO	SVOC	20406032405	060104-SOI-02689-04.5	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	395	U	395	UG/KG	UJ	395	CCVL, ICRSD, CCRRF
SO	SVOC	20406032405	060104-SOI-02689-04.5	N	SW8270C	SW3510C	Hexachlorophene	791	U	791	UG/KG	UJ	791	CCVL, ICRSD, CCRRF
SO	SVOC	20406032406	060104-SOI-02688-07.0	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	371	U	371	UG/KG	UJ	371	CCVL, ICRSD, CCRRF

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SO	SVOC	20406032406	060104-SOI-02688-07.0	N	SW8270C	SW3510C	Hexachlorophene	742	U	742	UG/KG	UJ	742	CCVL, ICRSD, CCRRF
SO	SVOC	20406032407	060104-SOI-02687-04.5	N	SW8270C	SW3510C	Hexachlorophene	1650	U	1650	UG/KG	UJ	1650	CCVL, ICRSD, CCRRF
SO	SVOC	20406032408	060104-SOI-02688-06.0	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	367	U	367	UG/KG	UJ	367	CCVL, ICRSD, CCRRF
SO	SVOC	20406032408	060104-SOI-02688-06.0	N	SW8270C	SW3510C	Hexachlorophene	735	U	735	UG/KG	UJ	735	CCVL, ICRSD, CCRRF
SO	SVOC	20406032409	060104-SOI-02690-00.5	N	SW8270C	SW3510C	Hexachlorophene	774	U	774	UG/KG	UJ	774	CCVL, ICRSD, CCRRF
SO	SVOC	20406032412	060104-SOI-02687-00.5-D	FD	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	388	U	388	UG/KG	UJ	388	CCVL, ICRSD, CCRRF
SO	SVOC	20406032412	060104-SOI-02687-00.5-D	FD	SW8270C	SW3510C	Hexachlorophene	775	U	775	UG/KG	UJ	775	CCVL, ICRSD, CCRRF
SO	SVOC	20406032413	060104-SOI-02690-02.0	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	380	U	380	UG/KG	UJ	380	CCVL, ICRSD, CCRRF
SO	SVOC	20406032413	060104-SOI-02690-02.0	N	SW8270C	SW3510C	Hexachlorophene	761	U	761	UG/KG	UJ	761	CCVL, ICRSD, CCRRF
SO	SVOC	20406032414	060104-SOI-02687-00.5	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	390	U	390	UG/KG	UJ	390	CCVL, ICRSD, CCRRF
SO	SVOC	20406032414	060104-SOI-02687-00.5	N	SW8270C	SW3510C	Hexachlorophene	781	U	781	UG/KG	UJ	781	CCVL, ICRSD, CCRRF
SO	SVOC	20406032415	060104-SOI-02689-02.0	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	376	U	376	UG/KG	UJ	376	CCVL, ICRSD, CCRRF
SO	SVOC	20406032415	060104-SOI-02689-02.0	N	SW8270C	SW3510C	Hexachlorophene	753	U	753	UG/KG	UJ	753	CCVL, ICRSD, CCRRF
SO	SVOC	20406032416	060104-SOI-02688-00.5	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	353	U	353	UG/KG	UJ	353	CCVL, ICRSD, CCRRF
SO	SVOC	20406032416	060104-SOI-02688-00.5	N	SW8270C	SW3510C	Hexachlorophene	706	U	706	UG/KG	UJ	706	CCVL, ICRSD, CCRRF
SO	SVOC	20406032405	060104-SOI-02689-04.5	N	SW8081A	SW3510C	Isodrin	30	U	30	UG/KG	UJ	30	CCVL, SSL
SO	SVOC	20406032409	060104-SOI-02690-00.5	N	SW8081A	SW3510C	Isodrin	58.7	U	58.7	UG/KG	UJ	58.7	CCVL, SSL
SO	SVOC	20406032413	060104-SOI-02690-02.0	N	SW8081A	SW3510C	Isodrin	28.8	U	28.8	UG/KG	UJ	28.8	CCVL, SSL
SO	SVOC	20406032402	060104-SOI-02688-02.0	N	SW8270C	SW3510C	Isosafrole	361	U	361	UG/KG	UJ	361	CCVL,CCRRF
SO	SVOC	20406050901	060304-SOI-02703-00.5	N	SW8270C	SW3510C	Aramite	388	U	388	UG/KG	UJ	388	ICRRF
SO	SVOC	20406050902	060304-SOI-02705-00.5	N	SW8270C	SW3510C	Aramite	390	U	390	UG/KG	UJ	390	ICRRF
SO	SVOC	20406050903	060304-SOI-02706-00.5	N	SW8270C	SW3510C	Aramite	358	U	358	UG/KG	UJ	358	ICRRF
SO	SVOC	20406050904	060304-SOI-02704-00.5	N	SW8270C	SW3510C	Aramite	391	U	391	UG/KG	UJ	391	ICRRF
SO	SVOC	20406050905	060304-SOI-02704-00.5-D	FD	SW8270C	SW3510C	Aramite	435	U	435	UG/KG	UJ	435	ICRRF
SO	SVOC	20406050906	060304-SOI-02719-00.5	N	SW8270C	SW3510C	Aramite	419	U	419	UG/KG	UJ	419	ICRRF
SO	SVOC	20406050907	060304-SOI-02720-00.5	N	SW8270C	SW3510C	Aramite	389	U	389	UG/KG	UJ	389	ICRRF
SO	SVOC	20406050910	060304-SOI-02721-00.5	N	SW8270C	SW3510C	Aramite	436	U	436	UG/KG	UJ	436	ICRRF
SO	SVOC	20406050911	060304-SOI-02722-00.5	N	SW8270C	SW3510C	Aramite	387	U	387	UG/KG	UJ	387	ICRRF
SO	SVOC	20406050912	060404-SOI-02711-00.5	N	SW8270C	SW3510C	Aramite	466	U	466	UG/KG	UJ	466	ICRRF
SO	SVOC	20406050913	060404-SOI-02712-00.5	N	SW8270C	SW3510C	Aramite	413	U	413	UG/KG	UJ	413	ICRRF
SO	SVOC	20406050914	060404-SOI-02713-00.5	N	SW8270C	SW3510C	Aramite	489	U	489	UG/KG	UJ	489	ICRRF
SO	SVOC	20406050915	060404-SOI-02714-00.5	N	SW8270C	SW3510C	Aramite	445	U	445	UG/KG	UJ	445	ICRRF
SO	SVOC	20406050916	060404-SOI-02727-00.5	N	SW8270C	SW3510C	Aramite	446	U	446	UG/KG	UJ	446	ICRRF
SO	SVOC	20406050917	060404-SOI-02728-00.5	N	SW8270C	SW3510C	Aramite	421	U	421	UG/KG	UJ	421	ICRRF
SO	SVOC	20406050918	060404-SOI-02729-00.5	N	SW8270C	SW3510C	Aramite	467	U	467	UG/KG	UJ	467	ICRRF
SO	SVOC	20406050919	060404-SOI-02730-00.5	N	SW8270C	SW3510C	Aramite	428	U	428	UG/KG	UJ	428	ICRRF
SO	SVOC	20406050920	060404-SOI-02730-00.5-D	FD	SW8270C	SW3510C	Aramite	426	U	426	UG/KG	UJ	426	ICRRF
SO	SVOC	20406032401	060104-SOI-02687-02.0	N	SW8270C	SW3510C	1,4-Naphthoquinone	1540	U	1540	UG/KG	UJ	1540	ICRSD
SO	SVOC	20406032401	060104-SOI-02687-02.0	N	SW8270C	SW3510C	2,4-Dinitrophenol	3850	U	3850	UG/KG	UJ	3850	ICRSD
SO	SVOC	20406032401	060104-SOI-02687-02.0	N	SW8270C	SW3510C	2-Methylnaphthalene	770	U	770	UG/KG	UJ	770	ICRSD
SO	SVOC	20406032401	060104-SOI-02687-02.0	N	SW8270C	SW3510C	4-Chloroaniline	770	U	770	UG/KG	UJ	770	ICRSD
SO	SVOC	20406032401	060104-SOI-02687-02.0	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	770	U	770	UG/KG	UJ	770	ICRSD
SO	SVOC	20406032401	060104-SOI-02687-02.0	N	SW8270C	SW3510C	Aniline	770	U	770	UG/KG	UJ	770	ICRSD
SO	SVOC	20406032402	060104-SOI-02688-02.0	N	SW8270C	SW3510C	1,4-Naphthoquinone	722	U	722	UG/KG	UJ	722	ICRSD
SO	SVOC	20406032402	060104-SOI-02688-02.0	N	SW8270C	SW3510C	2,4-Dinitrophenol	1800	U	1800	UG/KG	UJ	1800	ICRSD
SO	SVOC	20406032402	060104-SOI-02688-02.0	N	SW8270C	SW3510C	4-Nitrophenol	1800	U	1800	UG/KG	UJ	1800	ICRSD
SO	SVOC	20406032402	060104-SOI-02688-02.0	N	SW8270C	SW3510C	Aniline	361	U	361	UG/KG	UJ	361	ICRSD
SO	SVOC	20406032402	060104-SOI-02688-02.0	N	SW8270C	SW3510C	Benzo(b)fluoranthene	361	U	361	UG/KG	UJ	361	ICRSD
SO	SVOC	20406032402	060104-SOI-02688-02.0	N	SW8270C	SW3510C	Hexachlorocyclopentadiene	361	U	361	UG/KG	UJ	361	ICRSD
SO	SVOC	20406032402	060104-SOI-02688-02.0	N	SW8270C	SW3510C	o and/or p - Toluidine	361	U	361	UG/KG	UJ	361	ICRSD
SO	SVOC	20406032403	060104-SOI-02689-00.5	N	SW8270C	SW3510C	1,4-Naphthoquinone	795	U	795	UG/KG	UJ	795	ICRSD
SO	SVOC	20406032403	060104-SOI-02689-00.5	N	SW8270C	SW3510C	2,4-Dinitrophenol	1990	U	1990	UG/KG	UJ	1990	ICRSD
SO	SVOC	20406032403	060104-SOI-02689-00.5	N	SW8270C	SW3510C	4-Nitrophenol	1990	U	1990	UG/KG	UJ	1990	ICRSD
SO	SVOC	20406032403	060104-SOI-02689-00.5	N	SW8270C	SW3510C	Aniline	397	U	397	UG/KG	UJ	397	ICRSD
SO	SVOC	20406032403	060104-SOI-02689-00.5	N	SW8270C	SW3510C	Benzo(b)fluoranthene	397	U	397	UG/KG	UJ	397	ICRSD
SO	SVOC	20406032403	060104-SOI-02689-00.5	N	SW8270C	SW3510C	Hexachlorocyclopentadiene	397	U	397	UG/KG	UJ	397	ICRSD
SO	SVOC	20406032403	060104-SOI-02689-00.5	N	SW8270C	SW3510C	o and/or p - Toluidine	397	U	397	UG/KG	UJ	397	ICRSD
SO	SVOC	20406032404	060104-SOI-02688-04.0	N	SW8270C	SW3510C	1,4-Naphthoquinone	743	U	743	UG/KG	UJ	743	ICRSD
SO	SVOC	20406032404	060104-SOI-02688-04.0	N	SW8270C	SW3510C	2,4-Dinitrophenol	1860	U	1860	UG/KG	UJ	1860	ICRSD
SO	SVOC	20406032404	060104-SOI-02688-04.0	N	SW8270C	SW3510C	4-Nitrophenol	1860	U	1860	UG/KG	UJ	1860	ICRSD
SO	SVOC	20406032404	060104-SOI-02688-04.0	N	SW8270C	SW3510C	Aniline	371	U	371	UG/KG	UJ	371	ICRSD
SO	SVOC	20406032404	060104-SOI-02688-04.0	N	SW8270C	SW3510C	Benzo(b)fluoranthene	371	U	371	UG/KG	UJ	371	ICRSD
SO	SVOC	20406032404	060104-SOI-02688-04.0	N	SW8270C	SW3510C	Hexachlorocyclopentadiene	371	U	371	UG/KG	UJ	371	ICRSD
SO	SVOC	20406032404	060104-SOI-02688-04.0	N	SW8270C	SW3510C	o and/or p - Toluidine	371	U	371	UG/KG	UJ	371	ICRSD

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SO	SVOC	20406032405	060104-SOI-02689-04.5	N	SW8270C	SW3510C	1,4-Naphthoquinone	791	U	791	UG/KG	UJ	791	ICRSD
SO	SVOC	20406032405	060104-SOI-02689-04.5	N	SW8270C	SW3510C	2,4-Dinitrophenol	1980	U	1980	UG/KG	UJ	1980	ICRSD
SO	SVOC	20406032405	060104-SOI-02689-04.5	N	SW8270C	SW3510C	4-Nitrophenol	1980	U	1980	UG/KG	UJ	1980	ICRSD
SO	SVOC	20406032405	060104-SOI-02689-04.5	N	SW8270C	SW3510C	Aniline	395	U	395	UG/KG	UJ	395	ICRSD
SO	SVOC	20406032405	060104-SOI-02689-04.5	N	SW8270C	SW3510C	Benzo(b)fluoranthene	395	U	395	UG/KG	UJ	395	ICRSD
SO	SVOC	20406032405	060104-SOI-02689-04.5	N	SW8270C	SW3510C	Hexachlorocyclopentadiene	395	U	395	UG/KG	UJ	395	ICRSD
SO	SVOC	20406032405	060104-SOI-02689-04.5	N	SW8270C	SW3510C	o and/or p - Toluidine	395	U	395	UG/KG	UJ	395	ICRSD
SO	SVOC	20406032406	060104-SOI-02688-07.0	N	SW8270C	SW3510C	1,4-Naphthoquinone	742	U	742	UG/KG	UJ	742	ICRSD
SO	SVOC	20406032406	060104-SOI-02688-07.0	N	SW8270C	SW3510C	2,4-Dinitrophenol	1860	U	1860	UG/KG	UJ	1860	ICRSD
SO	SVOC	20406032406	060104-SOI-02688-07.0	N	SW8270C	SW3510C	4-Nitrophenol	1860	U	1860	UG/KG	UJ	1860	ICRSD
SO	SVOC	20406032406	060104-SOI-02688-07.0	N	SW8270C	SW3510C	Aniline	371	U	371	UG/KG	UJ	371	ICRSD
SO	SVOC	20406032406	060104-SOI-02688-07.0	N	SW8270C	SW3510C	Benzo(b)fluoranthene	371	U	371	UG/KG	UJ	371	ICRSD
SO	SVOC	20406032406	060104-SOI-02688-07.0	N	SW8270C	SW3510C	Hexachlorocyclopentadiene	371	U	371	UG/KG	UJ	371	ICRSD
SO	SVOC	20406032406	060104-SOI-02688-07.0	N	SW8270C	SW3510C	o and/or p - Toluidine	371	U	371	UG/KG	UJ	371	ICRSD
SO	SVOC	20406032407	060104-SOI-02687-04.5	N	SW8270C	SW3510C	1,4-Naphthoquinone	1650	U	1650	UG/KG	UJ	1650	ICRSD
SO	SVOC	20406032407	060104-SOI-02687-04.5	N	SW8270C	SW3510C	2,4-Dinitrophenol	4120	U	4120	UG/KG	UJ	4120	ICRSD
SO	SVOC	20406032407	060104-SOI-02687-04.5	N	SW8270C	SW3510C	2-Methylnaphthalene	825	U	825	UG/KG	UJ	825	ICRSD
SO	SVOC	20406032407	060104-SOI-02687-04.5	N	SW8270C	SW3510C	4-Chloroaniline	825	U	825	UG/KG	UJ	825	ICRSD
SO	SVOC	20406032407	060104-SOI-02687-04.5	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	825	U	825	UG/KG	UJ	825	ICRSD
SO	SVOC	20406032407	060104-SOI-02687-04.5	N	SW8270C	SW3510C	Aniline	825	U	825	UG/KG	UJ	825	ICRSD
SO	SVOC	20406032408	060104-SOI-02688-06.0	N	SW8270C	SW3510C	1,4-Naphthoquinone	735	U	735	UG/KG	UJ	735	ICRSD
SO	SVOC	20406032408	060104-SOI-02688-06.0	N	SW8270C	SW3510C	2,4-Dinitrophenol	1840	U	1840	UG/KG	UJ	1840	ICRSD
SO	SVOC	20406032408	060104-SOI-02688-06.0	N	SW8270C	SW3510C	4-Nitrophenol	1840	U	1840	UG/KG	UJ	1840	ICRSD
SO	SVOC	20406032408	060104-SOI-02688-06.0	N	SW8270C	SW3510C	Aniline	367	U	367	UG/KG	UJ	367	ICRSD
SO	SVOC	20406032408	060104-SOI-02688-06.0	N	SW8270C	SW3510C	Benzo(b)fluoranthene	367	U	367	UG/KG	UJ	367	ICRSD
SO	SVOC	20406032408	060104-SOI-02688-06.0	N	SW8270C	SW3510C	Hexachlorocyclopentadiene	367	U	367	UG/KG	UJ	367	ICRSD
SO	SVOC	20406032408	060104-SOI-02688-06.0	N	SW8270C	SW3510C	o and/or p - Toluidine	367	U	367	UG/KG	UJ	367	ICRSD
SO	SVOC	20406032409	060104-SOI-02690-00.5	N	SW8270C	SW3510C	1,4-Naphthoquinone	774	U	774	UG/KG	UJ	774	ICRSD
SO	SVOC	20406032409	060104-SOI-02690-00.5	N	SW8270C	SW3510C	2,4-Dinitrophenol	1940	U	1940	UG/KG	UJ	1940	ICRSD
SO	SVOC	20406032409	060104-SOI-02690-00.5	N	SW8270C	SW3510C	2-Methylnaphthalene	387	U	387	UG/KG	UJ	387	ICRSD
SO	SVOC	20406032409	060104-SOI-02690-00.5	N	SW8270C	SW3510C	4-Chloroaniline	387	U	387	UG/KG	UJ	387	ICRSD
SO	SVOC	20406032409	060104-SOI-02690-00.5	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	387	U	387	UG/KG	UJ	387	ICRSD
SO	SVOC	20406032409	060104-SOI-02690-00.5	N	SW8270C	SW3510C	Aniline	387	U	387	UG/KG	UJ	387	ICRSD
SO	SVOC	20406032412	060104-SOI-02687-00.5-D	FD	SW8270C	SW3510C	1,4-Naphthoquinone	775	U	775	UG/KG	UJ	775	ICRSD
SO	SVOC	20406032412	060104-SOI-02687-00.5-D	FD	SW8270C	SW3510C	2,4-Dinitrophenol	1940	U	1940	UG/KG	UJ	1940	ICRSD
SO	SVOC	20406032412	060104-SOI-02687-00.5-D	FD	SW8270C	SW3510C	4-Nitrophenol	1940	U	1940	UG/KG	UJ	1940	ICRSD
SO	SVOC	20406032412	060104-SOI-02687-00.5-D	FD	SW8270C	SW3510C	Aniline	388	U	388	UG/KG	UJ	388	ICRSD
SO	SVOC	20406032412	060104-SOI-02687-00.5-D	FD	SW8270C	SW3510C	Benzo(b)fluoranthene	388	U	388	UG/KG	UJ	388	ICRSD
SO	SVOC	20406032412	060104-SOI-02687-00.5-D	FD	SW8270C	SW3510C	Hexachlorocyclopentadiene	388	U	388	UG/KG	UJ	388	ICRSD
SO	SVOC	20406032412	060104-SOI-02687-00.5-D	FD	SW8270C	SW3510C	o and/or p - Toluidine	388	U	388	UG/KG	UJ	388	ICRSD
SO	SVOC	20406032413	060104-SOI-02690-02.0	N	SW8270C	SW3510C	1,4-Naphthoquinone	761	U	761	UG/KG	UJ	761	ICRSD
SO	SVOC	20406032413	060104-SOI-02690-02.0	N	SW8270C	SW3510C	2,4-Dinitrophenol	1900	U	1900	UG/KG	UJ	1900	ICRSD
SO	SVOC	20406032413	060104-SOI-02690-02.0	N	SW8270C	SW3510C	4-Nitrophenol	1900	U	1900	UG/KG	UJ	1900	ICRSD
SO	SVOC	20406032413	060104-SOI-02690-02.0	N	SW8270C	SW3510C	Aniline	380	U	380	UG/KG	UJ	380	ICRSD
SO	SVOC	20406032413	060104-SOI-02690-02.0	N	SW8270C	SW3510C	Benzo(b)fluoranthene	380	U	380	UG/KG	UJ	380	ICRSD
SO	SVOC	20406032413	060104-SOI-02690-02.0	N	SW8270C	SW3510C	Hexachlorocyclopentadiene	380	U	380	UG/KG	UJ	380	ICRSD
SO	SVOC	20406032413	060104-SOI-02690-02.0	N	SW8270C	SW3510C	o and/or p - Toluidine	380	U	380	UG/KG	UJ	380	ICRSD
SO	SVOC	20406032414	060104-SOI-02687-00.5	N	SW8270C	SW3510C	1,4-Naphthoquinone	781	U	781	UG/KG	UJ	781	ICRSD
SO	SVOC	20406032414	060104-SOI-02687-00.5	N	SW8270C	SW3510C	2,4-Dinitrophenol	1950	U	1950	UG/KG	UJ	1950	ICRSD
SO	SVOC	20406032414	060104-SOI-02687-00.5	N	SW8270C	SW3510C	4-Nitrophenol	1950	U	1950	UG/KG	UJ	1950	ICRSD
SO	SVOC	20406032414	060104-SOI-02687-00.5	N	SW8270C	SW3510C	Aniline	390	U	390	UG/KG	UJ	390	ICRSD
SO	SVOC	20406032414	060104-SOI-02687-00.5	N	SW8270C	SW3510C	Benzo(b)fluoranthene	390	U	390	UG/KG	UJ	390	ICRSD
SO	SVOC	20406032414	060104-SOI-02687-00.5	N	SW8081A	SW3510C	Diallate (Avadex)	29.6	U	29.6	UG/KG	UJ	29.6	ICRSD
SO	SVOC	20406032414	060104-SOI-02687-00.5	N	SW8270C	SW3510C	Hexachlorocyclopentadiene	390	U	390	UG/KG	UJ	390	ICRSD
SO	SVOC	20406032414	060104-SOI-02687-00.5	N	SW8270C	SW3510C	o and/or p - Toluidine	390	U	390	UG/KG	UJ	390	ICRSD
SO	SVOC	20406032415	060104-SOI-02689-02.0	N	SW8270C	SW3510C	1,4-Naphthoquinone	753	U	753	UG/KG	UJ	753	ICRSD
SO	SVOC	20406032415	060104-SOI-02689-02.0	N	SW8270C	SW3510C	2,4-Dinitrophenol	1880	U	1880	UG/KG	UJ	1880	ICRSD
SO	SVOC	20406032415	060104-SOI-02689-02.0	N	SW8270C	SW3510C	4-Nitrophenol	1880	U	1880	UG/KG	UJ	1880	ICRSD
SO	SVOC	20406032415	060104-SOI-02689-02.0	N	SW8270C	SW3510C	Aniline	376	U	376	UG/KG	UJ	376	ICRSD
SO	SVOC	20406032415	060104-SOI-02689-02.0	N	SW8270C	SW3510C	Benzo(b)fluoranthene	376	U	376	UG/KG	UJ	376	ICRSD
SO	SVOC	20406032415	060104-SOI-02689-02.0	N	SW8270C	SW3510C	Hexachlorocyclopentadiene	376	U	376	UG/KG	UJ	376	ICRSD
SO	SVOC	20406032415	060104-SOI-02689-02.0	N	SW8270C	SW3510C	o and/or p - Toluidine	376	U	376	UG/KG	UJ	376	ICRSD
SO	SVOC	20406032416	060104-SOI-02688-00.5	N	SW8270C	SW3510C	1,4-Naphthoquinone	706	U	706	UG/KG	UJ	706	ICRSD
SO	SVOC	20406032416	060104-SOI-02688-00.5	N	SW8270C	SW3510C	2,4-Dinitrophenol	1770	U	1770	UG/KG	UJ	1770	ICRSD

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SO	SVOC	20406032416	060104-SOI-02688-00.5	N	SW8270C	SW3510C	4-Nitrophenol	1770	U	1770	UG/KG	UJ	1770	ICRSD
SO	SVOC	20406032416	060104-SOI-02688-00.5	N	SW8270C	SW3510C	Aniline	353	U	353	UG/KG	UJ	353	ICRSD
SO	SVOC	20406032416	060104-SOI-02688-00.5	N	SW8270C	SW3510C	Benzo(b)fluoranthene	353	U	353	UG/KG	UJ	353	ICRSD
SO	SVOC	20406032416	060104-SOI-02688-00.5	N	SW8081A	SW3510C	Diallate (Avadex)	26.7	U	26.7	UG/KG	UJ	26.7	ICRSD
SO	SVOC	20406032416	060104-SOI-02688-00.5	N	SW8270C	SW3510C	Hexachlorocyclopentadiene	353	U	353	UG/KG	UJ	353	ICRSD
SO	SVOC	20406032416	060104-SOI-02688-00.5	N	SW8270C	SW3510C	o and/or p - Toluidine	353	U	353	UG/KG	UJ	353	ICRSD
SO	SVOC	20406042501	060204-SOI-02695-00.5	N	SW8270C	SW3510C	1,4-Naphthoquinone	849	U	849	UG/KG	UJ	849	ICRSD
SO	SVOC	20406042501	060204-SOI-02695-00.5	N	SW8270C	SW3510C	2-Methylnaphthalene	425	U	425	UG/KG	UJ	425	ICRSD
SO	SVOC	20406042501	060204-SOI-02695-00.5	N	SW8270C	SW3510C	4-Chloroaniline	425	U	425	UG/KG	UJ	425	ICRSD
SO	SVOC	20406042501	060204-SOI-02695-00.5	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	425	U	425	UG/KG	UJ	425	ICRSD
SO	SVOC	20406042501	060204-SOI-02695-00.5	N	SW8270C	SW3510C	Aniline	425	U	425	UG/KG	UJ	425	ICRSD
SO	SVOC	20406042501	060204-SOI-02695-00.5	N	SW8081A	SW3510C	Diallate (Avadex)	32.2	U	32.2	UG/KG	UJ	32.2	ICRSD
SO	SVOC	20406042501	060204-SOI-02695-00.5	N	SW8270C	SW3510C	Hexabromobenzene	425	U	425	UG/KG	UJ	425	ICRSD
SO	SVOC	20406042501	060204-SOI-02695-00.5	N	SW8270C	SW3510C	Hexachlorophene	849	U	849	UG/KG	UJ	849	ICRSD
SO	SVOC	20406042501	060204-SOI-02695-00.5	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	425	U	425	UG/KG	UJ	425	ICRSD
SO	SVOC	20406042501	060204-SOI-02695-00.5	N	SW8270C	SW3510C	o and/or p - Toluidine	425	U	425	UG/KG	UJ	425	ICRSD
SO	SVOC	20406042502	060204-SOI-02696-00.5	N	SW8270C	SW3510C	1,4-Naphthoquinone	925	U	925	UG/KG	UJ	925	ICRSD
SO	SVOC	20406042502	060204-SOI-02696-00.5	N	SW8270C	SW3510C	2-Methylnaphthalene	463	U	463	UG/KG	UJ	463	ICRSD
SO	SVOC	20406042502	060204-SOI-02696-00.5	N	SW8270C	SW3510C	4-Chloroaniline	463	U	463	UG/KG	UJ	463	ICRSD
SO	SVOC	20406042502	060204-SOI-02696-00.5	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	463	U	463	UG/KG	UJ	463	ICRSD
SO	SVOC	20406042502	060204-SOI-02696-00.5	N	SW8270C	SW3510C	Aniline	463	U	463	UG/KG	UJ	463	ICRSD
SO	SVOC	20406042502	060204-SOI-02696-00.5	N	SW8081A	SW3510C	Diallate (Avadex)	35.1	U	35.1	UG/KG	UJ	35.1	ICRSD
SO	SVOC	20406042502	060204-SOI-02696-00.5	N	SW8270C	SW3510C	Hexabromobenzene	463	U	463	UG/KG	UJ	463	ICRSD
SO	SVOC	20406042502	060204-SOI-02696-00.5	N	SW8270C	SW3510C	Hexachlorophene	925	U	925	UG/KG	UJ	925	ICRSD
SO	SVOC	20406042502	060204-SOI-02696-00.5	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	463	U	463	UG/KG	UJ	463	ICRSD
SO	SVOC	20406042502	060204-SOI-02696-00.5	N	SW8270C	SW3510C	o and/or p - Toluidine	463	U	463	UG/KG	UJ	463	ICRSD
SO	SVOC	20406042503	060204-SOI-02697-00.5	N	SW8270C	SW3510C	1,4-Naphthoquinone	892	U	892	UG/KG	UJ	892	ICRSD
SO	SVOC	20406042503	060204-SOI-02697-00.5	N	SW8270C	SW3510C	2-Methylnaphthalene	446	U	446	UG/KG	UJ	446	ICRSD
SO	SVOC	20406042503	060204-SOI-02697-00.5	N	SW8270C	SW3510C	4-Chloroaniline	446	U	446	UG/KG	UJ	446	ICRSD
SO	SVOC	20406042503	060204-SOI-02697-00.5	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	446	U	446	UG/KG	UJ	446	ICRSD
SO	SVOC	20406042503	060204-SOI-02697-00.5	N	SW8270C	SW3510C	Aniline	446	U	446	UG/KG	UJ	446	ICRSD
SO	SVOC	20406042503	060204-SOI-02697-00.5	N	SW8081A	SW3510C	Diallate (Avadex)	33.8	U	33.8	UG/KG	UJ	33.8	ICRSD
SO	SVOC	20406042503	060204-SOI-02697-00.5	N	SW8270C	SW3510C	Hexabromobenzene	446	U	446	UG/KG	UJ	446	ICRSD
SO	SVOC	20406042503	060204-SOI-02697-00.5	N	SW8270C	SW3510C	Hexachlorophene	892	U	892	UG/KG	UJ	892	ICRSD
SO	SVOC	20406042503	060204-SOI-02697-00.5	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	446	U	446	UG/KG	UJ	446	ICRSD
SO	SVOC	20406042503	060204-SOI-02697-00.5	N	SW8270C	SW3510C	o and/or p - Toluidine	446	U	446	UG/KG	UJ	446	ICRSD
SO	SVOC	20406042504	060204-SOI-02697-00.5-D	FD	SW8270C	SW3510C	1,4-Naphthoquinone	902	U	902	UG/KG	UJ	902	ICRSD
SO	SVOC	20406042504	060204-SOI-02697-00.5-D	FD	SW8270C	SW3510C	2-Methylnaphthalene	451	U	451	UG/KG	UJ	451	ICRSD
SO	SVOC	20406042504	060204-SOI-02697-00.5-D	FD	SW8270C	SW3510C	4-Chloroaniline	451	U	451	UG/KG	UJ	451	ICRSD
SO	SVOC	20406042504	060204-SOI-02697-00.5-D	FD	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	451	U	451	UG/KG	UJ	451	ICRSD
SO	SVOC	20406042504	060204-SOI-02697-00.5-D	FD	SW8270C	SW3510C	Aniline	451	U	451	UG/KG	UJ	451	ICRSD
SO	SVOC	20406042504	060204-SOI-02697-00.5-D	FD	SW8081A	SW3510C	Diallate (Avadex)	34.2	U	34.2	UG/KG	UJ	34.2	ICRSD
SO	SVOC	20406042504	060204-SOI-02697-00.5-D	FD	SW8270C	SW3510C	Hexabromobenzene	451	U	451	UG/KG	UJ	451	ICRSD
SO	SVOC	20406042504	060204-SOI-02697-00.5-D	FD	SW8270C	SW3510C	Hexachlorophene	902	U	902	UG/KG	UJ	902	ICRSD
SO	SVOC	20406042504	060204-SOI-02697-00.5-D	FD	SW8270C	SW3510C	n-Nitrosomethylethylamine	451	U	451	UG/KG	UJ	451	ICRSD
SO	SVOC	20406042504	060204-SOI-02697-00.5-D	FD	SW8270C	SW3510C	o and/or p - Toluidine	451	U	451	UG/KG	UJ	451	ICRSD
SO	SVOC	20406042505	060204-SOI-02698-00.5	N	SW8270C	SW3510C	1,4-Naphthoquinone	885	U	885	UG/KG	UJ	885	ICRSD
SO	SVOC	20406042505	060204-SOI-02698-00.5	N	SW8270C	SW3510C	2-Methylnaphthalene	442	U	442	UG/KG	UJ	442	ICRSD
SO	SVOC	20406042505	060204-SOI-02698-00.5	N	SW8270C	SW3510C	4-Chloroaniline	442	U	442	UG/KG	UJ	442	ICRSD
SO	SVOC	20406042505	060204-SOI-02698-00.5	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	442	U	442	UG/KG	UJ	442	ICRSD
SO	SVOC	20406042505	060204-SOI-02698-00.5	N	SW8270C	SW3510C	Aniline	442	U	442	UG/KG	UJ	442	ICRSD
SO	SVOC	20406042505	060204-SOI-02698-00.5	N	SW8081A	SW3510C	Diallate (Avadex)	33.5	U	33.5	UG/KG	UJ	33.5	ICRSD
SO	SVOC	20406042505	060204-SOI-02698-00.5	N	SW8270C	SW3510C	Hexabromobenzene	442	U	442	UG/KG	UJ	442	ICRSD
SO	SVOC	20406042505	060204-SOI-02698-00.5	N	SW8270C	SW3510C	Hexachlorophene	885	U	885	UG/KG	UJ	885	ICRSD
SO	SVOC	20406042505	060204-SOI-02698-00.5	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	442	U	442	UG/KG	UJ	442	ICRSD
SO	SVOC	20406042505	060204-SOI-02698-00.5	N	SW8270C	SW3510C	o and/or p - Toluidine	442	U	442	UG/KG	UJ	442	ICRSD
SO	SVOC	20406042507	060204-SOI-02695-01.5	N	SW8270C	SW3510C	1,4-Naphthoquinone	777	U	777	UG/KG	UJ	777	ICRSD
SO	SVOC	20406042507	060204-SOI-02695-01.5	N	SW8270C	SW3510C	2-Methylnaphthalene	388	U	388	UG/KG	UJ	388	ICRSD
SO	SVOC	20406042507	060204-SOI-02695-01.5	N	SW8270C	SW3510C	4-Chloroaniline	388	U	388	UG/KG	UJ	388	ICRSD
SO	SVOC	20406042507	060204-SOI-02695-01.5	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	388	U	388	UG/KG	UJ	388	ICRSD
SO	SVOC	20406042507	060204-SOI-02695-01.5	N	SW8270C	SW3510C	Aniline	388	U	388	UG/KG	UJ	388	ICRSD
SO	SVOC	20406042507	060204-SOI-02695-01.5	N	SW8081A	SW3510C	Diallate (Avadex)	29.4	U	29.4	UG/KG	UJ	29.4	ICRSD
SO	SVOC	20406042507	060204-SOI-02695-01.5	N	SW8270C	SW3510C	Hexabromobenzene	388	U	388	UG/KG	UJ	388	ICRSD
SO	SVOC	20406042507	060204-SOI-02695-01.5	N	SW8270C	SW3510C	Hexachlorophene	777	U	777	UG/KG	UJ	777	ICRSD

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SO	SVOC	20406042507	060204-SOI-02695-01.5	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	388	U	388	UG/KG	UJ	388	ICRSD
SO	SVOC	20406042507	060204-SOI-02695-01.5	N	SW8270C	SW3510C	o and/or p - Toluidine	388	U	388	UG/KG	UJ	388	ICRSD
SO	SVOC	20406042508	060204-SOI-02696-04.0	N	SW8270C	SW3510C	1,4-Naphthoquinone	825	U	825	UG/KG	UJ	825	ICRSD
SO	SVOC	20406042508	060204-SOI-02696-04.0	N	SW8270C	SW3510C	2-Methylnaphthalene	412	U	412	UG/KG	UJ	412	ICRSD
SO	SVOC	20406042508	060204-SOI-02696-04.0	N	SW8270C	SW3510C	4-Chloroaniline	412	U	412	UG/KG	UJ	412	ICRSD
SO	SVOC	20406042508	060204-SOI-02696-04.0	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	412	U	412	UG/KG	UJ	412	ICRSD
SO	SVOC	20406042508	060204-SOI-02696-04.0	N	SW8270C	SW3510C	Aniline	412	U	412	UG/KG	UJ	412	ICRSD
SO	SVOC	20406042508	060204-SOI-02696-04.0	N	SW8081A	SW3510C	Diallate (Avadex)	31.2	U	31.2	UG/KG	UJ	31.2	ICRSD
SO	SVOC	20406042508	060204-SOI-02696-04.0	N	SW8270C	SW3510C	Hexabromobenzene	412	U	412	UG/KG	UJ	412	ICRSD
SO	SVOC	20406042508	060204-SOI-02696-04.0	N	SW8270C	SW3510C	Hexachlorophene	825	U	825	UG/KG	UJ	825	ICRSD
SO	SVOC	20406042508	060204-SOI-02696-04.0	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	412	U	412	UG/KG	UJ	412	ICRSD
SO	SVOC	20406042508	060204-SOI-02696-04.0	N	SW8270C	SW3510C	o and/or p - Toluidine	412	U	412	UG/KG	UJ	412	ICRSD
SO	SVOC	20406042510	060204-SOI-02697-02.5	N	SW8270C	SW3510C	1,4-Naphthoquinone	767	U	767	UG/KG	UJ	767	ICRSD
SO	SVOC	20406042510	060204-SOI-02697-02.5	N	SW8270C	SW3510C	2-Methylnaphthalene	383	U	383	UG/KG	UJ	383	ICRSD
SO	SVOC	20406042510	060204-SOI-02697-02.5	N	SW8270C	SW3510C	4-Chloroaniline	383	U	383	UG/KG	UJ	383	ICRSD
SO	SVOC	20406042510	060204-SOI-02697-02.5	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	383	U	383	UG/KG	UJ	383	ICRSD
SO	SVOC	20406042510	060204-SOI-02697-02.5	N	SW8270C	SW3510C	Aniline	383	U	383	UG/KG	UJ	383	ICRSD
SO	SVOC	20406042510	060204-SOI-02697-02.5	N	SW8081A	SW3510C	Diallate (Avadex)	29.1	U	29.1	UG/KG	UJ	29.1	ICRSD
SO	SVOC	20406042510	060204-SOI-02697-02.5	N	SW8270C	SW3510C	Hexabromobenzene	383	U	383	UG/KG	UJ	383	ICRSD
SO	SVOC	20406042510	060204-SOI-02697-02.5	N	SW8270C	SW3510C	Hexachlorophene	767	U	767	UG/KG	UJ	767	ICRSD
SO	SVOC	20406042510	060204-SOI-02697-02.5	N	SW8270C	SW3510C	o and/or p - Toluidine	383	U	383	UG/KG	UJ	383	ICRSD
SO	SVOC	20406042511	060204-SOI-02696-02.0	N	SW8270C	SW3510C	1,4-Naphthoquinone	890	U	890	UG/KG	UJ	890	ICRSD
SO	SVOC	20406042511	060204-SOI-02696-02.0	N	SW8270C	SW3510C	2-Methylnaphthalene	445	U	445	UG/KG	UJ	445	ICRSD
SO	SVOC	20406042511	060204-SOI-02696-02.0	N	SW8270C	SW3510C	4-Chloroaniline	445	U	445	UG/KG	UJ	445	ICRSD
SO	SVOC	20406042511	060204-SOI-02696-02.0	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	445	U	445	UG/KG	UJ	445	ICRSD
SO	SVOC	20406042511	060204-SOI-02696-02.0	N	SW8270C	SW3510C	Aniline	445	U	445	UG/KG	UJ	445	ICRSD
SO	SVOC	20406042511	060204-SOI-02696-02.0	N	SW8081A	SW3510C	Diallate (Avadex)	33.7	U	33.7	UG/KG	UJ	33.7	ICRSD
SO	SVOC	20406042511	060204-SOI-02696-02.0	N	SW8270C	SW3510C	Hexabromobenzene	445	U	445	UG/KG	UJ	445	ICRSD
SO	SVOC	20406042511	060204-SOI-02696-02.0	N	SW8270C	SW3510C	Hexachlorophene	890	U	890	UG/KG	UJ	890	ICRSD
SO	SVOC	20406042511	060204-SOI-02696-02.0	N	SW8270C	SW3510C	o and/or p - Toluidine	445	U	445	UG/KG	UJ	445	ICRSD
SO	SVOC	20406050901	060304-SOI-02703-00.5	N	SW8270C	SW3510C	1,4-Naphthoquinone	776	U	776	UG/KG	UJ	776	ICRSD
SO	SVOC	20406050901	060304-SOI-02703-00.5	N	SW8270C	SW3510C	2,4-Dinitrophenol	1940	U	1940	UG/KG	UJ	1940	ICRSD
SO	SVOC	20406050901	060304-SOI-02703-00.5	N	SW8270C	SW3510C	2-Methylnaphthalene	388	U	388	UG/KG	UJ	388	ICRSD
SO	SVOC	20406050901	060304-SOI-02703-00.5	N	SW8270C	SW3510C	4-Chloroaniline	388	U	388	UG/KG	UJ	388	ICRSD
SO	SVOC	20406050901	060304-SOI-02703-00.5	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	388	U	388	UG/KG	UJ	388	ICRSD
SO	SVOC	20406050901	060304-SOI-02703-00.5	N	SW8270C	SW3510C	Aniline	388	U	388	UG/KG	UJ	388	ICRSD
SO	SVOC	20406050901	060304-SOI-02703-00.5	N	SW8270C	SW3510C	Hexachlorophene	776	U	776	UG/KG	UJ	776	ICRSD
SO	SVOC	20406050901	060304-SOI-02703-00.5	N	SW8270C	SW3510C	o and/or p - Toluidine	388	U	388	UG/KG	UJ	388	ICRSD
SO	SVOC	20406050902	060304-SOI-02705-00.5	N	SW8270C	SW3510C	1,4-Naphthoquinone	781	U	781	UG/KG	UJ	781	ICRSD
SO	SVOC	20406050902	060304-SOI-02705-00.5	N	SW8270C	SW3510C	2,4-Dinitrophenol	1950	U	1950	UG/KG	UJ	1950	ICRSD
SO	SVOC	20406050902	060304-SOI-02705-00.5	N	SW8270C	SW3510C	2-Methylnaphthalene	390	U	390	UG/KG	UJ	390	ICRSD
SO	SVOC	20406050902	060304-SOI-02705-00.5	N	SW8270C	SW3510C	4-Chloroaniline	390	U	390	UG/KG	UJ	390	ICRSD
SO	SVOC	20406050902	060304-SOI-02705-00.5	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	390	U	390	UG/KG	UJ	390	ICRSD
SO	SVOC	20406050902	060304-SOI-02705-00.5	N	SW8270C	SW3510C	Aniline	390	U	390	UG/KG	UJ	390	ICRSD
SO	SVOC	20406050902	060304-SOI-02705-00.5	N	SW8270C	SW3510C	Hexachlorophene	781	U	781	UG/KG	UJ	781	ICRSD
SO	SVOC	20406050902	060304-SOI-02705-00.5	N	SW8270C	SW3510C	o and/or p - Toluidine	390	U	390	UG/KG	UJ	390	ICRSD
SO	SVOC	20406050903	060304-SOI-02706-00.5	N	SW8270C	SW3510C	1,4-Naphthoquinone	716	U	716	UG/KG	UJ	716	ICRSD
SO	SVOC	20406050903	060304-SOI-02706-00.5	N	SW8270C	SW3510C	2,4-Dinitrophenol	1790	U	1790	UG/KG	UJ	1790	ICRSD
SO	SVOC	20406050903	060304-SOI-02706-00.5	N	SW8270C	SW3510C	2-Methylnaphthalene	358	U	358	UG/KG	UJ	358	ICRSD
SO	SVOC	20406050903	060304-SOI-02706-00.5	N	SW8270C	SW3510C	4-Chloroaniline	358	U	358	UG/KG	UJ	358	ICRSD
SO	SVOC	20406050903	060304-SOI-02706-00.5	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	358	U	358	UG/KG	UJ	358	ICRSD
SO	SVOC	20406050903	060304-SOI-02706-00.5	N	SW8270C	SW3510C	Aniline	358	U	358	UG/KG	UJ	358	ICRSD
SO	SVOC	20406050903	060304-SOI-02706-00.5	N	SW8270C	SW3510C	Hexachlorophene	716	U	716	UG/KG	UJ	716	ICRSD
SO	SVOC	20406050903	060304-SOI-02706-00.5	N	SW8270C	SW3510C	o and/or p - Toluidine	358	U	358	UG/KG	UJ	358	ICRSD
SO	SVOC	20406050904	060304-SOI-02704-00.5	N	SW8270C	SW3510C	1,4-Naphthoquinone	782	U	782	UG/KG	UJ	782	ICRSD
SO	SVOC	20406050904	060304-SOI-02704-00.5	N	SW8270C	SW3510C	2,4-Dinitrophenol	1950	U	1950	UG/KG	UJ	1950	ICRSD
SO	SVOC	20406050904	060304-SOI-02704-00.5	N	SW8270C	SW3510C	2-Methylnaphthalene	391	U	391	UG/KG	UJ	391	ICRSD
SO	SVOC	20406050904	060304-SOI-02704-00.5	N	SW8270C	SW3510C	4-Chloroaniline	391	U	391	UG/KG	UJ	391	ICRSD
SO	SVOC	20406050904	060304-SOI-02704-00.5	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	391	U	391	UG/KG	UJ	391	ICRSD
SO	SVOC	20406050904	060304-SOI-02704-00.5	N	SW8270C	SW3510C	Aniline	391	U	391	UG/KG	UJ	391	ICRSD
SO	SVOC	20406050904	060304-SOI-02704-00.5	N	SW8270C	SW3510C	Hexachlorophene	782	U	782	UG/KG	UJ	782	ICRSD
SO	SVOC	20406050904	060304-SOI-02704-00.5	N	SW8270C	SW3510C	o and/or p - Toluidine	391	U	391	UG/KG	UJ	391	ICRSD
SO	SVOC	20406050905	060304-SOI-02704-00.5-D	FD	SW8270C	SW3510C	1,4-Naphthoquinone	870	U	870	UG/KG	UJ	870	ICRSD
SO	SVOC	20406050905	060304-SOI-02704-00.5-D	FD	SW8270C	SW3510C	2,4-Dinitrophenol	2170	U	2170	UG/KG	UJ	2170	ICRSD

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SO	SVOC	20406050905	060304-SOI-02704-00.5-D	FD	SW8270C	SW3510C	2-Methylnaphthalene	435	U	435	UG/KG	UJ	435	ICRSD
SO	SVOC	20406050905	060304-SOI-02704-00.5-D	FD	SW8270C	SW3510C	4-Chloroaniline	435	U	435	UG/KG	UJ	435	ICRSD
SO	SVOC	20406050905	060304-SOI-02704-00.5-D	FD	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	435	U	435	UG/KG	UJ	435	ICRSD
SO	SVOC	20406050905	060304-SOI-02704-00.5-D	FD	SW8270C	SW3510C	Aniline	435	U	435	UG/KG	UJ	435	ICRSD
SO	SVOC	20406050905	060304-SOI-02704-00.5-D	FD	SW8270C	SW3510C	Hexachlorophene	870	U	870	UG/KG	UJ	870	ICRSD
SO	SVOC	20406050905	060304-SOI-02704-00.5-D	FD	SW8270C	SW3510C	o and/or p - Toluidine	435	U	435	UG/KG	UJ	435	ICRSD
SO	SVOC	20406050906	060304-SOI-02719-00.5	N	SW8270C	SW3510C	1,4-Naphthoquinone	838	U	838	UG/KG	UJ	838	ICRSD
SO	SVOC	20406050906	060304-SOI-02719-00.5	N	SW8270C	SW3510C	2,4-Dinitrophenol	2090	U	2090	UG/KG	UJ	2090	ICRSD
SO	SVOC	20406050906	060304-SOI-02719-00.5	N	SW8270C	SW3510C	2-Methylnaphthalene	419	U	419	UG/KG	UJ	419	ICRSD
SO	SVOC	20406050906	060304-SOI-02719-00.5	N	SW8270C	SW3510C	4-Chloroaniline	419	U	419	UG/KG	UJ	419	ICRSD
SO	SVOC	20406050906	060304-SOI-02719-00.5	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	419	U	419	UG/KG	UJ	419	ICRSD
SO	SVOC	20406050906	060304-SOI-02719-00.5	N	SW8270C	SW3510C	Aniline	419	U	419	UG/KG	UJ	419	ICRSD
SO	SVOC	20406050906	060304-SOI-02719-00.5	N	SW8270C	SW3510C	Hexachlorophene	838	U	838	UG/KG	UJ	838	ICRSD
SO	SVOC	20406050906	060304-SOI-02719-00.5	N	SW8270C	SW3510C	o and/or p - Toluidine	419	U	419	UG/KG	UJ	419	ICRSD
SO	SVOC	20406050907	060304-SOI-02720-00.5	N	SW8270C	SW3510C	1,4-Naphthoquinone	779	U	779	UG/KG	UJ	779	ICRSD
SO	SVOC	20406050907	060304-SOI-02720-00.5	N	SW8270C	SW3510C	2-Methylnaphthalene	389	U	389	UG/KG	UJ	389	ICRSD
SO	SVOC	20406050907	060304-SOI-02720-00.5	N	SW8270C	SW3510C	4-Chloroaniline	389	U	389	UG/KG	UJ	389	ICRSD
SO	SVOC	20406050907	060304-SOI-02720-00.5	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	389	U	389	UG/KG	UJ	389	ICRSD
SO	SVOC	20406050907	060304-SOI-02720-00.5	N	SW8270C	SW3510C	Hexachlorophene	779	U	779	UG/KG	UJ	779	ICRSD
SO	SVOC	20406050907	060304-SOI-02720-00.5	N	SW8270C	SW3510C	o and/or p - Toluidine	389	U	389	UG/KG	UJ	389	ICRSD
SO	SVOC	20406050910	060304-SOI-02721-00.5	N	SW8270C	SW3510C	1,4-Naphthoquinone	871	U	871	UG/KG	UJ	871	ICRSD
SO	SVOC	20406050910	060304-SOI-02721-00.5	N	SW8270C	SW3510C	2,4-Dinitrophenol	2180	U	2180	UG/KG	UJ	2180	ICRSD
SO	SVOC	20406050910	060304-SOI-02721-00.5	N	SW8270C	SW3510C	2-Methylnaphthalene	436	U	436	UG/KG	UJ	436	ICRSD
SO	SVOC	20406050910	060304-SOI-02721-00.5	N	SW8270C	SW3510C	4-Chloroaniline	436	U	436	UG/KG	UJ	436	ICRSD
SO	SVOC	20406050910	060304-SOI-02721-00.5	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	436	U	436	UG/KG	UJ	436	ICRSD
SO	SVOC	20406050910	060304-SOI-02721-00.5	N	SW8270C	SW3510C	Aniline	436	U	436	UG/KG	UJ	436	ICRSD
SO	SVOC	20406050910	060304-SOI-02721-00.5	N	SW8270C	SW3510C	Hexachlorophene	871	U	871	UG/KG	UJ	871	ICRSD
SO	SVOC	20406050910	060304-SOI-02721-00.5	N	SW8270C	SW3510C	o and/or p - Toluidine	436	U	436	UG/KG	UJ	436	ICRSD
SO	SVOC	20406050911	060304-SOI-02722-00.5	N	SW8270C	SW3510C	1,4-Naphthoquinone	775	U	775	UG/KG	UJ	775	ICRSD
SO	SVOC	20406050911	060304-SOI-02722-00.5	N	SW8270C	SW3510C	2,4-Dinitrophenol	1940	U	1940	UG/KG	UJ	1940	ICRSD
SO	SVOC	20406050911	060304-SOI-02722-00.5	N	SW8270C	SW3510C	2-Methylnaphthalene	387	U	387	UG/KG	UJ	387	ICRSD
SO	SVOC	20406050911	060304-SOI-02722-00.5	N	SW8270C	SW3510C	4-Chloroaniline	387	U	387	UG/KG	UJ	387	ICRSD
SO	SVOC	20406050911	060304-SOI-02722-00.5	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	387	U	387	UG/KG	UJ	387	ICRSD
SO	SVOC	20406050911	060304-SOI-02722-00.5	N	SW8270C	SW3510C	Aniline	387	U	387	UG/KG	UJ	387	ICRSD
SO	SVOC	20406050911	060304-SOI-02722-00.5	N	SW8270C	SW3510C	Hexachlorophene	775	U	775	UG/KG	UJ	775	ICRSD
SO	SVOC	20406050911	060304-SOI-02722-00.5	N	SW8270C	SW3510C	o and/or p - Toluidine	387	U	387	UG/KG	UJ	387	ICRSD
SO	SVOC	20406050912	060404-SOI-02711-00.5	N	SW8270C	SW3510C	1,4-Naphthoquinone	931	U	931	UG/KG	UJ	931	ICRSD
SO	SVOC	20406050912	060404-SOI-02711-00.5	N	SW8270C	SW3510C	2,4-Dinitrophenol	2330	U	2330	UG/KG	UJ	2330	ICRSD
SO	SVOC	20406050912	060404-SOI-02711-00.5	N	SW8270C	SW3510C	2-Methylnaphthalene	466	U	466	UG/KG	UJ	466	ICRSD
SO	SVOC	20406050912	060404-SOI-02711-00.5	N	SW8270C	SW3510C	4-Chloroaniline	466	U	466	UG/KG	UJ	466	ICRSD
SO	SVOC	20406050912	060404-SOI-02711-00.5	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	466	U	466	UG/KG	UJ	466	ICRSD
SO	SVOC	20406050912	060404-SOI-02711-00.5	N	SW8270C	SW3510C	Aniline	466	U	466	UG/KG	UJ	466	ICRSD
SO	SVOC	20406050912	060404-SOI-02711-00.5	N	SW8270C	SW3510C	Hexachlorophene	931	U	931	UG/KG	UJ	931	ICRSD
SO	SVOC	20406050912	060404-SOI-02711-00.5	N	SW8270C	SW3510C	o and/or p - Toluidine	466	U	466	UG/KG	UJ	466	ICRSD
SO	SVOC	20406050913	060404-SOI-02712-00.5	N	SW8270C	SW3510C	1,4-Naphthoquinone	826	U	826	UG/KG	UJ	826	ICRSD
SO	SVOC	20406050913	060404-SOI-02712-00.5	N	SW8270C	SW3510C	2,4-Dinitrophenol	2060	U	2060	UG/KG	UJ	2060	ICRSD
SO	SVOC	20406050913	060404-SOI-02712-00.5	N	SW8270C	SW3510C	2-Methylnaphthalene	413	U	413	UG/KG	UJ	413	ICRSD
SO	SVOC	20406050913	060404-SOI-02712-00.5	N	SW8270C	SW3510C	4-Chloroaniline	413	U	413	UG/KG	UJ	413	ICRSD
SO	SVOC	20406050913	060404-SOI-02712-00.5	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	413	U	413	UG/KG	UJ	413	ICRSD
SO	SVOC	20406050913	060404-SOI-02712-00.5	N	SW8270C	SW3510C	Aniline	413	U	413	UG/KG	UJ	413	ICRSD
SO	SVOC	20406050913	060404-SOI-02712-00.5	N	SW8270C	SW3510C	Hexachlorophene	826	U	826	UG/KG	UJ	826	ICRSD
SO	SVOC	20406050913	060404-SOI-02712-00.5	N	SW8270C	SW3510C	o and/or p - Toluidine	413	U	413	UG/KG	UJ	413	ICRSD
SO	SVOC	20406050914	060404-SOI-02713-00.5	N	SW8270C	SW3510C	1,4-Naphthoquinone	977	U	977	UG/KG	UJ	977	ICRSD
SO	SVOC	20406050914	060404-SOI-02713-00.5	N	SW8270C	SW3510C	2,4-Dinitrophenol	2440	U	2440	UG/KG	UJ	2440	ICRSD
SO	SVOC	20406050914	060404-SOI-02713-00.5	N	SW8270C	SW3510C	2-Methylnaphthalene	489	U	489	UG/KG	UJ	489	ICRSD
SO	SVOC	20406050914	060404-SOI-02713-00.5	N	SW8270C	SW3510C	4-Chloroaniline	489	U	489	UG/KG	UJ	489	ICRSD
SO	SVOC	20406050914	060404-SOI-02713-00.5	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	489	U	489	UG/KG	UJ	489	ICRSD
SO	SVOC	20406050914	060404-SOI-02713-00.5	N	SW8270C	SW3510C	Aniline	489	U	489	UG/KG	UJ	489	ICRSD
SO	SVOC	20406050914	060404-SOI-02713-00.5	N	SW8270C	SW3510C	Hexachlorophene	977	U	977	UG/KG	UJ	977	ICRSD
SO	SVOC	20406050914	060404-SOI-02713-00.5	N	SW8270C	SW3510C	o and/or p - Toluidine	489	U	489	UG/KG	UJ	489	ICRSD
SO	SVOC	20406050915	060404-SOI-02714-00.5	N	SW8270C	SW3510C	1,4-Naphthoquinone	890	U	890	UG/KG	UJ	890	ICRSD
SO	SVOC	20406050915	060404-SOI-02714-00.5	N	SW8270C	SW3510C	2,4-Dinitrophenol	2220	U	2220	UG/KG	UJ	2220	ICRSD
SO	SVOC	20406050915	060404-SOI-02714-00.5	N	SW8270C	SW3510C	2-Methylnaphthalene	445	U	445	UG/KG	UJ	445	ICRSD
SO	SVOC	20406050915	060404-SOI-02714-00.5	N	SW8270C	SW3510C	4-Chloroaniline	445	U	445	UG/KG	UJ	445	ICRSD

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SO	SVOC	20406050915	060404-SOI-02714-00.5	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	445	U	445	UG/KG	UJ	445	ICRSD
SO	SVOC	20406050915	060404-SOI-02714-00.5	N	SW8270C	SW3510C	Aniline	445	U	445	UG/KG	UJ	445	ICRSD
SO	SVOC	20406050915	060404-SOI-02714-00.5	N	SW8270C	SW3510C	Hexachlorophene	890	U	890	UG/KG	UJ	890	ICRSD
SO	SVOC	20406050915	060404-SOI-02714-00.5	N	SW8270C	SW3510C	o and/or p - Toluidine	445	U	445	UG/KG	UJ	445	ICRSD
SO	SVOC	20406050916	060404-SOI-02727-00.5	N	SW8270C	SW3510C	1,4-Naphthoquinone	892	U	892	UG/KG	UJ	892	ICRSD
SO	SVOC	20406050916	060404-SOI-02727-00.5	N	SW8270C	SW3510C	2,4-Dinitrophenol	2230	U	2230	UG/KG	UJ	2230	ICRSD
SO	SVOC	20406050916	060404-SOI-02727-00.5	N	SW8270C	SW3510C	2-Methylnaphthalene	446	U	446	UG/KG	UJ	446	ICRSD
SO	SVOC	20406050916	060404-SOI-02727-00.5	N	SW8270C	SW3510C	4-Chloroaniline	446	U	446	UG/KG	UJ	446	ICRSD
SO	SVOC	20406050916	060404-SOI-02727-00.5	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	446	U	446	UG/KG	UJ	446	ICRSD
SO	SVOC	20406050916	060404-SOI-02727-00.5	N	SW8270C	SW3510C	Aniline	446	U	446	UG/KG	UJ	446	ICRSD
SO	SVOC	20406050916	060404-SOI-02727-00.5	N	SW8270C	SW3510C	Hexachlorophene	892	U	892	UG/KG	UJ	892	ICRSD
SO	SVOC	20406050916	060404-SOI-02727-00.5	N	SW8270C	SW3510C	o and/or p - Toluidine	446	U	446	UG/KG	UJ	446	ICRSD
SO	SVOC	20406050917	060404-SOI-02728-00.5	N	SW8270C	SW3510C	1,4-Naphthoquinone	842	U	842	UG/KG	UJ	842	ICRSD
SO	SVOC	20406050917	060404-SOI-02728-00.5	N	SW8270C	SW3510C	2,4-Dinitrophenol	2100	U	2100	UG/KG	UJ	2100	ICRSD
SO	SVOC	20406050917	060404-SOI-02728-00.5	N	SW8270C	SW3510C	2-Methylnaphthalene	421	U	421	UG/KG	UJ	421	ICRSD
SO	SVOC	20406050917	060404-SOI-02728-00.5	N	SW8270C	SW3510C	4-Chloroaniline	421	U	421	UG/KG	UJ	421	ICRSD
SO	SVOC	20406050917	060404-SOI-02728-00.5	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	421	U	421	UG/KG	UJ	421	ICRSD
SO	SVOC	20406050917	060404-SOI-02728-00.5	N	SW8270C	SW3510C	Aniline	421	U	421	UG/KG	UJ	421	ICRSD
SO	SVOC	20406050917	060404-SOI-02728-00.5	N	SW8270C	SW3510C	Hexachlorophene	842	U	842	UG/KG	UJ	842	ICRSD
SO	SVOC	20406050917	060404-SOI-02728-00.5	N	SW8270C	SW3510C	o and/or p - Toluidine	421	U	421	UG/KG	UJ	421	ICRSD
SO	SVOC	20406050918	060404-SOI-02729-00.5	N	SW8270C	SW3510C	1,4-Naphthoquinone	935	U	935	UG/KG	UJ	935	ICRSD
SO	SVOC	20406050918	060404-SOI-02729-00.5	N	SW8270C	SW3510C	2-Methylnaphthalene	467	U	467	UG/KG	UJ	467	ICRSD
SO	SVOC	20406050918	060404-SOI-02729-00.5	N	SW8270C	SW3510C	4-Chloroaniline	467	U	467	UG/KG	UJ	467	ICRSD
SO	SVOC	20406050918	060404-SOI-02729-00.5	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	467	U	467	UG/KG	UJ	467	ICRSD
SO	SVOC	20406050918	060404-SOI-02729-00.5	N	SW8270C	SW3510C	Aniline	467	U	467	UG/KG	UJ	467	ICRSD
SO	SVOC	20406050918	060404-SOI-02729-00.5	N	SW8270C	SW3510C	Hexachlorophene	935	U	935	UG/KG	UJ	935	ICRSD
SO	SVOC	20406050918	060404-SOI-02729-00.5	N	SW8270C	SW3510C	o and/or p - Toluidine	467	U	467	UG/KG	UJ	467	ICRSD
SO	SVOC	20406050919	060404-SOI-02730-00.5	N	SW8270C	SW3510C	1,4-Naphthoquinone	855	U	855	UG/KG	UJ	855	ICRSD
SO	SVOC	20406050919	060404-SOI-02730-00.5	N	SW8270C	SW3510C	2,4-Dinitrophenol	2140	U	2140	UG/KG	UJ	2140	ICRSD
SO	SVOC	20406050919	060404-SOI-02730-00.5	N	SW8270C	SW3510C	2-Methylnaphthalene	428	U	428	UG/KG	UJ	428	ICRSD
SO	SVOC	20406050919	060404-SOI-02730-00.5	N	SW8270C	SW3510C	4-Chloroaniline	428	U	428	UG/KG	UJ	428	ICRSD
SO	SVOC	20406050919	060404-SOI-02730-00.5	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	428	U	428	UG/KG	UJ	428	ICRSD
SO	SVOC	20406050919	060404-SOI-02730-00.5	N	SW8270C	SW3510C	Aniline	428	U	428	UG/KG	UJ	428	ICRSD
SO	SVOC	20406050919	060404-SOI-02730-00.5	N	SW8270C	SW3510C	Hexachlorophene	855	U	855	UG/KG	UJ	855	ICRSD
SO	SVOC	20406050919	060404-SOI-02730-00.5	N	SW8270C	SW3510C	o and/or p - Toluidine	428	U	428	UG/KG	UJ	428	ICRSD
SO	SVOC	20406050920	060404-SOI-02730-00.5-D	FD	SW8270C	SW3510C	1,4-Naphthoquinone	852	U	852	UG/KG	UJ	852	ICRSD
SO	SVOC	20406050920	060404-SOI-02730-00.5-D	FD	SW8270C	SW3510C	2,4-Dinitrophenol	2130	U	2130	UG/KG	UJ	2130	ICRSD
SO	SVOC	20406050920	060404-SOI-02730-00.5-D	FD	SW8270C	SW3510C	2-Methylnaphthalene	426	U	426	UG/KG	UJ	426	ICRSD
SO	SVOC	20406050920	060404-SOI-02730-00.5-D	FD	SW8270C	SW3510C	4-Chloroaniline	426	U	426	UG/KG	UJ	426	ICRSD
SO	SVOC	20406050920	060404-SOI-02730-00.5-D	FD	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	426	U	426	UG/KG	UJ	426	ICRSD
SO	SVOC	20406050920	060404-SOI-02730-00.5-D	FD	SW8270C	SW3510C	Aniline	426	U	426	UG/KG	UJ	426	ICRSD
SO	SVOC	20406050920	060404-SOI-02730-00.5-D	FD	SW8270C	SW3510C	Hexachlorophene	852	U	852	UG/KG	UJ	852	ICRSD
SO	SVOC	20406050920	060404-SOI-02730-00.5-D	FD	SW8270C	SW3510C	o and/or p - Toluidine	426	U	426	UG/KG	UJ	426	ICRSD
SED	SVOC	20406302301	062804-SED-02691-00.2	N	SW8270C	SW3510C	Hexachlorophene	772	U	772	UG/KG	UJ	772	ICRSD
SED	SVOC	20406302302	062804-SED-02692-00.2	N	SW8270C	SW3510C	Hexachlorophene	808	U	808	UG/KG	UJ	808	ICRSD
SED	SVOC	20406302303	062804-SED-02693-00.2	N	SW8270C	SW3510C	Hexachlorophene	782	U	782	UG/KG	UJ	782	ICRSD
SED	SVOC	20406302304	062804-SED-02694-00.2	N	SW8270C	SW3510C	Hexachlorophene	732	U	732	UG/KG	UJ	732	ICRSD
SED	SVOC	20406302305	062904-SED-02699-00.2	N	SW8270C	SW3510C	Hexachlorophene	751	U	751	UG/KG	UJ	751	ICRSD
SED	SVOC	20406302306	062904-SED-02700-00.2	N	SW8270C	SW3510C	Hexachlorophene	749	U	749	UG/KG	UJ	749	ICRSD
SED	SVOC	20406302307	062904-SED-02701-00.2	N	SW8270C	SW3510C	Hexachlorophene	805	U	805	UG/KG	UJ	805	ICRSD
SED	SVOC	20406302308	062904-SED-02702-00.2	N	SW8270C	SW3510C	Hexachlorophene	731	U	731	UG/KG	UJ	731	ICRSD
SED	SVOC	20406302309	062904-SED-02731-00.2	N	SW8270C	SW3510C	Hexachlorophene	790	U	790	UG/KG	UJ	790	ICRSD
SED	SVOC	20406302312	062904-SED-02732-00.2	N	SW8270C	SW3510C	Hexachlorophene	834	U	834	UG/KG	UJ	834	ICRSD
SED	SVOC	20406302313	062904-SED-02733-00.2	N	SW8270C	SW3510C	Hexachlorophene	798	U	798	UG/KG	UJ	798	ICRSD
SED	SVOC	20406302314	062904-SED-02734-00.2	N	SW8270C	SW3510C	Hexachlorophene	779	U	779	UG/KG	UJ	779	ICRSD
SED	SVOC	20406302315	062904-SED-02734-00.2-D	FD	SW8270C	SW3510C	Hexachlorophene	776	U	776	UG/KG	UJ	776	ICRSD
SED	SVOC	20407020801	063004-SED-02707-00.2	N	SW8270C	SW3510C	1,4-Naphthoquinone	781	U	781	UG/KG	UJ	781	ICRSD
SED	SVOC	20407020801	063004-SED-02707-00.2	N	SW8270C	SW3510C	4-Chloroaniline	391	U	391	UG/KG	UJ	391	ICRSD
SED	SVOC	20407020801	063004-SED-02707-00.2	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	391	U	391	UG/KG	UJ	391	ICRSD
SED	SVOC	20407020801	063004-SED-02707-00.2	N	SW8270C	SW3510C	Acetophenone	391	U	391	UG/KG	UJ	391	ICRSD
SED	SVOC	20407020801	063004-SED-02707-00.2	N	SW8270C	SW3510C	Aniline	391	U	391	UG/KG	UJ	391	ICRSD
SED	SVOC	20407020801	063004-SED-02707-00.2	N	SW8270C	SW3510C	Hexabromobenzene	391	U	391	UG/KG	UJ	391	ICRSD
SED	SVOC	20407020801	063004-SED-02707-00.2	N	SW8270C	SW3510C	Hexachlorophene	781	U	781	UG/KG	UJ	781	ICRSD
SED	SVOC	20407020801	063004-SED-02707-00.2	N	SW8270C	SW3510C	o and/or p - Toluidine	391	U	391	UG/KG	UJ	391	ICRSD

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SED	SVOC	20407020802	063004-SED-02708-00.2	N	SW8270C	SW3510C	1,4-Naphthoquinone	831	U	831	UG/KG	UJ	831	ICRSD
SED	SVOC	20407020802	063004-SED-02708-00.2	N	SW8270C	SW3510C	4-Chloroaniline	416	U	416	UG/KG	UJ	416	ICRSD
SED	SVOC	20407020802	063004-SED-02708-00.2	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	416	U	416	UG/KG	UJ	416	ICRSD
SED	SVOC	20407020802	063004-SED-02708-00.2	N	SW8270C	SW3510C	Acetophenone	416	U	416	UG/KG	UJ	416	ICRSD
SED	SVOC	20407020802	063004-SED-02708-00.2	N	SW8270C	SW3510C	Aniline	416	U	416	UG/KG	UJ	416	ICRSD
SED	SVOC	20407020802	063004-SED-02708-00.2	N	SW8270C	SW3510C	Hexabromobenzene	416	U	416	UG/KG	UJ	416	ICRSD
SED	SVOC	20407020802	063004-SED-02708-00.2	N	SW8270C	SW3510C	Hexachlorophene	831	U	831	UG/KG	UJ	831	ICRSD
SED	SVOC	20407020802	063004-SED-02708-00.2	N	SW8270C	SW3510C	o and/or p - Toluidine	416	U	416	UG/KG	UJ	416	ICRSD
SED	SVOC	20407020803	063004-SED-02708-00.2-D	FD	SW8270C	SW3510C	1,4-Naphthoquinone	832	U	832	UG/KG	UJ	832	ICRSD
SED	SVOC	20407020803	063004-SED-02708-00.2-D	FD	SW8270C	SW3510C	4-Chloroaniline	416	U	416	UG/KG	UJ	416	ICRSD
SED	SVOC	20407020803	063004-SED-02708-00.2-D	FD	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	416	U	416	UG/KG	UJ	416	ICRSD
SED	SVOC	20407020803	063004-SED-02708-00.2-D	FD	SW8270C	SW3510C	Acetophenone	416	U	416	UG/KG	UJ	416	ICRSD
SED	SVOC	20407020803	063004-SED-02708-00.2-D	FD	SW8270C	SW3510C	Hexabromobenzene	416	U	416	UG/KG	UJ	416	ICRSD
SED	SVOC	20407020803	063004-SED-02708-00.2-D	FD	SW8270C	SW3510C	Hexachlorophene	832	U	832	UG/KG	UJ	832	ICRSD
SED	SVOC	20407020803	063004-SED-02708-00.2-D	FD	SW8270C	SW3510C	o and/or p - Toluidine	416	U	416	UG/KG	UJ	416	ICRSD
SED	SVOC	20407020806	063004-SED-02709-00.2	N	SW8270C	SW3510C	1,4-Naphthoquinone	776	U	776	UG/KG	UJ	776	ICRSD
SED	SVOC	20407020806	063004-SED-02709-00.2	N	SW8270C	SW3510C	4-Chloroaniline	388	U	388	UG/KG	UJ	388	ICRSD
SED	SVOC	20407020806	063004-SED-02709-00.2	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	388	U	388	UG/KG	UJ	388	ICRSD
SED	SVOC	20407020806	063004-SED-02709-00.2	N	SW8270C	SW3510C	Acetophenone	388	U	388	UG/KG	UJ	388	ICRSD
SED	SVOC	20407020806	063004-SED-02709-00.2	N	SW8270C	SW3510C	Aniline	388	U	388	UG/KG	UJ	388	ICRSD
SED	SVOC	20407020806	063004-SED-02709-00.2	N	SW8270C	SW3510C	Hexabromobenzene	388	U	388	UG/KG	UJ	388	ICRSD
SED	SVOC	20407020806	063004-SED-02709-00.2	N	SW8270C	SW3510C	Hexachlorophene	776	U	776	UG/KG	UJ	776	ICRSD
SED	SVOC	20407020806	063004-SED-02709-00.2	N	SW8270C	SW3510C	o and/or p - Toluidine	388	U	388	UG/KG	UJ	388	ICRSD
SED	SVOC	20407020807	063004-SED-02710-00.2	N	SW8270C	SW3510C	1,4-Naphthoquinone	754	U	754	UG/KG	UJ	754	ICRSD
SED	SVOC	20407020807	063004-SED-02710-00.2	N	SW8270C	SW3510C	4-Chloroaniline	377	U	377	UG/KG	UJ	377	ICRSD
SED	SVOC	20407020807	063004-SED-02710-00.2	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	377	U	377	UG/KG	UJ	377	ICRSD
SED	SVOC	20407020807	063004-SED-02710-00.2	N	SW8270C	SW3510C	Acetophenone	377	U	377	UG/KG	UJ	377	ICRSD
SED	SVOC	20407020807	063004-SED-02710-00.2	N	SW8270C	SW3510C	Aniline	377	U	377	UG/KG	UJ	377	ICRSD
SED	SVOC	20407020807	063004-SED-02710-00.2	N	SW8270C	SW3510C	Hexabromobenzene	377	U	377	UG/KG	UJ	377	ICRSD
SED	SVOC	20407020807	063004-SED-02710-00.2	N	SW8270C	SW3510C	Hexachlorophene	754	U	754	UG/KG	UJ	754	ICRSD
SED	SVOC	20407020807	063004-SED-02710-00.2	N	SW8270C	SW3510C	o and/or p - Toluidine	377	U	377	UG/KG	UJ	377	ICRSD
SED	SVOC	20407020808	063004-SED-02715-00.2	N	SW8270C	SW3510C	1,4-Naphthoquinone	847	U	847	UG/KG	UJ	847	ICRSD
SED	SVOC	20407020808	063004-SED-02715-00.2	N	SW8270C	SW3510C	4-Chloroaniline	423	U	423	UG/KG	UJ	423	ICRSD
SED	SVOC	20407020808	063004-SED-02715-00.2	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	423	U	423	UG/KG	UJ	423	ICRSD
SED	SVOC	20407020808	063004-SED-02715-00.2	N	SW8270C	SW3510C	Acetophenone	423	U	423	UG/KG	UJ	423	ICRSD
SED	SVOC	20407020808	063004-SED-02715-00.2	N	SW8270C	SW3510C	Aniline	423	U	423	UG/KG	UJ	423	ICRSD
SED	SVOC	20407020808	063004-SED-02715-00.2	N	SW8270C	SW3510C	Hexabromobenzene	423	U	423	UG/KG	UJ	423	ICRSD
SED	SVOC	20407020808	063004-SED-02715-00.2	N	SW8270C	SW3510C	Hexachlorophene	847	U	847	UG/KG	UJ	847	ICRSD
SED	SVOC	20407020808	063004-SED-02715-00.2	N	SW8270C	SW3510C	o and/or p - Toluidine	423	U	423	UG/KG	UJ	423	ICRSD
SED	SVOC	20407020809	063004-SED-02716-00.2	N	SW8270C	SW3510C	1,4-Naphthoquinone	757	U	757	UG/KG	UJ	757	ICRSD
SED	SVOC	20407020809	063004-SED-02716-00.2	N	SW8270C	SW3510C	4-Chloroaniline	378	U	378	UG/KG	UJ	378	ICRSD
SED	SVOC	20407020809	063004-SED-02716-00.2	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	378	U	378	UG/KG	UJ	378	ICRSD
SED	SVOC	20407020809	063004-SED-02716-00.2	N	SW8270C	SW3510C	Acetophenone	378	U	378	UG/KG	UJ	378	ICRSD
SED	SVOC	20407020809	063004-SED-02716-00.2	N	SW8270C	SW3510C	Aniline	378	U	378	UG/KG	UJ	378	ICRSD
SED	SVOC	20407020809	063004-SED-02716-00.2	N	SW8270C	SW3510C	Hexabromobenzene	378	U	378	UG/KG	UJ	378	ICRSD
SED	SVOC	20407020809	063004-SED-02716-00.2	N	SW8270C	SW3510C	Hexachlorophene	757	U	757	UG/KG	UJ	757	ICRSD
SED	SVOC	20407020809	063004-SED-02716-00.2	N	SW8270C	SW3510C	o and/or p - Toluidine	378	U	378	UG/KG	UJ	378	ICRSD
SED	SVOC	20407020810	063004-SED-02717-00.2	N	SW8270C	SW3510C	1,4-Naphthoquinone	846	U	846	UG/KG	UJ	846	ICRSD
SED	SVOC	20407020810	063004-SED-02717-00.2	N	SW8270C	SW3510C	4-Chloroaniline	423	U	423	UG/KG	UJ	423	ICRSD
SED	SVOC	20407020810	063004-SED-02717-00.2	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	423	U	423	UG/KG	UJ	423	ICRSD
SED	SVOC	20407020810	063004-SED-02717-00.2	N	SW8270C	SW3510C	Acetophenone	423	U	423	UG/KG	UJ	423	ICRSD
SED	SVOC	20407020810	063004-SED-02717-00.2	N	SW8270C	SW3510C	Aniline	423	U	423	UG/KG	UJ	423	ICRSD
SED	SVOC	20407020810	063004-SED-02717-00.2	N	SW8270C	SW3510C	Hexabromobenzene	423	U	423	UG/KG	UJ	423	ICRSD
SED	SVOC	20407020810	063004-SED-02717-00.2	N	SW8270C	SW3510C	Hexachlorophene	846	U	846	UG/KG	UJ	846	ICRSD
SED	SVOC	20407020810	063004-SED-02717-00.2	N	SW8270C	SW3510C	o and/or p - Toluidine	423	U	423	UG/KG	UJ	423	ICRSD
SED	SVOC	20407020811	063004-SED-02718-00.2	N	SW8270C	SW3510C	1,4-Naphthoquinone	810	U	810	UG/KG	UJ	810	ICRSD
SED	SVOC	20407020811	063004-SED-02718-00.2	N	SW8270C	SW3510C	4-Chloroaniline	405	U	405	UG/KG	UJ	405	ICRSD
SED	SVOC	20407020811	063004-SED-02718-00.2	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	405	U	405	UG/KG	UJ	405	ICRSD
SED	SVOC	20407020811	063004-SED-02718-00.2	N	SW8270C	SW3510C	Acetophenone	405	U	405	UG/KG	UJ	405	ICRSD
SED	SVOC	20407020811	063004-SED-02718-00.2	N	SW8270C	SW3510C	Aniline	405	U	405	UG/KG	UJ	405	ICRSD
SED	SVOC	20407020811	063004-SED-02718-00.2	N	SW8270C	SW3510C	Hexabromobenzene	405	U	405	UG/KG	UJ	405	ICRSD
SED	SVOC	20407020811	063004-SED-02718-00.2	N	SW8270C	SW3510C	Hexachlorophene	810	U	810	UG/KG	UJ	810	ICRSD
SED	SVOC	20407020811	063004-SED-02718-00.2	N	SW8270C	SW3510C	o and/or p - Toluidine	405	U	405	UG/KG	UJ	405	ICRSD
SED	SVOC	20407020812	063004-SED-02723-00.2	N	SW8270C	SW3510C	1,4-Naphthoquinone	783	U	783	UG/KG	UJ	783	ICRSD

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SED	SVOC	20407020812	063004-SED-02723-00.2	N	SW8270C	SW3510C	4-Chloroaniline	391	U	391	UG/KG	UJ	391	ICRSD
SED	SVOC	20407020812	063004-SED-02723-00.2	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	391	U	391	UG/KG	UJ	391	ICRSD
SED	SVOC	20407020812	063004-SED-02723-00.2	N	SW8270C	SW3510C	Acetophenone	391	U	391	UG/KG	UJ	391	ICRSD
SED	SVOC	20407020812	063004-SED-02723-00.2	N	SW8270C	SW3510C	Aniline	391	U	391	UG/KG	UJ	391	ICRSD
SED	SVOC	20407020812	063004-SED-02723-00.2	N	SW8270C	SW3510C	Hexabromobenzene	391	U	391	UG/KG	UJ	391	ICRSD
SED	SVOC	20407020812	063004-SED-02723-00.2	N	SW8270C	SW3510C	Hexachlorophene	783	U	783	UG/KG	UJ	783	ICRSD
SED	SVOC	20407020812	063004-SED-02723-00.2	N	SW8270C	SW3510C	o and/or p - Toluidine	391	U	391	UG/KG	UJ	391	ICRSD
SED	SVOC	20407020813	063004-SED-02724-00.2	N	SW8270C	SW3510C	1,4-Naphthoquinone	748	U	748	UG/KG	UJ	748	ICRSD
SED	SVOC	20407020813	063004-SED-02724-00.2	N	SW8270C	SW3510C	4-Chloroaniline	374	U	374	UG/KG	UJ	374	ICRSD
SED	SVOC	20407020813	063004-SED-02724-00.2	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	374	U	374	UG/KG	UJ	374	ICRSD
SED	SVOC	20407020813	063004-SED-02724-00.2	N	SW8270C	SW3510C	Acetophenone	374	U	374	UG/KG	UJ	374	ICRSD
SED	SVOC	20407020813	063004-SED-02724-00.2	N	SW8270C	SW3510C	Aniline	374	U	374	UG/KG	UJ	374	ICRSD
SED	SVOC	20407020813	063004-SED-02724-00.2	N	SW8270C	SW3510C	Hexabromobenzene	374	U	374	UG/KG	UJ	374	ICRSD
SED	SVOC	20407020813	063004-SED-02724-00.2	N	SW8270C	SW3510C	Hexachlorophene	748	U	748	UG/KG	UJ	748	ICRSD
SED	SVOC	20407020813	063004-SED-02724-00.2	N	SW8270C	SW3510C	o and/or p - Toluidine	374	U	374	UG/KG	UJ	374	ICRSD
SED	SVOC	20407020814	063004-SED-02725-00.2	N	SW8270C	SW3510C	1,4-Naphthoquinone	820	U	820	UG/KG	UJ	820	ICRSD
SED	SVOC	20407020814	063004-SED-02725-00.2	N	SW8270C	SW3510C	4-Chloroaniline	410	U	410	UG/KG	UJ	410	ICRSD
SED	SVOC	20407020814	063004-SED-02725-00.2	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	410	U	410	UG/KG	UJ	410	ICRSD
SED	SVOC	20407020814	063004-SED-02725-00.2	N	SW8270C	SW3510C	Acetophenone	410	U	410	UG/KG	UJ	410	ICRSD
SED	SVOC	20407020814	063004-SED-02725-00.2	N	SW8270C	SW3510C	Aniline	410	U	410	UG/KG	UJ	410	ICRSD
SED	SVOC	20407020814	063004-SED-02725-00.2	N	SW8270C	SW3510C	Hexabromobenzene	410	U	410	UG/KG	UJ	410	ICRSD
SED	SVOC	20407020814	063004-SED-02725-00.2	N	SW8270C	SW3510C	Hexachlorophene	820	U	820	UG/KG	UJ	820	ICRSD
SED	SVOC	20407020814	063004-SED-02725-00.2	N	SW8270C	SW3510C	o and/or p - Toluidine	410	U	410	UG/KG	UJ	410	ICRSD
SED	SVOC	20407020815	063004-SED-02726-00.2	N	SW8270C	SW3510C	1,4-Naphthoquinone	797	U	797	UG/KG	uj	797	ICRSD
SED	SVOC	20407020815	063004-SED-02726-00.2	N	SW8270C	SW3510C	4-Chloroaniline	398	U	398	UG/KG	UJ	398	ICRSD
SED	SVOC	20407020815	063004-SED-02726-00.2	N	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	398	U	398	UG/KG	UJ	398	ICRSD
SED	SVOC	20407020815	063004-SED-02726-00.2	N	SW8270C	SW3510C	Acetophenone	398	U	398	UG/KG	UJ	398	ICRSD
SED	SVOC	20407020815	063004-SED-02726-00.2	N	SW8270C	SW3510C	Aniline	398	U	398	UG/KG	UJ	398	ICRSD
SED	SVOC	20407020815	063004-SED-02726-00.2	N	SW8270C	SW3510C	Hexabromobenzene	398	U	398	UG/KG	UJ	398	ICRSD
SED	SVOC	20407020815	063004-SED-02726-00.2	N	SW8270C	SW3510C	Hexachlorophene	797	U	797	UG/KG	UJ	797	ICRSD
SED	SVOC	20407020815	063004-SED-02726-00.2	N	SW8270C	SW3510C	o and/or p - Toluidine	398	U	398	UG/KG	UJ	398	ICRSD
SED	SVOC	20407020816	063004-SED-02726-00.2-D	FD	SW8270C	SW3510C	1,4-Naphthoquinone	800	U	800	UG/KG	UJ	800	ICRSD
SED	SVOC	20407020816	063004-SED-02726-00.2-D	FD	SW8270C	SW3510C	4-Chloroaniline	400	U	400	UG/KG	UJ	400	ICRSD
SED	SVOC	20407020816	063004-SED-02726-00.2-D	FD	SW8270C	SW3510C	4-Nitroquinoline-1-oxide	400	U	400	UG/KG	UJ	400	ICRSD
SED	SVOC	20407020816	063004-SED-02726-00.2-D	FD	SW8270C	SW3510C	Acetophenone	400	U	400	UG/KG	UJ	400	ICRSD
SED	SVOC	20407020816	063004-SED-02726-00.2-D	FD	SW8270C	SW3510C	Aniline	400	U	400	UG/KG	UJ	400	ICRSD
SED	SVOC	20407020816	063004-SED-02726-00.2-D	FD	SW8270C	SW3510C	Hexabromobenzene	400	U	400	UG/KG	UJ	400	ICRSD
SED	SVOC	20407020816	063004-SED-02726-00.2-D	FD	SW8270C	SW3510C	Hexachlorophene	800	U	800	UG/KG	UJ	800	ICRSD
SED	SVOC	20407020816	063004-SED-02726-00.2-D	FD	SW8270C	SW3510C	o and/or p - Toluidine	400	U	400	UG/KG	UJ	400	ICRSD
SO	SVOC	20406032401	060104-SOI-02687-02.0	N	SW8081A	SW3510C	Diallate (Avadex)	58.3	U	58.3	UG/KG	UJ	58.3	ICRSD, CCVL
SO	SVOC	20406032401	060104-SOI-02687-02.0	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	770	U	770	UG/KG	UJ	770	ICRSD, CCVL
SO	SVOC	20406032402	060104-SOI-02688-02.0	N	SW8081A	SW3510C	Diallate (Avadex)	27.3	U	27.3	UG/KG	UJ	27.3	ICRSD, CCVL
SO	SVOC	20406032402	060104-SOI-02688-02.0	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	361	U	361	UG/KG	UJ	361	ICRSD, CCVL
SO	SVOC	20406032403	060104-SOI-02689-00.5	N	SW8081A	SW3510C	Diallate (Avadex)	30.1	U	30.1	UG/KG	UJ	30.1	ICRSD, CCVL
SO	SVOC	20406032403	060104-SOI-02689-00.5	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	397	U	397	UG/KG	UJ	397	ICRSD, CCVL
SO	SVOC	20406032404	060104-SOI-02688-04.0	N	SW8081A	SW3510C	Diallate (Avadex)	56.3	U	56.3	UG/KG	UJ	56.3	ICRSD, CCVL
SO	SVOC	20406032404	060104-SOI-02688-04.0	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	371	U	371	UG/KG	UJ	371	ICRSD, CCVL
SO	SVOC	20406032405	060104-SOI-02689-04.5	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	395	U	395	UG/KG	UJ	395	ICRSD, CCVL
SO	SVOC	20406032406	060104-SOI-02688-07.0	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	371	U	371	UG/KG	UJ	371	ICRSD, CCVL
SO	SVOC	20406032407	060104-SOI-02687-04.5	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	825	U	825	UG/KG	UJ	825	ICRSD, CCVL
SO	SVOC	20406032408	060104-SOI-02688-06.0	N	SW8081A	SW3510C	Diallate (Avadex)	27.8	U	27.8	UG/KG	UJ	27.8	ICRSD, CCVL
SO	SVOC	20406032408	060104-SOI-02688-06.0	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	367	U	367	UG/KG	UJ	367	ICRSD, CCVL
SO	SVOC	20406032409	060104-SOI-02690-00.5	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	387	U	387	UG/KG	UJ	387	ICRSD, CCVL
SO	SVOC	20406032412	060104-SOI-02687-00.5-D	FD	SW8270C	SW3510C	n-Nitrosomethylethylamine	388	U	388	UG/KG	UJ	388	ICRSD, CCVL
SO	SVOC	20406032413	060104-SOI-02690-02.0	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	380	U	380	UG/KG	UJ	380	ICRSD, CCVL
SO	SVOC	20406032414	060104-SOI-02687-00.5	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	390	U	390	UG/KG	UJ	390	ICRSD, CCVL
SO	SVOC	20406032415	060104-SOI-02689-02.0	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	376	U	376	UG/KG	UJ	376	ICRSD, CCVL
SO	SVOC	20406032416	060104-SOI-02688-00.5	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	353	U	353	UG/KG	UJ	353	ICRSD, CCVL
SO	SVOC	20406042510	060204-SOI-02697-02.5	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	383	U	383	UG/KG	UJ	383	ICRSD, CCVL
SO	SVOC	20406042511	060204-SOI-02696-02.0	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	445	U	445	UG/KG	UJ	445	ICRSD, CCVL
SO	SVOC	20406050901	060304-SOI-02703-00.5	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	388	U	388	UG/KG	UJ	388	ICRSD, CCVL
SO	SVOC	20406050902	060304-SOI-02705-00.5	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	390	U	390	UG/KG	UJ	390	ICRSD, CCVL
SO	SVOC	20406050903	060304-SOI-02706-00.5	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	358	U	358	UG/KG	UJ	358	ICRSD, CCVL
SO	SVOC	20406050904	060304-SOI-02704-00.5	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	391	U	391	UG/KG	UJ	391	ICRSD, CCVL

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SO	SVOC	20406050905	060304-SOI-02704-00.5-D	FD	SW8270C	SW3510C	n-Nitrosomethylethylamine	435	U	435	UG/KG	UJ	435	ICRSD, CCVL
SO	SVOC	20406050906	060304-SOI-02719-00.5	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	419	U	419	UG/KG	UJ	419	ICRSD, CCVL
SO	SVOC	20406050907	060304-SOI-02720-00.5	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	389	U	389	UG/KG	UJ	389	ICRSD, CCVL
SO	SVOC	20406050910	060304-SOI-02721-00.5	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	436	U	436	UG/KG	UJ	436	ICRSD, CCVL
SO	SVOC	20406050911	060304-SOI-02722-00.5	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	387	U	387	UG/KG	UJ	387	ICRSD, CCVL
SO	SVOC	20406050912	060404-SOI-02711-00.5	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	466	U	466	UG/KG	UJ	466	ICRSD, CCVL
SO	SVOC	20406050913	060404-SOI-02712-00.5	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	413	U	413	UG/KG	UJ	413	ICRSD, CCVL
SO	SVOC	20406050914	060404-SOI-02713-00.5	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	489	U	489	UG/KG	UJ	489	ICRSD, CCVL
SO	SVOC	20406050915	060404-SOI-02714-00.5	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	445	U	445	UG/KG	UJ	445	ICRSD, CCVL
SO	SVOC	20406050916	060404-SOI-02727-00.5	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	446	U	446	UG/KG	UJ	446	ICRSD, CCVL
SO	SVOC	20406050917	060404-SOI-02728-00.5	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	421	U	421	UG/KG	UJ	421	ICRSD, CCVL
SO	SVOC	20406050918	060404-SOI-02729-00.5	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	467	U	467	UG/KG	UJ	467	ICRSD, CCVL
SO	SVOC	20406050919	060404-SOI-02730-00.5	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	428	U	428	UG/KG	UJ	428	ICRSD, CCVL
SO	SVOC	20406050920	060404-SOI-02730-00.5-D	FD	SW8270C	SW3510C	n-Nitrosomethylethylamine	426	U	426	UG/KG	UJ	426	ICRSD, CCVL
SO	SVOC	20406032405	060104-SOI-02689-04.5	N	SW8081A	SW3510C	Diallate (Avadex)	30	U	30	UG/KG	UJ	30	ICRSD, CCVL, SSL
SO	SVOC	20406032409	060104-SOI-02690-00.5	N	SW8081A	SW3510C	Diallate (Avadex)	58.7	U	58.7	UG/KG	UJ	58.7	ICRSD, CCVL, SSL
SO	SVOC	20406032413	060104-SOI-02690-02.0	N	SW8081A	SW3510C	Diallate (Avadex)	28.8	U	28.8	UG/KG	UJ	28.8	ICRSD, CCVL, SSL
SO	SVOC	20406050901	060304-SOI-02703-00.5	N	SW8270C	SW3510C	Hexabromobenzene	388	U	388	UG/KG	UJ	388	ICRSD, ICRRF, CCRRF
SO	SVOC	20406050902	060304-SOI-02705-00.5	N	SW8270C	SW3510C	Hexabromobenzene	390	U	390	UG/KG	UJ	390	ICRSD, ICRRF, CCRRF
SO	SVOC	20406050903	060304-SOI-02706-00.5	N	SW8270C	SW3510C	Hexabromobenzene	358	U	358	UG/KG	UJ	358	ICRSD, ICRRF, CCRRF
SO	SVOC	20406050904	060304-SOI-02704-00.5	N	SW8270C	SW3510C	Hexabromobenzene	391	U	391	UG/KG	UJ	391	ICRSD, ICRRF, CCRRF
SO	SVOC	20406050905	060304-SOI-02704-00.5-D	FD	SW8270C	SW3510C	Hexabromobenzene	435	U	435	UG/KG	UJ	435	ICRSD, ICRRF, CCRRF
SO	SVOC	20406050906	060304-SOI-02719-00.5	N	SW8270C	SW3510C	Hexabromobenzene	419	U	419	UG/KG	UJ	419	ICRSD, ICRRF, CCRRF
SO	SVOC	20406050907	060304-SOI-02720-00.5	N	SW8270C	SW3510C	Hexabromobenzene	389	U	389	UG/KG	UJ	389	ICRSD, ICRRF, CCRRF
SO	SVOC	20406050910	060304-SOI-02721-00.5	N	SW8270C	SW3510C	Hexabromobenzene	436	U	436	UG/KG	UJ	436	ICRSD, ICRRF, CCRRF
SO	SVOC	20406050911	060304-SOI-02722-00.5	N	SW8270C	SW3510C	Hexabromobenzene	387	U	387	UG/KG	UJ	387	ICRSD, ICRRF, CCRRF
SO	SVOC	20406050912	060404-SOI-02711-00.5	N	SW8270C	SW3510C	Hexabromobenzene	466	U	466	UG/KG	UJ	466	ICRSD, ICRRF, CCRRF
SO	SVOC	20406050913	060404-SOI-02712-00.5	N	SW8270C	SW3510C	Hexabromobenzene	413	U	413	UG/KG	UJ	413	ICRSD, ICRRF, CCRRF
SO	SVOC	20406050914	060404-SOI-02713-00.5	N	SW8270C	SW3510C	Hexabromobenzene	489	U	489	UG/KG	UJ	489	ICRSD, ICRRF, CCRRF
SO	SVOC	20406050915	060404-SOI-02714-00.5	N	SW8270C	SW3510C	Hexabromobenzene	445	U	445	UG/KG	UJ	445	ICRSD, ICRRF, CCRRF
SO	SVOC	20406050916	060404-SOI-02727-00.5	N	SW8270C	SW3510C	Hexabromobenzene	446	U	446	UG/KG	UJ	446	ICRSD, ICRRF, CCRRF
SO	SVOC	20406050917	060404-SOI-02728-00.5	N	SW8270C	SW3510C	Hexabromobenzene	421	U	421	UG/KG	UJ	421	ICRSD, ICRRF, CCRRF
SO	SVOC	20406050918	060404-SOI-02729-00.5	N	SW8270C	SW3510C	Hexabromobenzene	467	U	467	UG/KG	UJ	467	ICRSD, ICRRF, CCRRF
SO	SVOC	20406050919	060404-SOI-02730-00.5	N	SW8270C	SW3510C	Hexabromobenzene	428	U	428	UG/KG	UJ	428	ICRSD, ICRRF, CCRRF
SO	SVOC	20406050920	060404-SOI-02730-00.5-D	FD	SW8270C	SW3510C	Hexabromobenzene	426	U	426	UG/KG	UJ	426	ICRSD, ICRRF, CCRRF
SO	SVOC	20406050918	060404-SOI-02729-00.5	N	SW8270C	SW3510C	2,4-Dinitrophenol	2340	U	2340	UG/KG	UJ	2340	ICRSD, MSDL
SO	SVOC	20406050907	060304-SOI-02720-00.5	N	SW8270C	SW3510C	Aniline	389	U	389	UG/KG	UJ	389	ICRSD, MSL
SED	SVOC	20407020803	063004-SED-02708-00.2-D	FD	SW8270C	SW3510C	Aniline	416	U	416	UG/KG	UJ	416	ICRSD, MSL
SO	SVOC	20406050907	060304-SOI-02720-00.5	N	SW8270C	SW3510C	2,4-Dinitrophenol	1950	U	1950	UG/KG	UJ	1950	ICRSD, MSL, MSDL
SED	SVOC	20406302301	062804-SED-02691-00.2	N	SW8270C	SW3510C	m,p-Cresol	386	U	386	UG/KG	UJ	386	LCSL
SED	SVOC	20406302301	062804-SED-02691-00.2	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	386	U	386	UG/KG	UJ	386	LCSL
SED	SVOC	20406302301	062804-SED-02691-00.2	N	SW8270C	SW3510C	Pyridine	386	U	386	UG/KG	UJ	386	LCSL
SED	SVOC	20406302302	062804-SED-02692-00.2	N	SW8270C	SW3510C	m,p-Cresol	404	U	404	UG/KG	UJ	404	LCSL
SED	SVOC	20406302302	062804-SED-02692-00.2	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	404	U	404	UG/KG	UJ	404	LCSL
SED	SVOC	20406302302	062804-SED-02692-00.2	N	SW8270C	SW3510C	Pyridine	404	U	404	UG/KG	UJ	404	LCSL
SED	SVOC	20406302303	062804-SED-02693-00.2	N	SW8270C	SW3510C	m,p-Cresol	391	U	391	UG/KG	UJ	391	LCSL
SED	SVOC	20406302303	062804-SED-02693-00.2	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	391	U	391	UG/KG	UJ	391	LCSL
SED	SVOC	20406302303	062804-SED-02693-00.2	N	SW8270C	SW3510C	Pyridine	391	U	391	UG/KG	UJ	391	LCSL
SED	SVOC	20406302304	062804-SED-02694-00.2	N	SW8270C	SW3510C	m,p-Cresol	366	U	366	UG/KG	UJ	366	LCSL
SED	SVOC	20406302304	062804-SED-02694-00.2	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	366	U	366	UG/KG	UJ	366	LCSL
SED	SVOC	20406302304	062804-SED-02694-00.2	N	SW8270C	SW3510C	Pyridine	366	U	366	UG/KG	UJ	366	LCSL
SED	SVOC	20406302305	062904-SED-02699-00.2	N	SW8270C	SW3510C	m,p-Cresol	376	U	376	UG/KG	UJ	376	LCSL
SED	SVOC	20406302305	062904-SED-02699-00.2	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	376	U	376	UG/KG	UJ	376	LCSL
SED	SVOC	20406302305	062904-SED-02699-00.2	N	SW8270C	SW3510C	Pyridine	376	U	376	UG/KG	UJ	376	LCSL
SED	SVOC	20406302306	062904-SED-02700-00.2	N	SW8270C	SW3510C	m,p-Cresol	374	U	374	UG/KG	UJ	374	LCSL
SED	SVOC	20406302306	062904-SED-02700-00.2	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	374	U	374	UG/KG	UJ	374	LCSL
SED	SVOC	20406302306	062904-SED-02700-00.2	N	SW8270C	SW3510C	Pyridine	374	U	374	UG/KG	UJ	374	LCSL
SED	SVOC	20406302307	062904-SED-02701-00.2	N	SW8270C	SW3510C	m,p-Cresol	403	U	403	UG/KG	UJ	403	LCSL
SED	SVOC	20406302307	062904-SED-02701-00.2	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	403	U	403	UG/KG	UJ	403	LCSL
SED	SVOC	20406302307	062904-SED-02701-00.2	N	SW8270C	SW3510C	Pyridine	403	U	403	UG/KG	UJ	403	LCSL
SED	SVOC	20406302309	062904-SED-02731-00.2	N	SW8270C	SW3510C	m,p-Cresol	395	U	395	UG/KG	UJ	395	LCSL
SED	SVOC	20406302309	062904-SED-02731-00.2	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	395	U	395	UG/KG	UJ	395	LCSL
SED	SVOC	20406302309	062904-SED-02731-00.2	N	SW8270C	SW3510C	Pyridine	395	U	395	UG/KG	UJ	395	LCSL
SED	SVOC	20406302312	062904-SED-02732-00.2	N	SW8270C	SW3510C	m,p-Cresol	417	U	417	UG/KG	UJ	417	LCSL

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SED	SVOC	20406302312	062904-SED-02732-00.2	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	417	U	417	UG/KG	UJ	417	LCSL
SED	SVOC	20406302312	062904-SED-02732-00.2	N	SW8270C	SW3510C	Pyridine	417	U	417	UG/KG	UJ	417	LCSL
SED	SVOC	20406302313	062904-SED-02733-00.2	N	SW8270C	SW3510C	m,p-Cresol	399	U	399	UG/KG	UJ	399	LCSL
SED	SVOC	20406302313	062904-SED-02733-00.2	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	399	U	399	UG/KG	UJ	399	LCSL
SED	SVOC	20406302313	062904-SED-02733-00.2	N	SW8270C	SW3510C	Pyridine	399	U	399	UG/KG	UJ	399	LCSL
SED	SVOC	20406302314	062904-SED-02734-00.2	N	SW8270C	SW3510C	m,p-Cresol	390	U	390	UG/KG	UJ	390	LCSL
SED	SVOC	20406302314	062904-SED-02734-00.2	N	SW8270C	SW3510C	n-Nitrosomethylethylamine	390	U	390	UG/KG	UJ	390	LCSL
SED	SVOC	20406302314	062904-SED-02734-00.2	N	SW8270C	SW3510C	Pyridine	390	U	390	UG/KG	UJ	390	LCSL
SED	SVOC	20406302315	062904-SED-02734-00.2-D	FD	SW8270C	SW3510C	m,p-Cresol	388	U	388	UG/KG	UJ	388	LCSL
SED	SVOC	20406302315	062904-SED-02734-00.2-D	FD	SW8270C	SW3510C	n-Nitrosomethylethylamine	388	U	388	UG/KG	UJ	388	LCSL
SED	SVOC	20406302315	062904-SED-02734-00.2-D	FD	SW8270C	SW3510C	Pyridine	388	U	388	UG/KG	UJ	388	LCSL
SO	SVOC	20406050907	060304-SOI-02720-00.5	N	SW8270C	SW3510C	Hexachloroethane	389	U	389	UG/KG	UJ	389	MSDL
SO	SVOC	20406050918	060404-SOI-02729-00.5	N	SW8270C	SW3510C	4,6-Dinitro-2-methylphenol	2340	U	2340	UG/KG	UJ	2340	MSDL
SO	SVOC	20406050907	060304-SOI-02720-00.5	N	SW8270C	SW3510C	4,6-Dinitro-2-methylphenol	1950	U	1950	UG/KG	UJ	1950	MSL, MSDL
SO	SVOC	20406032405	060104-SOI-02689-04.5	N	SW8081A	SW3510C	Chlorobenzilate	30	U	30	UG/KG	UJ	30	SSL
SO	SVOC	20406032409	060104-SOI-02690-00.5	N	SW8081A	SW3510C	Chlorobenzilate	58.7	U	58.7	UG/KG	UJ	58.7	SSL
SO	SVOC	20406032413	060104-SOI-02690-02.0	N	SW8081A	SW3510C	Chlorobenzilate	28.8	U	28.8	UG/KG	UJ	28.8	SSL
SO	SVOC	20406050905	060304-SOI-02704-00.5-D	FD	SW8081A	SW3510C	Chlorobenzilate	33	U	33	UG/KG	UJ	33	SSL
SO	SVOC	20406050905	060304-SOI-02704-00.5-D	FD	SW8081A	SW3510C	Diallate (Avadex)	33	U	33	UG/KG	UJ	33	SSL
SO	SVOC	20406050905	060304-SOI-02704-00.5-D	FD	SW8081A	SW3510C	Isodrin	33	U	33	UG/KG	UJ	33	SSL
SO	SVOC	20406050912	060404-SOI-02711-00.5	N	SW8081A	SW3510C	Chlorobenzilate	35.3	U	35.3	UG/KG	UJ	35.3	SSL
SO	SVOC	20406050912	060404-SOI-02711-00.5	N	SW8081A	SW3510C	Diallate (Avadex)	35.3	U	35.3	UG/KG	UJ	35.3	SSL
SO	SVOC	20406050912	060404-SOI-02711-00.5	N	SW8081A	SW3510C	Isodrin	35.3	U	35.3	UG/KG	UJ	35.3	SSL
SED	VOC	20407020803	063004-SED-02708-00.2-D	FD	SW8260B	NONE	ACETONITRILE	4.39	U	4.39	UG/KG	UJ	97	CCRRF
SED	VOC	20407020802	063004-SED-02708-00.2	N	SW8260B	NONE	METHYL ETHYL KETONE (2-BUTANONE)	0.342	U	0.342	UG/KG	UJ	5.48	CCRRF
SED	VOC	20407020803	063004-SED-02708-00.2-D	FD	SW8260B	NONE	METHYL ETHYL KETONE (2-BUTANONE)	0.303	U	0.303	UG/KG	UJ	4.85	CCRRF
SED	VOC	20407020802	063004-SED-02708-00.2	N	SW8260B	NONE	ACETONITRILE	4.95	U	4.95	UG/KG	UJ	110	CCRRF
SED	VOC	20407020810	063004-SED-02717-00.2	N	SW8260B	NONE	METHYL ETHYL KETONE (2-BUTANONE)	0.354	U	0.354	UG/KG	UJ	5.67	CCRRF
SED	VOC	20407020810	063004-SED-02717-00.2	N	SW8260B	NONE	ACETONITRILE	5.13	U	5.13	UG/KG	UJ	113	CCRRF
SED	VOC	20407020812	063004-SED-02723-00.2	N	SW8260B	NONE	PENTOCHLORETHANE	0.426	U	0.426	UG/KG	UJ	4.21	CCVL
SED	VOC	20407020814	063004-SED-02725-00.2	N	SW8260B	NONE	PENTOCHLORETHANE	0.425	U	0.425	UG/KG	UJ	4.2	CCVL
SED	VOC	20407020807	063004-SED-02710-00.2	N	SW8260B	NONE	PENTOCHLORETHANE	0.429	U	0.429	UG/KG	UJ	4.24	CCVL
SED	VOC	20407020813	063004-SED-02724-00.2	N	SW8260B	NONE	PENTOCHLORETHANE	0.456	U	0.456	UG/KG	UJ	4.5	CCVL
SED	VOC	20407020810	063004-SED-02717-00.2	N	SW8260B	NONE	CHLOROETHANE	0.687	U	0.687	UG/KG	UJ	5.67	CCVL
SED	VOC	20407020811	063004-SED-02718-00.2	N	SW8260B	NONE	PENTOCHLORETHANE	0.532	U	0.532	UG/KG	UJ	5.25	CCVL
SED	VOC	20407020802	063004-SED-02708-00.2	N	SW8260B	NONE	PENTOCHLORETHANE	0.554	U	0.554	UG/KG	UJ	5.48	CCVL
SED	VOC	20407020802	063004-SED-02708-00.2	N	SW8260B	NONE	CHLOROETHANE	0.664	U	0.664	UG/KG	UJ	5.48	CCVL
SED	VOC	20407020809	063004-SED-02716-00.2	N	SW8260B	NONE	PENTOCHLORETHANE	0.437	U	0.437	UG/KG	UJ	4.32	CCVL
SED	VOC	20407020810	063004-SED-02717-00.2	N	SW8260B	NONE	PENTOCHLORETHANE	0.574	U	0.574	UG/KG	UJ	5.67	CCVL
SED	VOC	20407020806	063004-SED-02709-00.2	N	SW8260B	NONE	PENTOCHLORETHANE	0.468	U	0.468	UG/KG	UJ	4.63	CCVL
SED	VOC	20407020816	063004-SED-02726-00.2-D	FD	SW8260B	NONE	PENTOCHLORETHANE	0.466	U	0.466	UG/KG	UJ	4.61	CCVL
SED	VOC	20407020803	063004-SED-02708-00.2-D	FD	SW8260B	NONE	CHLOROETHANE	0.588	U	0.588	UG/KG	UJ	4.85	CCVL,ICRSD
SED	VOC	20406302304	062804-SED-02694-00.2	N	SW8260B	NONE	ACROLEIN	1.85	U	1.85	UG/KG	UJ	19.7	ICRRF
SED	VOC	20406302304	062804-SED-02694-00.2	N	SW8260B	NONE	PROPIONITRILE	0.788	U	0.788	UG/KG	UJ	3.94	ICRRF
SED	VOC	20406302304	062804-SED-02694-00.2	N	SW8260B	NONE	TETRAHYDROFURAN	78.8	U	78.8	UG/KG	UJ	78.8	ICRRF
SED	VOC	20406302305	062904-SED-02699-00.2	N	SW8260B	NONE	TETRAHYDROFURAN	73.7	U	73.7	UG/KG	UJ	73.7	ICRRF
SED	VOC	20406302314	062904-SED-02734-00.2	N	SW8260B	NONE	ACROLEIN	2.26	U	2.26	UG/KG	UJ	24.1	ICRRF
SED	VOC	20406302314	062904-SED-02734-00.2	N	SW8260B	NONE	PROPIONITRILE	0.965	U	0.965	UG/KG	UJ	4.82	ICRRF
SED	VOC	20406302314	062904-SED-02734-00.2	N	SW8260B	NONE	TETRAHYDROFURAN	96.5	U	96.5	UG/KG	UJ	96.5	ICRRF
SED	VOC	20406302314	062904-SED-02734-00.2	N	SW8260B	NONE	ACETONITRILE	4.36	U	4.36	UG/KG	UJ	96.5	ICRRF
SED	VOC	20406302314	062904-SED-02734-00.2	N	SW8260B	NONE	ISOBUTYL ALCOHOL	0.965	U	0.965	UG/KG	UJ	4.82	ICRRF
SED	VOC	20406302303	062804-SED-02693-00.2	N	SW8260B	NONE	ACROLEIN	2.2	U	2.2	UG/KG	UJ	23.6	ICRRF
SED	VOC	20406302303	062804-SED-02693-00.2	N	SW8260B	NONE	PROPIONITRILE	0.942	U	0.942	UG/KG	UJ	4.71	ICRRF
SED	VOC	20406302305	062904-SED-02699-00.2	N	SW8260B	NONE	ACETONITRILE	3.33	U	3.33	UG/KG	UJ	73.7	ICRRF
SED	VOC	20406302305	062904-SED-02699-00.2	N	SW8260B	NONE	ISOBUTYL ALCOHOL	0.737	U	0.737	UG/KG	UJ	3.69	ICRRF
SED	VOC	20406302315	062904-SED-02734-00.2-D	FD	SW8260B	NONE	ACROLEIN	2.28	U	2.28	UG/KG	UJ	24.4	ICRRF
SED	VOC	20406302315	062904-SED-02734-00.2-D	FD	SW8260B	NONE	TETRAHYDROFURAN	97.6	U	97.6	UG/KG	UJ	97.6	ICRRF
SED	VOC	20406302315	062904-SED-02734-00.2-D	FD	SW8260B	NONE	ACETONITRILE	4.41	U	4.41	UG/KG	UJ	97.6	ICRRF
SED	VOC	20406302307	062904-SED-02701-00.2	N	SW8260B	NONE	ACROLEIN	1.93	U	1.93	UG/KG	UJ	20.6	ICRRF
SED	VOC	20406302307	062904-SED-02701-00.2	N	SW8260B	NONE	PROPIONITRILE	0.823	U	0.823	UG/KG	UJ	4.12	ICRRF
SED	VOC	20406302307	062904-SED-02701-00.2	N	SW8260B	NONE	TETRAHYDROFURAN	82.3	U	82.3	UG/KG	UJ	82.3	ICRRF
SED	VOC	20406302307	062904-SED-02701-00.2	N	SW8260B	NONE	ACETONITRILE	3.72	U	3.72	UG/KG	UJ	82.3	ICRRF
SED	VOC	20406302307	062904-SED-02701-00.2	N	SW8260B	NONE	ISOBUTYL ALCOHOL	0.823	U	0.823	UG/KG	UJ	4.12	ICRRF
SED	VOC	20406302313	062904-SED-02733-00.2	N	SW8260B	NONE	ACROLEIN	2.44	U	2.44	UG/KG	UJ	26	ICRRF
SED	VOC	20406302313	062904-SED-02733-00.2	N	SW8260B	NONE	PROPIONITRILE	1.04	U	1.04	UG/KG	UJ	5.21	ICRRF
SED	VOC	20406302313	062904-SED-02733-00.2	N	SW8260B	NONE	TETRAHYDROFURAN	104	U	104	UG/KG	UJ	104	ICRRF

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SED	VOC	20406302302	062804-SED-02692-00.2	N	SW8260B	NONE	ACROLEIN	2.28	U	2.28	UG/KG	UJ	24.3	ICRRF
SED	VOC	20406302302	062804-SED-02692-00.2	N	SW8260B	NONE	PROPIONITRILE	0.973	U	0.973	UG/KG	UJ	4.87	ICRRF
SED	VOC	20406302302	062804-SED-02692-00.2	N	SW8260B	NONE	TETRAHYDROFURAN	97.3	U	97.3	UG/KG	UJ	97.3	ICRRF
SED	VOC	20406302302	062804-SED-02692-00.2	N	SW8260B	NONE	ACETONITRILE	4.4	U	4.4	UG/KG	UJ	97.3	ICRRF
SED	VOC	20406302302	062804-SED-02692-00.2	N	SW8260B	NONE	ISOBUTYL ALCOHOL	0.973	U	0.973	UG/KG	UJ	4.87	ICRRF
SED	VOC	20406302309	062904-SED-02731-00.2	N	SW8260B	NONE	ACROLEIN	2.21	U	2.21	UG/KG	UJ	23.6	ICRRF
SED	VOC	20406302309	062904-SED-02731-00.2	N	SW8260B	NONE	PROPIONITRILE	0.945	U	0.945	UG/KG	UJ	4.73	ICRRF
SED	VOC	20406302309	062904-SED-02731-00.2	N	SW8260B	NONE	TETRAHYDROFURAN	94.5	U	94.5	UG/KG	UJ	94.5	ICRRF
SED	VOC	20406302309	062904-SED-02731-00.2	N	SW8260B	NONE	ACETONITRILE	4.27	U	4.27	UG/KG	UJ	94.5	ICRRF
SED	VOC	20406302309	062904-SED-02731-00.2	N	SW8260B	NONE	ISOBUTYL ALCOHOL	0.945	U	0.945	UG/KG	UJ	4.73	ICRRF
SED	VOC	20406302301	062804-SED-02691-00.2	N	SW8260B	NONE	ACROLEIN	2.06	U	2.06	UG/KG	UJ	22	ICRRF
SED	VOC	20406302301	062804-SED-02691-00.2	N	SW8260B	NONE	PROPIONITRILE	0.879	U	0.879	UG/KG	UJ	4.39	ICRRF
SED	VOC	20406302301	062804-SED-02691-00.2	N	SW8260B	NONE	TETRAHYDROFURAN	87.9	U	87.9	UG/KG	UJ	87.9	ICRRF
SED	VOC	20406302301	062804-SED-02691-00.2	N	SW8260B	NONE	ACETONITRILE	3.97	U	3.97	UG/KG	UJ	87.9	ICRRF
SED	VOC	20406302301	062804-SED-02691-00.2	N	SW8260B	NONE	ISOBUTYL ALCOHOL	0.879	U	0.879	UG/KG	UJ	4.39	ICRRF
SED	VOC	20406302308	062904-SED-02702-00.2	N	SW8260B	NONE	ACROLEIN	1.7	U	1.7	UG/KG	UJ	18.1	ICRRF
SED	VOC	20406302308	062904-SED-02702-00.2	N	SW8260B	NONE	PROPIONITRILE	0.725	U	0.725	UG/KG	UJ	3.63	ICRRF
SED	VOC	20406302308	062904-SED-02702-00.2	N	SW8260B	NONE	TETRAHYDROFURAN	72.5	U	72.5	UG/KG	UJ	72.5	ICRRF
SED	VOC	20406302304	062804-SED-02694-00.2	N	SW8260B	NONE	ACETONITRILE	3.56	U	3.56	UG/KG	UJ	78.8	ICRRF
SED	VOC	20406302304	062804-SED-02694-00.2	N	SW8260B	NONE	ISOBUTYL ALCOHOL	0.788	U	0.788	UG/KG	UJ	3.94	ICRRF
SED	VOC	20406302313	062904-SED-02733-00.2	N	SW8260B	NONE	ACETONITRILE	4.71	U	4.71	UG/KG	UJ	104	ICRRF
SED	VOC	20406302313	062904-SED-02733-00.2	N	SW8260B	NONE	ISOBUTYL ALCOHOL	1.04	U	1.04	UG/KG	UJ	5.21	ICRRF
SED	VOC	20406302303	062804-SED-02693-00.2	N	SW8260B	NONE	TETRAHYDROFURAN	94.2	U	94.2	UG/KG	UJ	94.2	ICRRF
SED	VOC	20406302303	062804-SED-02693-00.2	N	SW8260B	NONE	ACETONITRILE	4.26	U	4.26	UG/KG	UJ	94.2	ICRRF
SED	VOC	20406302303	062804-SED-02693-00.2	N	SW8260B	NONE	ISOBUTYL ALCOHOL	0.942	U	0.942	UG/KG	UJ	4.71	ICRRF
SED	VOC	20406302306	062904-SED-02700-00.2	N	SW8260B	NONE	ACROLEIN	1.75	U	1.75	UG/KG	UJ	18.7	ICRRF
SED	VOC	20406302306	062904-SED-02700-00.2	N	SW8260B	NONE	PROPIONITRILE	0.749	U	0.749	UG/KG	UJ	3.75	ICRRF
SED	VOC	20406302306	062904-SED-02700-00.2	N	SW8260B	NONE	TETRAHYDROFURAN	74.9	U	74.9	UG/KG	UJ	74.9	ICRRF
SED	VOC	20406302306	062904-SED-02700-00.2	N	SW8260B	NONE	ACETONITRILE	3.39	U	3.39	UG/KG	UJ	74.9	ICRRF
SED	VOC	20406302306	062904-SED-02700-00.2	N	SW8260B	NONE	ISOBUTYL ALCOHOL	0.749	U	0.749	UG/KG	UJ	3.75	ICRRF
SED	VOC	20406302312	062904-SED-02732-00.2	N	SW8260B	NONE	ACROLEIN	2.28	U	2.28	UG/KG	UJ	24.4	ICRRF
SED	VOC	20406302312	062904-SED-02732-00.2	N	SW8260B	NONE	PROPIONITRILE	0.975	U	0.975	UG/KG	UJ	4.88	ICRRF
SED	VOC	20406302312	062904-SED-02732-00.2	N	SW8260B	NONE	TETRAHYDROFURAN	97.5	U	97.5	UG/KG	UJ	97.5	ICRRF
SED	VOC	20406302312	062904-SED-02732-00.2	N	SW8260B	NONE	ACETONITRILE	4.41	U	4.41	UG/KG	UJ	97.5	ICRRF
SED	VOC	20406302312	062904-SED-02732-00.2	N	SW8260B	NONE	ISOBUTYL ALCOHOL	0.975	U	0.975	UG/KG	UJ	4.88	ICRRF
SED	VOC	20406302305	062904-SED-02699-00.2	N	SW8260B	NONE	ACROLEIN	1.72	U	1.72	UG/KG	UJ	18.4	ICRRF
SED	VOC	20406302305	062904-SED-02699-00.2	N	SW8260B	NONE	PROPIONITRILE	0.737	U	0.737	UG/KG	UJ	3.69	ICRRF
SED	VOC	20406302308	062904-SED-02702-00.2	N	SW8260B	NONE	ACETONITRILE	3.28	U	3.28	UG/KG	UJ	72.5	ICRRF
SED	VOC	20406302308	062904-SED-02702-00.2	N	SW8260B	NONE	ISOBUTYL ALCOHOL	0.725	U	0.725	UG/KG	UJ	3.63	ICRRF
SED	VOC	20407020803	063004-SED-02708-00.2-D	FD	SW8260B	NONE	ACRYLONITRILE	0.691	U	0.691	UG/KG	UJ	24.3	ICRRF
SED	VOC	20407020803	063004-SED-02708-00.2-D	FD	SW8260B	NONE	ACROLEIN	2.27	U	2.27	UG/KG	UJ	24.3	ICRRF
SED	VOC	20407020803	063004-SED-02708-00.2-D	FD	SW8260B	NONE	ISOBUTANOL	0.97	U	0.97	UG/KG	UJ	4.85	ICRRF,CCRRF
SED	VOC	20407020813	063004-SED-02724-00.2	N	SW8260B	NONE	2-HEXANONE	0.744	U	0.744	UG/KG	UJ	4.5	ICRSD
SED	VOC	20407020812	063004-SED-02723-00.2	N	SW8260B	NONE	2-HEXANONE	0.696	U	0.696	UG/KG	UJ	4.21	ICRSD
SED	VOC	20407020814	063004-SED-02725-00.2	N	SW8260B	NONE	2-HEXANONE	0.694	U	0.694	UG/KG	UJ	4.2	ICRSD
SED	VOC	20407020814	063004-SED-02725-00.2	N	SW8260B	NONE	ACRYLONITRILE	0.598	U	0.598	UG/KG	UJ	21	ICRSD
SED	VOC	20407020811	063004-SED-02718-00.2	N	SW8260B	NONE	2-HEXANONE	0.868	U	0.868	UG/KG	UJ	5.25	ICRSD
SED	VOC	20407020816	063004-SED-02726-00.2-D	FD	SW8260B	NONE	VINYL ACETATE	0.902	U	0.902	UG/KG	UJ	4.61	ICRSD
SED	VOC	20407020811	063004-SED-02718-00.2	N	SW8260B	NONE	ACRYLONITRILE	0.748	U	0.748	UG/KG	UJ	26.3	ICRSD
SED	VOC	20407020816	063004-SED-02726-00.2-D	FD	SW8260B	NONE	ACRYLONITRILE	0.656	U	0.656	UG/KG	UJ	23	ICRSD
SED	VOC	20407020812	063004-SED-02723-00.2	N	SW8260B	NONE	ACRYLONITRILE	0.6	U	0.6	UG/KG	UJ	21.1	ICRSD
SED	VOC	20407020812	063004-SED-02723-00.2	N	SW8260B	NONE	VINYL ACETATE	0.824	U	0.824	UG/KG	UJ	4.21	ICRSD
SED	VOC	20407020813	063004-SED-02724-00.2	N	SW8260B	NONE	ACRYLONITRILE	0.641	U	0.641	UG/KG	UJ	22.5	ICRSD
SED	VOC	20407020813	063004-SED-02724-00.2	N	SW8260B	NONE	VINYL ACETATE	0.882	U	0.882	UG/KG	UJ	4.5	ICRSD
SED	VOC	20407020809	063004-SED-02716-00.2	N	SW8260B	NONE	ACRYLONITRILE	0.615	U	0.615	UG/KG	UJ	21.6	ICRSD
SED	VOC	20407020809	063004-SED-02716-00.2	N	SW8260B	NONE	2-HEXANONE	0.713	U	0.713	UG/KG	UJ	4.32	ICRSD
SED	VOC	20407020811	063004-SED-02718-00.2	N	SW8260B	NONE	VINYL ACETATE	1.03	U	1.03	UG/KG	UJ	5.25	ICRSD
SED	VOC	20407020803	063004-SED-02708-00.2-D	FD	SW8260B	NONE	BROMOFORM	0.164	U	0.164	UG/KG	UJ	4.85	ICRSD
SED	VOC	20407020803	063004-SED-02708-00.2-D	FD	SW8260B	NONE	PENTOCHLORETHANE	0.491	U	0.491	UG/KG	UJ	4.85	ICRSD
SED	VOC	20407020816	063004-SED-02726-00.2-D	FD	SW8260B	NONE	2-HEXANONE	0.761	U	0.761	UG/KG	UJ	4.61	ICRSD
SED	VOC	20407020807	063004-SED-02710-00.2	N	SW8260B	NONE	ACRYLONITRILE	0.604	U	0.604	UG/KG	UJ	21.2	ICRSD
SED	VOC	20407020807	063004-SED-02710-00.2	N	SW8260B	NONE	VINYL ACETATE	0.831	U	0.831	UG/KG	UJ	4.24	ICRSD
SED	VOC	20407020807	063004-SED-02710-00.2	N	SW8260B	NONE	2-HEXANONE	0.701	U	0.701	UG/KG	UJ	4.24	ICRSD
SED	VOC	20407020806	063004-SED-02709-00.2	N	SW8260B	NONE	VINYL ACETATE	0.906	U	0.906	UG/KG	UJ	4.63	ICRSD
SED	VOC	20407020806	063004-SED-02709-00.2	N	SW8260B	NONE	ACRYLONITRILE	0.659	U	0.659	UG/KG	UJ	23.1	ICRSD
SED	VOC	20407020803	063004-SED-02708-00.2-D	FD	SW8260B	NONE	1,3-DICHLOROBENZENE	0.229	U	0.229	UG/KG	UJ	4.85	ICRSD
SED	VOC	20407020806	063004-SED-02709-00.2	N	SW8260B	NONE	2-HEXANONE	0.765	U	0.765	UG/KG	UJ	4.63	ICRSD
SED	VOC	20407020814	063004-SED-02725-00.2	N	SW8260B	NONE	VINYL ACETATE	0.823	U	0.823	UG/KG	UJ	4.2	ICRSD

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SED	VOC	20407020809	063004-SED-02716-00.2	N	SW8260B	NONE	VINYL ACETATE	0.845	U	0.845	UG/KG	UJ	4.32	ICRSD
SOI	VOC	20406042503DL	060204-SOI-02697-00.5	N	SW8260B	NONE	1,3-DICHLOROBENZENE	21	U	21	UG/KG	UJ	446	ISL
SOI	VOC	20406042503DL	060204-SOI-02697-00.5	N	SW8260B	NONE	1,1,2,2-TETRACHLOROETHANE	16	U	16	UG/KG	UJ	446	ISL
SOI	VOC	20406042503DL	060204-SOI-02697-00.5	N	SW8260B	NONE	1,2,3-TRICHLOROBENZENE	21.1	U	21.1	UG/KG	UJ	446	ISL
SOI	VOC	20406042503DL	060204-SOI-02697-00.5	N	SW8260B	NONE	1,2-DICHLOROBENZENE	10.2	U	10.2	UG/KG	UJ	446	ISL
SOI	VOC	20406042503DL	060204-SOI-02697-00.5	N	SW8260B	NONE	1,2,4-TRIMETHYLBENZENE	17.6	U	17.6	UG/KG	UJ	446	ISL
SOI	VOC	20406042503DL	060204-SOI-02697-00.5	N	SW8260B	NONE	1,2-DIBROMO-3-CHLOROPROPANE	77.2	U	77.2	UG/KG	UJ	446	ISL
SOI	VOC	20406042503DL	060204-SOI-02697-00.5	N	SW8260B	NONE	1,2,3-TRICHLOROPROPANE	21.8	U	21.8	UG/KG	UJ	446	ISL
SOI	VOC	20406042503DL	060204-SOI-02697-00.5	N	SW8260B	NONE	TERT-BUTYLBENZENE	22.5	U	22.5	UG/KG	UJ	446	ISL
SOI	VOC	20406042503DL	060204-SOI-02697-00.5	N	SW8260B	NONE	4-ISOPROPYLTOLUENE	14.3	U	14.3	UG/KG	UJ	446	ISL
SOI	VOC	20406042503DL	060204-SOI-02697-00.5	N	SW8260B	NONE	N-PROPYLBENZENE	12.5	U	12.5	UG/KG	UJ	446	ISL
SOI	VOC	20406042503DL	060204-SOI-02697-00.5	N	SW8260B	NONE	N-BUTYLBENZENE	15.9	U	15.9	UG/KG	UJ	446	ISL
SOI	VOC	20406042503DL	060204-SOI-02697-00.5	N	SW8260B	NONE	1,4-DICHLOROBENZENE	37.5	U	37.5	UG/KG	UJ	446	ISL
SOI	VOC	20406042503DL	060204-SOI-02697-00.5	N	SW8260B	NONE	1,3,5-TRIMETHYLBENZENE	14.5	U	14.5	UG/KG	UJ	446	ISL
SOI	VOC	20406042503DL	060204-SOI-02697-00.5	N	SW8260B	NONE	BROMOBENZENE	20.9	U	20.9	UG/KG	UJ	446	ISL
SOI	VOC	20406042503DL	060204-SOI-02697-00.5	N	SW8260B	NONE	TRANS-1,4-DICHLORO-2-BUTENE	64.3	U	64.3	UG/KG	UJ	446	ISL
SOI	VOC	20406042503DL	060204-SOI-02697-00.5	N	SW8260B	NONE	1,2,4-TRICHLOROBENZENE	29.1	U	29.1	UG/KG	UJ	446	ISL
SOI	VOC	20406042503DL	060204-SOI-02697-00.5	N	SW8260B	NONE	SEC-BUTYLBENZENE	10.4	U	10.4	UG/KG	UJ	446	ISL
SOI	VOC	20406042504DL	060204-SOI-02697-00.5-D	FD	SW8260B	NONE	N-PROPYLBENZENE	8.18	U	8.18	UG/KG	UJ	292	ISL
SOI	VOC	20406042504DL	060204-SOI-02697-00.5-D	FD	SW8260B	NONE	N-BUTYLBENZENE	10.4	U	10.4	UG/KG	UJ	292	ISL
SOI	VOC	20406042504DL	060204-SOI-02697-00.5-D	FD	SW8260B	NONE	1,4-DICHLOROBENZENE	24.6	U	24.6	UG/KG	UJ	292	ISL
SOI	VOC	20406042504DL	060204-SOI-02697-00.5-D	FD	SW8260B	NONE	1,3,5-TRIMETHYLBENZENE	9.52	U	9.52	UG/KG	UJ	292	ISL
SOI	VOC	20406042504DL	060204-SOI-02697-00.5-D	FD	SW8260B	NONE	BROMOBENZENE	13.7	U	13.7	UG/KG	UJ	292	ISL
SOI	VOC	20406042504DL	060204-SOI-02697-00.5-D	FD	SW8260B	NONE	TRANS-1,4-DICHLORO-2-BUTENE	42.1	U	42.1	UG/KG	UJ	292	ISL
SOI	VOC	20406042504DL	060204-SOI-02697-00.5-D	FD	SW8260B	NONE	1,2,4-TRICHLOROBENZENE	19.1	U	19.1	UG/KG	UJ	292	ISL
SOI	VOC	20406042504DL	060204-SOI-02697-00.5-D	FD	SW8260B	NONE	SEC-BUTYLBENZENE	6.84	U	6.84	UG/KG	UJ	292	ISL
SOI	VOC	20406042504DL	060204-SOI-02697-00.5-D	FD	SW8260B	NONE	1,3-DICHLOROBENZENE	13.8	U	13.8	UG/KG	UJ	292	ISL
SOI	VOC	20406042504DL	060204-SOI-02697-00.5-D	FD	SW8260B	NONE	1,1,2,2-TETRACHLOROETHANE	10.5	U	10.5	UG/KG	UJ	292	ISL
SOI	VOC	20406042504DL	060204-SOI-02697-00.5-D	FD	SW8260B	NONE	1,2,3-TRICHLOROBENZENE	13.8	U	13.8	UG/KG	UJ	292	ISL
SOI	VOC	20406042504DL	060204-SOI-02697-00.5-D	FD	SW8260B	NONE	1,2-DICHLOROBENZENE	6.66	U	6.66	UG/KG	UJ	292	ISL
SOI	VOC	20406042504DL	060204-SOI-02697-00.5-D	FD	SW8260B	NONE	1,2,4-TRIMETHYLBENZENE	11.6	U	11.6	UG/KG	UJ	292	ISL
SOI	VOC	20406042504DL	060204-SOI-02697-00.5-D	FD	SW8260B	NONE	1,2-DIBROMO-3-CHLOROPROPANE	50.6	U	50.6	UG/KG	UJ	292	ISL
SOI	VOC	20406042504DL	060204-SOI-02697-00.5-D	FD	SW8260B	NONE	1,2,3-TRICHLOROPROPANE	14.3	U	14.3	UG/KG	UJ	292	ISL
SOI	VOC	20406042504DL	060204-SOI-02697-00.5-D	FD	SW8260B	NONE	TERT-BUTYLBENZENE	14.7	U	14.7	UG/KG	UJ	292	ISL
SOI	VOC	20406042504DL	060204-SOI-02697-00.5-D	FD	SW8260B	NONE	4-ISOPROPYLTOLUENE	9.41	U	9.41	UG/KG	UJ	292	ISL
SED	VOC	20406302309	062904-SED-02731-00.2	N	SW8260B	NONE	ACRYLONITRILE	0.673	U	0.673	UG/KG	UJ	23.6	MSL
SED	VOC	20406302309	062904-SED-02731-00.2	N	SW8260B	NONE	ACETONE	0.354	U	0.354	UG/KG	UJ	23.6	MSL
SED	VOC	20407020803	063004-SED-02708-00.2-D	FD	SW8260B	NONE	M,P-XYLENES	11.7	=	11.7	UG/KG	J	4.85	MSL
SOI	VOC	20406032409	060104-SOI-02690-00.5	N	SW8260B	NONE	1,2,4-TRICHLOROBENZENE	0.333	U	0.333	UG/KG	UJ	5.09	MSL,MSDL,SSL
SOI	VOC	20406032409	060104-SOI-02690-00.5	N	SW8260B	NONE	1,2,3-TRICHLOROBENZENE	0.241	U	0.241	UG/KG	UJ	5.09	MSL,MSDL,SSL
SOI	VOC	20406032409	060104-SOI-02690-00.5	N	SW8260B	NONE	ACETONE	126	=	126	UG/KG	J	25.5	MSL,MSDP,SSL,CCVH,MSDL
SOI	VOC	20406032401	060104-SOI-02687-02.0	N	SW8260B	NONE	ACETONE	54.4	=	54.4	UG/KG	J	33.7	SSL, CCVH
SOI	VOC	20406032412	060104-SOI-02687-00.5-D	FD	SW8260B	NONE	ACETONE	154	=	154	UG/KG	J	30.3	SSL, CCVH
SOI	VOC	20406032407	060104-SOI-02687-04.5	N	SW8260B	NONE	ACETONE	77	=	77	UG/KG	J	25.3	SSL, CCVH
SOI	VOC	20406032402	060104-SOI-02688-02.0	N	SW8260B	NONE	ACETONE	114	=	114	UG/KG	J	26.9	SSL, CCVH
SOI	VOC	20406032404	060104-SOI-02688-04.0	N	SW8260B	NONE	ACETONE	88.1	=	88.1	UG/KG	J	21.5	SSL, CCVH
SOI	VOC	20406032408	060104-SOI-02688-06.0	N	SW8260B	NONE	ACETONE	114	=	114	UG/KG	J	23.8	SSL, CCVH
SOI	VOC	20406032406	060104-SOI-02688-07.0	N	SW8260B	NONE	ACETONE	44.4	=	44.4	UG/KG	J	22.4	SSL, CCVH
SOI	VOC	20406032415	060104-SOI-02689-02.0	N	SW8260B	NONE	ACETONE	359	=	359	UG/KG	J	24.5	SSL, CCVH
SOI	VOC	20406032403	060104-SOI-02689-00.5	N	SW8260B	NONE	ACETONE	142	=	142	UG/KG	J	26.5	SSL, CCVH
SOI	VOC	20406032405	060104-SOI-02689-04.5	N	SW8260B	NONE	ACETONE	191	=	191	UG/KG	J	23.9	SSL, CCVH
SOI	VOC	20406032413	060104-SOI-02690-02.0	N	SW8260B	NONE	ACETONE	100	=	100	UG/KG	J	24.3	SSL, CCVH
SOI	VOC	20406032414	060104-SOI-02687-00.5	N	SW8260B	NONE	ACETONE	82.6	=	82.6	UG/KG	J	32.9	SSL, CCVH
SOI	VOC	20406042501	060204-SOI-02695-00.5	N	SW8260B	NONE	BROMOMETHANE	1.49	U	1.49	UG/KG	UJ	4.94	SSL, ICRSD
SOI	VOC	20406042503	060204-SOI-02697-00.5	N	SW8260B	NONE	BROMOMETHANE	2.04	U	2.04	UG/KG	UJ	6.77	SSL, ICRSD
SOI	VOC	20406042507	060204-SOI-02695-01.5	N	SW8260B	NONE	BROMOMETHANE	1.37	U	1.37	UG/KG	UJ	4.54	SSL, ICRSD
SOI	VOC	20406042502	060204-SOI-02696-00.5	N	SW8260B	NONE	BROMOMETHANE	1.86	U	1.86	UG/KG	UJ	6.18	SSL, ICRSD
SOI	VOC	20406042504	060204-SOI-02697-00.5-D	FD	SW8260B	NONE	BROMOMETHANE	1.85	U	1.85	UG/KG	UJ	6.16	SSL, ICRSD
SOI	VOC	20406042508	060204-SOI-02696-04.0	N	SW8260B	NONE	BROMOMETHANE	2.29	U	2.29	UG/KG	UJ	7.6	SSL, ICRSD
SOI	VOC	20406042511	060204-SOI-02696-02.0	N	SW8260B	NONE	BROMOMETHANE	2.02	U	2.02	UG/KG	UJ	6.7	SSL, ICRSD
SOI	VOC	20406032401	060104-SOI-02687-02.0	N	SW8260B	NONE	BROMOMETHANE	2.03	U	2.03	UG/KG	UJ	6.73	SSL, ICRSD
SOI	VOC	20406032412	060104-SOI-02687-00.5-D	FD	SW8260B	NONE	BROMOMETHANE	1.83	U	1.83	UG/KG	UJ	6.07	SSL, ICRSD
SOI	VOC	20406032407	060104-SOI-02687-04.5	N	SW8260B	NONE	BROMOMETHANE	1.52	U	1.52	UG/KG	UJ	5.06	SSL, ICRSD
SOI	VOC	20406032416	060104-SOI-02688-00.5	N	SW8260B	NONE	BROMOMETHANE	1.65	U	1.65	UG/KG	UJ	5.47	SSL, ICRSD
SOI	VOC	20406032402	060104-SOI-02688-02.0	N	SW8260B	NONE	BROMOMETHANE	1.62	U	1.62	UG/KG	UJ	5.37	SSL, ICRSD
SOI	VOC	20406032404	060104-SOI-02688-04.0	N	SW8260B	NONE	BROMOMETHANE	1.29	U	1.29	UG/KG	UJ	4.3	SSL, ICRSD
SOI	VOC	20406032408	060104-SOI-02688-06.0	N	SW8260B	NONE	BROMOMETHANE	1.43	U	1.43	UG/KG	UJ	4.76	SSL, ICRSD
SOI	VOC	20406032406	060104-SOI-02688-07.0	N	SW8260B	NONE	BROMOMETHANE	1.35	U	1.35	UG/KG	UJ	4.49	SSL, ICRSD

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SOI	VOC	20406032415	060104-SOI-02689-02.0	N	SW8260B	NONE	BROMOMETHANE	1.47	U	1.47	UG/KG	UJ	4.9	SSL, ICRSD
SOI	VOC	20406032403	060104-SOI-02689-00.5	N	SW8260B	NONE	BROMOMETHANE	1.59	U	1.59	UG/KG	UJ	5.29	SSL, ICRSD
SOI	VOC	20406032409	060104-SOI-02690-00.5	N	SW8260B	NONE	BROMOMETHANE	1.53	U	1.53	UG/KG	UJ	5.09	SSL, ICRSD
SOI	VOC	20406032413	060104-SOI-02690-02.0	N	SW8260B	NONE	BROMOMETHANE	1.47	U	1.47	UG/KG	UJ	4.87	SSL, ICRSD
SOI	VOC	20406042510	060204-SOI-02697-02.5	N	SW8260B	NONE	BROMOMETHANE	1.51	U	1.51	UG/KG	UJ	5.01	SSL, ICRSD
SOI	VOC	20406032414	060104-SOI-02687-00.5	N	SW8260B	NONE	BROMOMETHANE	1.98	U	1.98	UG/KG	UJ	6.59	SSL, ICRSD
SOI	VOC	20406042505	060204-SOI-02698-00.5	N	SW8260B	NONE	BROMOMETHANE	1.91	U	1.91	UG/KG	UJ	6.35	SSL, ICRSD
SOI	VOC	20406042503	060204-SOI-02697-00.5	N	SW8260B	NONE	XYLENE (TOTAL)	0.774	U	0.774	UG/KG	UJ	13.5	SSL, ISL
SOI	VOC	20406042501	060204-SOI-02695-00.5	N	SW8260B	NONE	ETHYLBENZENE	0.205	U	0.205	UG/KG	UJ	4.94	SSL, LCSDL
SOI	VOC	20406042508	060204-SOI-02696-04.0	N	SW8260B	NONE	ETHYLBENZENE	0.315	U	0.315	UG/KG	UJ	7.6	SSL, LCSDL
SOI	VOC	20406042511	060204-SOI-02696-02.0	N	SW8260B	NONE	ETHYLBENZENE	0.278	U	0.278	UG/KG	UJ	6.7	SSL, LCSDL
SOI	VOC	20406042503	060204-SOI-02697-00.5	N	SW8260B	NONE	ETHYLBENZENE	0.28	U	0.28	UG/KG	UJ	6.77	SSL, LCSDL
SOI	VOC	20406042510	060204-SOI-02697-02.5	N	SW8260B	NONE	ETHYLBENZENE	0.207	U	0.207	UG/KG	UJ	5.01	SSL, LCSDL
SOI	VOC	20406042504	060204-SOI-02697-00.5-D	FD	SW8260B	NONE	ETHYLBENZENE	0.255	U	0.255	UG/KG	UJ	6.16	SSL, LCSDL
SOI	VOC	20406042505	060204-SOI-02698-00.5	N	SW8260B	NONE	ETHYLBENZENE	0.263	U	0.263	UG/KG	UJ	6.35	SSL, LCSDL
SOI	VOC	20406050911	060304-SOI-02722-00.5	N	SW8260B	NONE	CARBON DISULFIDE	25.8	=	25.8	UG/KG	J	5.1	SSL,CCVH
SOI	VOC	20406050912	060404-SOI-02711-00.5	N	SW8260B	NONE	CARBON DISULFIDE	20	=	20	UG/KG	J	6.14	SSL,CCVH
SOI	VOC	20406050913	060404-SOI-02712-00.5	N	SW8260B	NONE	CARBON DISULFIDE	15.1	=	15.1	UG/KG	J	5.09	SSL,CCVH
SOI	VOC	20406050915	060404-SOI-02714-00.5	N	SW8260B	NONE	CARBON DISULFIDE	24.8	=	24.8	UG/KG	J	6.06	SSL,CCVH
SOI	VOC	20406050914	060404-SOI-02713-00.5	N	SW8260B	NONE	CARBON DISULFIDE	24.9	=	24.9	UG/KG	J	8.43	SSL,CCVH
SOI	VOC	20406050916	060404-SOI-02727-00.5	N	SW8260B	NONE	CARBON DISULFIDE	17.6	=	17.6	UG/KG	J	6.2	SSL,CCVH
SOI	VOC	20406050917	060404-SOI-02728-00.5	N	SW8260B	NONE	CARBON DISULFIDE	23.6	=	23.6	UG/KG	J	6.23	SSL,CCVH
SOI	VOC	20406050918	060404-SOI-02729-00.5	N	SW8260B	NONE	CARBON DISULFIDE	23.1	=	23.1	UG/KG	J	8.53	SSL,CCVH
SOI	VOC	20406050919	060404-SOI-02730-00.5	N	SW8260B	NONE	CARBON DISULFIDE	35.9	=	35.9	UG/KG	J	10.8	SSL,CCVH
SOI	VOC	20406050920	060404-SOI-02730-00.5-D	FD	SW8260B	NONE	CARBON DISULFIDE	36	=	36	UG/KG	J	8.08	SSL,CCVH
SOI	VOC	20406050901	060304-SOI-02703-00.5	N	SW8260B	NONE	TETRAHYDROFURAN	116	U	116	UG/KG	UJ	116	SSL,CCVL
SOI	VOC	20406050904	060304-SOI-02704-00.5	N	SW8260B	NONE	TETRAHYDROFURAN	204	U	204	UG/KG	UJ	204	SSL,CCVL
SOI	VOC	20406050905	060304-SOI-02704-00.5-D	FD	SW8260B	NONE	TETRAHYDROFURAN	150	U	150	UG/KG	UJ	150	SSL,CCVL
SOI	VOC	20406050902	060304-SOI-02705-00.5	N	SW8260B	NONE	TETRAHYDROFURAN	142	U	142	UG/KG	UJ	142	SSL,CCVL
SOI	VOC	20406050903	060304-SOI-02706-00.5	N	SW8260B	NONE	TETRAHYDROFURAN	107	U	107	UG/KG	UJ	107	SSL,CCVL
SOI	VOC	20406050906	060304-SOI-02719-00.5	N	SW8260B	NONE	TETRAHYDROFURAN	128	U	128	UG/KG	UJ	128	SSL,CCVL
SOI	VOC	20406050907	060304-SOI-02720-00.5	N	SW8260B	NONE	ALLYL CHLORIDE	1.18	U	1.18	UG/KG	UJ	5.89	SSL,CCVL
SOI	VOC	20406050907	060304-SOI-02720-00.5	N	SW8260B	NONE	TETRAHYDROFURAN	118	U	118	UG/KG	UJ	118	SSL,CCVL
SOI	VOC	20406050910	060304-SOI-02721-00.5	N	SW8260B	NONE	METHYLENE CHLORIDE	0.525	U	0.525	UG/KG	UJ	5.48	SSL,CCVL
SOI	VOC	20406050911	060304-SOI-02722-00.5	N	SW8260B	NONE	ACETONE	144	=	144	UG/KG	J	25.5	SSL,CCVL
SOI	VOC	20406050911	060304-SOI-02722-00.5	N	SW8260B	NONE	METHYLENE CHLORIDE	0.489	U	0.489	UG/KG	UJ	5.1	SSL,CCVL
SOI	VOC	20406050912	060404-SOI-02711-00.5	N	SW8260B	NONE	ACETONE	109	=	109	UG/KG	J	30.7	SSL,CCVL
SOI	VOC	20406050912	060404-SOI-02711-00.5	N	SW8260B	NONE	METHYLENE CHLORIDE	0.589	U	0.589	UG/KG	UJ	6.14	SSL,CCVL
SOI	VOC	20406050913	060404-SOI-02712-00.5	N	SW8260B	NONE	ACETONE	92.1	=	92.1	UG/KG	J	25.4	SSL,CCVL
SOI	VOC	20406050913	060404-SOI-02712-00.5	N	SW8260B	NONE	METHYLENE CHLORIDE	0.487	U	0.487	UG/KG	UJ	5.09	SSL,CCVL
SOI	VOC	20406050915	060404-SOI-02714-00.5	N	SW8260B	NONE	ACETONE	55.7	=	55.7	UG/KG	J	30.3	SSL,CCVL
SOI	VOC	20406050915	060404-SOI-02714-00.5	N	SW8260B	NONE	METHYLENE CHLORIDE	0.581	U	0.581	UG/KG	UJ	6.06	SSL,CCVL
SOI	VOC	20406050914	060404-SOI-02713-00.5	N	SW8260B	NONE	ACETONE	86.5	=	86.5	UG/KG	J	42.2	SSL,CCVL
SOI	VOC	20406050914	060404-SOI-02713-00.5	N	SW8260B	NONE	METHYLENE CHLORIDE	0.808	U	0.808	UG/KG	UJ	8.43	SSL,CCVL
SOI	VOC	20406050916	060404-SOI-02727-00.5	N	SW8260B	NONE	ACETONE	43.1	=	43.1	UG/KG	J	31	SSL,CCVL
SOI	VOC	20406050916	060404-SOI-02727-00.5	N	SW8260B	NONE	METHYLENE CHLORIDE	0.594	U	0.594	UG/KG	UJ	6.2	SSL,CCVL
SOI	VOC	20406050917	060404-SOI-02728-00.5	N	SW8260B	NONE	ACETONE	55.3	=	55.3	UG/KG	J	31.1	SSL,CCVL
SOI	VOC	20406050917	060404-SOI-02728-00.5	N	SW8260B	NONE	METHYLENE CHLORIDE	0.596	U	0.596	UG/KG	UJ	6.23	SSL,CCVL
SOI	VOC	20406050918	060404-SOI-02729-00.5	N	SW8260B	NONE	ACETONE	218	=	218	UG/KG	J	42.7	SSL,CCVL
SOI	VOC	20406050919	060404-SOI-02730-00.5	N	SW8260B	NONE	ACETONE	174	=	174	UG/KG	J	54.2	SSL,CCVL
SOI	VOC	20406050920	060404-SOI-02730-00.5-D	FD	SW8260B	NONE	ACETONE	135	=	135	UG/KG	J	40.4	SSL,CCVL
SOI	VOC	20406050920	060404-SOI-02730-00.5-D	FD	SW8260B	NONE	METHYLENE CHLORIDE	0.775	U	0.775	UG/KG	UJ	8.08	SSL,CCVL
SED	VOC	20407020815	063004-SED-02726-00.2	N	SW8260B	NONE	PENTOCHLORETHANE	0.468	U	0.468	UG/KG	UJ	4.62	SSL,CCVL
SED	VOC	20407020808	063004-SED-02715-00.2	N	SW8260B	NONE	PENTOCHLORETHANE	0.597	U	0.597	UG/KG	UJ	5.9	SSL,CCVL
SED	VOC	20407020801	063004-SED-02707-00.2	N	SW8260B	NONE	PENTOCHLORETHANE	0.443	U	0.443	UG/KG	UJ	4.38	SSL,CCVL
SOI	VOC	20406050907	060304-SOI-02720-00.5	N	SW8260B	NONE	PROPIONITRILE	1.18	U	1.18	UG/KG	UJ	5.89	SSL,CCVL,CCRRF
SOI	VOC	20406050901	060304-SOI-02703-00.5	N	SW8260B	NONE	ACROLEIN	2.7	U	2.7	UG/KG	UJ	28.9	SSL,ICRRF
SOI	VOC	20406050904	060304-SOI-02704-00.5	N	SW8260B	NONE	ACROLEIN	4.78	U	4.78	UG/KG	UJ	51.1	SSL,ICRRF
SOI	VOC	20406050905	060304-SOI-02704-00.5-D	FD	SW8260B	NONE	ACROLEIN	3.52	U	3.52	UG/KG	UJ	37.6	SSL,ICRRF
SOI	VOC	20406050902	060304-SOI-02705-00.5	N	SW8260B	NONE	ACROLEIN	3.33	U	3.33	UG/KG	UJ	35.5	SSL,ICRRF
SOI	VOC	20406050903	060304-SOI-02706-00.5	N	SW8260B	NONE	ACROLEIN	2.51	U	2.51	UG/KG	UJ	26.8	SSL,ICRRF
SOI	VOC	20406050906	060304-SOI-02719-00.5	N	SW8260B	NONE	ACROLEIN	2.99	U	2.99	UG/KG	UJ	32	SSL,ICRRF
SOI	VOC	20406032412	060104-SOI-02687-00.5-D	FD	SW8260B	NONE	ACROLEIN	2.84	U	2.84	UG/KG	UJ	30.3	SSL,ICRRF,CCRRF
SOI	VOC	20406032407	060104-SOI-02687-04.5	N	SW8260B	NONE	ACROLEIN	2.37	U	2.37	UG/KG	UJ	25.3	SSL,ICRRF,CCRRF
SOI	VOC	20406032402	060104-SOI-02688-02.0	N	SW8260B	NONE	ACROLEIN	2.51	U	2.51	UG/KG	UJ	26.9	SSL,ICRRF,CCRRF
SOI	VOC	20406032416	060104-SOI-02688-00.5	N	SW8260B	NONE	ACROLEIN	2.56	U	2.56	UG/KG	UJ	27.3	SSL,ICRRF,CCRRF
SOI	VOC	20406032404	060104-SOI-02688-04.0	N	SW8260B	NONE	ACROLEIN	2.01	U	2.01	UG/KG	UJ	21.5	SSL,ICRRF,CCRRF
SOI	VOC	20406032408	060104-SOI-02688-06.0	N	SW8260B	NONE	ACROLEIN	2.23	U	2.23	UG/KG	UJ	23.8	SSL,ICRRF,CCRRF

Table B.1
Validation Summary - Changed Qualifiers

SAMPLE TYPE	PARAMETER GROUP	LAB SAMPLE ID	FIELD SAMPLE ID	SAMPLE PURPOSE	ANALYTICAL METHOD	PREP METHOD	PARAMETER NAME	LAB RESULT	LAB QUAL	REPORT RESULT	REPORT UNITS	VAL QUAL	LAB DETECTION LIMIT	VALIDATION REASON CODES
SOI	VOC	20406032406	060104-SOI-02688-07.0	N	SW8260B	NONE	ACROLEIN	2.1	U	2.1	UG/KG	UJ	22.4	SSL,ICRRF,CCRRF
SOI	VOC	20406032415	060104-SOI-02689-02.0	N	SW8260B	NONE	ACROLEIN	2.29	U	2.29	UG/KG	UJ	24.5	SSL,ICRRF,CCRRF
SOI	VOC	20406032403	060104-SOI-02689-00.5	N	SW8260B	NONE	ACROLEIN	2.48	U	2.48	UG/KG	UJ	26.5	SSL,ICRRF,CCRRF
SOI	VOC	20406032405	060104-SOI-02689-04.5	N	SW8260B	NONE	ACROLEIN	2.24	U	2.24	UG/KG	UJ	23.9	SSL,ICRRF,CCRRF
SOI	VOC	20406032409	060104-SOI-02690-00.5	N	SW8260B	NONE	ACROLEIN	2.38	U	2.38	UG/KG	UJ	25.5	SSL,ICRRF,CCRRF
SOI	VOC	20406032401	060104-SOI-02687-02.0	N	SW8260B	NONE	ACROLEIN	3.15	U	3.15	UG/KG	UJ	33.7	SSL,ICRRF,CCRRF
SOI	VOC	20406050901	060304-SOI-02703-00.5	N	SW8260B	NONE	ISOBUTYL ALCOHOL	1.16	U	1.16	UG/KG	UJ	5.78	SSL,ICRRF,CCRRF
SOI	VOC	20406050904	060304-SOI-02704-00.5	N	SW8260B	NONE	ISOBUTYL ALCOHOL	2.04	U	2.04	UG/KG	UJ	10.2	SSL,ICRRF,CCRRF
SOI	VOC	20406050905	060304-SOI-02704-00.5-D	FD	SW8260B	NONE	ISOBUTYL ALCOHOL	1.5	U	1.5	UG/KG	UJ	7.52	SSL,ICRRF,CCRRF
SOI	VOC	20406050903	060304-SOI-02706-00.5	N	SW8260B	NONE	ISOBUTYL ALCOHOL	1.07	U	1.07	UG/KG	UJ	5.36	SSL,ICRRF,CCRRF
SOI	VOC	20406050902	060304-SOI-02705-00.5	N	SW8260B	NONE	ISOBUTYL ALCOHOL	1.42	U	1.42	UG/KG	UJ	7.11	SSL,ICRRF,CCRRF
SOI	VOC	20406050906	060304-SOI-02719-00.5	N	SW8260B	NONE	ISOBUTYL ALCOHOL	1.28	U	1.28	UG/KG	UJ	6.4	SSL,ICRRF,CCRRF
SOI	VOC	20406050910	060304-SOI-02721-00.5	N	SW8260B	NONE	ACROLEIN	2.57	U	2.57	UG/KG	UJ	27.4	SSL,ICRRF,CCRRF
SOI	VOC	20406050910	060304-SOI-02721-00.5	N	SW8260B	NONE	ISOBUTYL ALCOHOL	1.1	U	1.1	UG/KG	UJ	5.48	SSL,ICRRF,CCRRF
SOI	VOC	20406050911	060304-SOI-02722-00.5	N	SW8260B	NONE	ACROLEIN	2.39	U	2.39	UG/KG	UJ	25.5	SSL,ICRRF,CCRRF
SOI	VOC	20406050911	060304-SOI-02722-00.5	N	SW8260B	NONE	ISOBUTYL ALCOHOL	1.02	U	1.02	UG/KG	UJ	5.1	SSL,ICRRF,CCRRF
SOI	VOC	20406050912	060404-SOI-02711-00.5	N	SW8260B	NONE	ACROLEIN	2.88	U	2.88	UG/KG	UJ	30.7	SSL,ICRRF,CCRRF
SOI	VOC	20406050913	060404-SOI-02712-00.5	N	SW8260B	NONE	ACROLEIN	2.38	U	2.38	UG/KG	UJ	25.4	SSL,ICRRF,CCRRF
SOI	VOC	20406050912	060404-SOI-02711-00.5	N	SW8260B	NONE	ISOBUTYL ALCOHOL	1.23	U	1.23	UG/KG	UJ	6.14	SSL,ICRRF,CCRRF
SOI	VOC	20406050913	060404-SOI-02712-00.5	N	SW8260B	NONE	ISOBUTYL ALCOHOL	1.02	U	1.02	UG/KG	UJ	5.09	SSL,ICRRF,CCRRF
SOI	VOC	20406050915	060404-SOI-02714-00.5	N	SW8260B	NONE	ACROLEIN	2.84	U	2.84	UG/KG	UJ	30.3	SSL,ICRRF,CCRRF
SOI	VOC	20406050914	060404-SOI-02713-00.5	N	SW8260B	NONE	ACROLEIN	3.95	U	3.95	UG/KG	UJ	42.2	SSL,ICRRF,CCRRF
SOI	VOC	20406050914	060404-SOI-02713-00.5	N	SW8260B	NONE	ISOBUTYL ALCOHOL	1.69	U	1.69	UG/KG	UJ	8.43	SSL,ICRRF,CCRRF
SOI	VOC	20406050915	060404-SOI-02714-00.5	N	SW8260B	NONE	ISOBUTYL ALCOHOL	1.21	U	1.21	UG/KG	UJ	6.06	SSL,ICRRF,CCRRF
SOI	VOC	20406050916	060404-SOI-02727-00.5	N	SW8260B	NONE	ACROLEIN	2.9	U	2.9	UG/KG	UJ	31	SSL,ICRRF,CCRRF
SOI	VOC	20406050917	060404-SOI-02728-00.5	N	SW8260B	NONE	ACROLEIN	2.91	U	2.91	UG/KG	UJ	31.1	SSL,ICRRF,CCRRF
SOI	VOC	20406050916	060404-SOI-02727-00.5	N	SW8260B	NONE	ISOBUTYL ALCOHOL	1.24	U	1.24	UG/KG	UJ	6.2	SSL,ICRRF,CCRRF
SOI	VOC	20406050917	060404-SOI-02728-00.5	N	SW8260B	NONE	ISOBUTYL ALCOHOL	1.25	U	1.25	UG/KG	UJ	6.23	SSL,ICRRF,CCRRF
SOI	VOC	20406050918	060404-SOI-02729-00.5	N	SW8260B	NONE	ACROLEIN	3.99	U	3.99	UG/KG	UJ	42.7	SSL,ICRRF,CCRRF
SOI	VOC	20406050918	060404-SOI-02729-00.5	N	SW8260B	NONE	ISOBUTYL ALCOHOL	1.71	U	1.71	UG/KG	UJ	8.53	SSL,ICRRF,CCRRF
SOI	VOC	20406050919	060404-SOI-02730-00.5	N	SW8260B	NONE	ACROLEIN	5.07	U	5.07	UG/KG	UJ	54.2	SSL,ICRRF,CCRRF
SOI	VOC	20406050920	060404-SOI-02730-00.5-D	FD	SW8260B	NONE	ACROLEIN	3.78	U	3.78	UG/KG	UJ	40.4	SSL,ICRRF,CCRRF
SOI	VOC	20406050919	060404-SOI-02730-00.5	N	SW8260B	NONE	ISOBUTYL ALCOHOL	2.17	U	2.17	UG/KG	UJ	10.8	SSL,ICRRF,CCRRF
SOI	VOC	20406050920	060404-SOI-02730-00.5-D	FD	SW8260B	NONE	ISOBUTYL ALCOHOL	1.62	U	1.62	UG/KG	UJ	8.08	SSL,ICRRF,CCRRF
SOI	VOC	20406032414	060104-SOI-02687-00.5	N	SW8260B	NONE	ACROLEIN	3.08	U	3.08	UG/KG	UJ	32.9	SSL,ICRRF,CCRRF
SOI	VOC	20406050907	060304-SOI-02720-00.5	N	SW8260B	NONE	ISOBUTYL ALCOHOL	1.18	U	1.18	UG/KG	UJ	5.89	SSL,ICRRF,CCVL,CCRRF
SOI	VOC	20406050901	060304-SOI-02703-00.5	N	SW8260B	NONE	BROMOMETHANE	1.74	U	1.74	UG/KG	UJ	5.78	SSL,ICRSD
SOI	VOC	20406050905	060304-SOI-02704-00.5-D	FD	SW8260B	NONE	BROMOMETHANE	2.26	U	2.26	UG/KG	UJ	7.52	SSL,ICRSD
SOI	VOC	20406050904	060304-SOI-02704-00.5	N	SW8260B	NONE	BROMOMETHANE	3.07	U	3.07	UG/KG	UJ	10.2	SSL,ICRSD
SOI	VOC	20406050903	060304-SOI-02706-00.5	N	SW8260B	NONE	BROMOMETHANE	1.61	U	1.61	UG/KG	UJ	5.36	SSL,ICRSD
SOI	VOC	20406050902	060304-SOI-02705-00.5	N	SW8260B	NONE	BROMOMETHANE	2.14	U	2.14	UG/KG	UJ	7.11	SSL,ICRSD
SOI	VOC	20406050906	060304-SOI-02719-00.5	N	SW8260B	NONE	BROMOMETHANE	1.93	U	1.93	UG/KG	UJ	6.4	SSL,ICRSD
SOI	VOC	20406050910	060304-SOI-02721-00.5	N	SW8260B	NONE	BROMOMETHANE	1.65	U	1.65	UG/KG	UJ	5.48	SSL,ICRSD
SOI	VOC	20406050911	060304-SOI-02722-00.5	N	SW8260B	NONE	BROMOMETHANE	1.54	U	1.54	UG/KG	UJ	5.1	SSL,ICRSD
SOI	VOC	20406050912	060404-SOI-02711-00.5	N	SW8260B	NONE	BROMOMETHANE	1.85	U	1.85	UG/KG	UJ	6.14	SSL,ICRSD
SOI	VOC	20406050913	060404-SOI-02712-00.5	N	SW8260B	NONE	BROMOMETHANE	1.53	U	1.53	UG/KG	UJ	5.09	SSL,ICRSD
SOI	VOC	20406050915	060404-SOI-02714-00.5	N	SW8260B	NONE	BROMOMETHANE	1.82	U	1.82	UG/KG	UJ	6.06	SSL,ICRSD
SOI	VOC	20406050914	060404-SOI-02713-00.5	N	SW8260B	NONE	BROMOMETHANE	2.54	U	2.54	UG/KG	UJ	8.43	SSL,ICRSD
SOI	VOC	20406050916	060404-SOI-02727-00.5	N	SW8260B	NONE	BROMOMETHANE	1.87	U	1.87	UG/KG	UJ	6.2	SSL,ICRSD
SOI	VOC	20406050917	060404-SOI-02728-00.5	N	SW8260B	NONE	BROMOMETHANE	1.87	U	1.87	UG/KG	UJ	6.23	SSL,ICRSD
SOI	VOC	20406050918	060404-SOI-02729-00.5	N	SW8260B	NONE	BROMOMETHANE	2.57	U	2.57	UG/KG	UJ	8.53	SSL,ICRSD
SOI	VOC	20406050919	060404-SOI-02730-00.5	N	SW8260B	NONE	BROMOMETHANE	3.26	U	3.26	UG/KG	UJ	10.8	SSL,ICRSD
SOI	VOC	20406050920	060404-SOI-02730-00.5-D	FD	SW8260B	NONE	BROMOMETHANE	2.43	U	2.43	UG/KG	UJ	8.08	SSL,ICRSD
SED	VOC	20407020815	063004-SED-02726-00.2	N	SW8260B	NONE	2-HEXANONE	0.764	U	0.764	UG/KG	UJ	4.62	SSL,ICRSD
SED	VOC	20407020815	063004-SED-02726-00.2	N	SW8260B	NONE	ACRYLONITRILE	0.658	U	0.658	UG/KG	UJ	23.1	SSL,ICRSD
SED	VOC	20407020815	063004-SED-02726-00.2	N	SW8260B	NONE	VINYL ACETATE	0.905	U	0.905	UG/KG	UJ	4.62	SSL,ICRSD
SED	VOC	20407020808	063004-SED-02715-00.2	N	SW8260B	NONE	VINYL ACETATE	1.15	U	1.15	UG/KG	UJ	5.9	SSL,ICRSD
SED	VOC	20407020801	063004-SED-02707-00.2	N	SW8260B	NONE	VINYL ACETATE	0.857	U	0.857	UG/KG	UJ	4.38	SSL,ICRSD
SED	VOC	20407020808	063004-SED-02715-00.2	N	SW8260B	NONE	2-HEXANONE	0.974	U	0.974	UG/KG	UJ	5.9	SSL,ICRSD
SED	VOC	20407020801	063004-SED-02707-00.2	N	SW8260B	NONE	ACETONITRILE	3.96	U	3.96	UG/KG	UJ	87.5	SSL,ICRSD
SED	VOC	20407020801	063004-SED-02707-00.2	N	SW8260B	NONE	2-HEXANONE	0.723	U	0.723	UG/KG	UJ	4.38	SSL,ICRSD
SED	VOC	20407020808	063004-SED-02715-00.2	N	SW8260B	NONE	ACRYLONITRILE	0.84	U	0.84	UG/KG	UJ	29.5	SSL,ICRSD
SOI	VOC	20406050907	060304-SOI-02720-00.5	N	SW8260B	NONE	BROMOMETHANE	1.77	U	1.77	UG/KG	UJ	5.89	SSL,ICRSD,CCVL
SOI	VOC	20406050906	060304-SOI-02719-00.5	N	SW8260B	NONE	ETHYLBENZENE	0.265	U	0.265	UG/KG	UJ	6.4	SSL,LCSL,LCSDL
SOI	VOC	20406032409	060104-SOI-02690-00.5	N	SW8260B	NONE	ISOPROPYLBENZENE (CUMENE)	0.156	U	0.156	UG/KG	UJ	5.09	SSL,MSDL

Table B.2
Validation Summary - Detections in Blank Samples

Matrix	Parameter Group	SDG	Lab Sample ID	Field ID	QAQC Type	LR Type	Analysis Method	Extraction Method	Analyte	Lab Result	Lab Qualifier	RL Adjusted	Units
QCW	GEN	204060425	20406042516	060204-QCW-02738-R	EB		SW9060	NONE	Total Organic Carbon	1.1	=	1	mg/L
QCW	MET	204060425	171930	171930	LB		SW6010B	SW3010A	Antimony	2.61	B	20	ug/L
QCW	MET	204060509	171930	171930	LB		SW6010B	SW3010A	Antimony	2.61	B	20	ug/L
SO	MET	204063023	177477	177477	LB		SW6010B	SW3050B	Antimony	176	B	2000	ug/Kg
QCW	MET	204060425	20406042516	060204-QCW-02738-R	EB		SW6010B	SW3010A	Barium	0.53	B	10	ug/L
QCW	MET	204063023	20406302317	062904-QCW-02734-R	EB		SW6010B	SW3010A	Barium	1.29	B	10	ug/L
SO	MET	204060324	171117	171117	LB		SW6010B	SW3050B	Beryllium	9.05	B	200	ug/Kg
SO	MET	204060425	171435	171435	LB		SW6010B	SW3050B	Beryllium	12	B	200	ug/Kg
SO	MET	204060509	171733	171733	LB		SW6010B	SW3050B	Beryllium	8.04	B	200	ug/Kg
SO	MET	204063023	177919	177919	LB		SW6010B	SW3050B	Beryllium	3.31	B	200	ug/Kg
SO	MET	204070208	178095	178095	LB	RE	SW6010B	SW3050B	Beryllium	2.61	B	200	ug/Kg
SO	MET	204060324	171117	171117	LB		SW6010B	SW3050B	Cadmium	37	B	200	ug/Kg
SO	MET	204060425	171435	171435	LB		SW6010B	SW3050B	Cadmium	12.5	B	200	ug/Kg
SO	MET	204060509	171733	171733	LB		SW6010B	SW3050B	Cadmium	14.9	B	200	ug/Kg
QCW	MET	204060425	171930	171930	LB		SW6010B	SW3010A	Cadmium	1.73	B	5	ug/L
QCW	MET	204060509	171930	171930	LB		SW6010B	SW3010A	Cadmium	1.73	B	5	ug/L
SO	MET	204063023	177477	177477	LB		SW6010B	SW3050B	Cadmium	49	B	200	ug/Kg
SO	MET	204063023	177919	177919	LB		SW6010B	SW3050B	Cadmium	15.7	B	200	ug/Kg
SO	MET	204070208	178095	178095	LB	RE	SW6010B	SW3050B	Cadmium	34.9	B	200	ug/Kg
QCW	MET	204070208	178907	178907	LB		SW6010B	SW3010A	Cadmium	0.41	B	5	ug/L
QCW	MET	204063023	178907	178907	LB		SW6010B	SW3010A	Cadmium	0.41	B	5	ug/L
QCW	MET	204060425	20406042516	060204-QCW-02738-R	EB		SW6010B	SW3010A	Cobalt	0.66	B	10	ug/L
QCW	MET	204060509	171930	171930	LB		SW6010B	SW3010A	Lead	1.22	B	10	ug/L
QCW	MET	204060425	171930	171930	LB		SW6010B	SW3010A	Lead	1.22	B	10	ug/L
QCW	MET	204070208	178907	178907	LB		SW6010B	SW3010A	Lead	2.05	B	10	ug/L
QCW	MET	204063023	178907	178907	LB		SW6010B	SW3010A	Lead	2.05	B	10	ug/L
QCW	MET	204063023	20406302317	062904-QCW-02734-R	EB		SW6010B	SW3010A	Lead	1.98	B	10	ug/L
SO	MET	204070208	178097	178097	LB		SW7471	METHOD	Mercury	3.01	B	10	ug/Kg
SO	MET	204060324	171117	171117	LB		SW6010B	SW3050B	Nickel	64.3	B	1000	ug/Kg
SO	MET	204060425	171435	171435	LB		SW6010B	SW3050B	Nickel	60.1	B	1000	ug/Kg
SO	MET	204060509	171733	171733	LB		SW6010B	SW3050B	Nickel	33.5	B	1000	ug/Kg
SO	MET	204070208	178095	178095	LB	RE	SW6010B	SW3050B	Nickel	22.5	B	1000	ug/Kg
QCW	MET	204060425	20406042516	060204-QCW-02738-R	EB		SW6010B	SW3010A	Nickel	0.51	B	25	ug/L
QCW	MET	204060509	20406050922	060404-QCW-02747-R	EB		SW6010B	SW3010A	Nickel	0.56	B	25	ug/L
SO	MET	204060324	171117	171117	LB		SW6010B	SW3050B	Thallium	229	B	800	ug/Kg
SO	MET	204060425	171435	171435	LB		SW6010B	SW3050B	Thallium	246	B	800	ug/Kg
SO	MET	204060509	171733	171733	LB		SW6010B	SW3050B	Thallium	116	B	800	ug/Kg
SO	MET	204063023	177919	177919	LB		SW6010B	SW3050B	Thallium	199	B	800	ug/Kg
QCW	MET	204070208	178907	178907	LB		SW6010B	SW3010A	Thallium	6.79	B	20	ug/L
QCW	MET	204063023	178907	178907	LB		SW6010B	SW3010A	Thallium	6.79	B	20	ug/L
QCW	MET	204060509	20406050922	060404-QCW-02747-R	EB		SW6010B	SW3010A	Thallium	3.29	B	20	ug/L
QCW	MET	204063023	20406302317	062904-QCW-02734-R	EB		SW6010B	SW3010A	Thallium	5.3	B	20	ug/L
SO	MET	204060324	171117	171117	LB		SW6010B	SW3050B	Tin	977	B	4000	ug/Kg
SO	MET	204060425	171435	171435	LB		SW6010B	SW3050B	Tin	784	B	4000	ug/Kg

Table B.2
Validation Summary - Detections in Blank Samples

Matrix	Parameter Group	SDG	Lab Sample ID	Field ID	QAQC Type	LR Type	Analysis Method	Extraction Method	Analyte	Lab Result	Lab Qualifier	RL Adjusted	Units
SO	MET	204060509	171733	171733	LB		SW6010B	SW3050B	Tin	1240	B	4000	ug/Kg
SO	MET	204063023	177477	177477	LB		SW6010B	SW3050B	Tin	1000	B	4000	ug/Kg
SO	MET	204070208	178095	178095	LB	RE	SW6010B	SW3050B	Tin	871	B	4000	ug/Kg
SO	MET	204070208	178095	178095	LB		SW6010B	SW3050B	Zinc	485	B	800	ug/Kg
QCW	MET	204060425	20406042516	060204-QCW-02738-R	EB		SW6010B	SW3010A	Zinc	24	=	20	ug/L
QCW	MET	204063023	20406302317	062904-QCW-02734-R	EB		SW6010B	SW3010A	Zinc	16.6	B	20	ug/L
QCW	SVOC	204060425	20406042516	060204-QCW-02738-R	EB		SW8270C	SW3510C	Hexabromobenzene	18.4	=	5	ug/L
QCW	SVOC	204060509	20406050922	060404-QCW-02747-R	EB		SW8270C	SW3510C	Hexabromobenzene	19.1	=	5	ug/L
SO	VOC	204070208	179417	179417	LB		SW8260B	NONE	Acetone	1.83	J	25	ug/Kg
QCW	VOC	204060425	20406042516	060204-QCW-02738-R	EB		SW8260B	NONE	Chloroform	0.229	J	1	ug/L
QCW	VOC	204060509	20406050922	060404-QCW-02747-R	EB		SW8260B	NONE	Chloroform	0.172	J	1	ug/L
QCW	VOC	204060509	20406050923	060304-QCW-02746-T	TB		SW8260B	NONE	m,p-Xylene	0.098	J	2	ug/L
QCW	VOC	204060509	173634	173634	LB		SW8260B	NONE	Methylene chloride	0.128	J	5	ug/L
QCW	VOC	204060425	173634	173634	LB		SW8260B	NONE	Methylene chloride	0.128	J	5	ug/L
SO	VOC	204063023	178506	178506	LB		SW8260B	NONE	Methylene chloride	1.19	J	5	ug/Kg
SO	VOC	204070208	179417	179417	LB		SW8260B	NONE	Methylene chloride	1.58	J	5	ug/Kg
SO	VOC	204070208	179420	179420	LB		SW8260B	NONE	Methylene chloride	1.91	J	5	ug/Kg
QCW	VOC	204060425	20406042516	060204-QCW-02738-R	EB		SW8260B	NONE	Methylene chloride	0.701	J	5	ug/L
QCW	VOC	204060509	20406050922	060404-QCW-02747-R	EB		SW8260B	NONE	Methylene chloride	0.157	J	5	ug/L
QCW	VOC	204060509	20406050923	060304-QCW-02746-T	TB		SW8260B	NONE	Methylene chloride	0.93	J	5	ug/L
QCW	VOC	204060509	20406050924	060304-QCW-02745-T	TB		SW8260B	NONE	Methylene chloride	0.52	J	5	ug/L
QCW	VOC	204060509	20406050925	060404-QCW-02748-T	TB		SW8260B	NONE	Methylene chloride	0.657	J	5	ug/L
QCW	VOC	204060509	20406050926	060404-QCW-02749-T	TB		SW8260B	NONE	Methylene chloride	0.615	J	5	ug/L
QCW	VOC	204060509	20406050923	060304-QCW-02746-T	TB		SW8260B	NONE	o-Xylene	0.026	J	1	ug/L
QCW	VOC	204060509	20406050923	060304-QCW-02746-T	TB		SW8260B	NONE	Styrene	0.046	J	1	ug/L
QCW	VOC	204060509	20406050922	060404-QCW-02747-R	EB		SW8260B	NONE	Toluene	0.24	J	1	ug/L
QCW	VOC	204060509	20406050923	060304-QCW-02746-T	TB		SW8260B	NONE	Xylene (total)	0.125	J	5	ug/L

Plan

Sampling and Analysis Plan for Ecological Risk Assessment Support Sampling

Prepared for

The Dow Chemical Company

May 2004

CH2MHILL

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Abbreviations and Acronyms

ATV	all-terrain vehicle
bgs	below ground surface
COC	chain of custody
Dow	The Dow Chemical Company
DPT	direct push technology
DQO	data quality objective
Entrix	Entrix, Inc.
ERA	ecological risk assessment
GIS	geographic information system
GPS	global positioning system
HS&E	Health, Safety, and Environment
HSP	health and safety plan
ID	identification
JHA	job hazard analysis
LTI	Limno-Tech Inc.
MDEQ	Michigan Department of Environmental Quality
MI-OSHA	Michigan Occupational Safety and Health Administration
MOCA	Midland Offsite Corrective Actions
MS/MSD	matrix spike/matrix spike duplicate
PCOI	potential contaminants of interest
ppt	part per trillion
QAPP	quality assurance project plan
RI	remedial investigation
SAP	sampling and analysis plan
site	Tittabawassee River study area
SOP	standard operating procedure
STAC	Safety Task Analysis Card
SWP	Safety Work Permit
USEPA	United States Environmental Protection Agency

1 Introduction

1.1 Background

Several previous investigations, including a comprehensive investigation conducted by the Michigan Department of Environmental Quality (MDEQ), have indicated that dioxins and furans may be present in sediment and soil in and along the Tittabawassee River. On June 12, 2003, MDEQ issued an Operating License to The Dow Chemical Company (Dow). One of the conditions of this Operating License was to conduct an ecological risk assessment (ERA) as part of the Midland Offsite Corrective Actions (MOCA) program remedial investigation (RI) process.

As part of the ERA, six study areas have been established in the vicinity of the Dow Midland facility (Plant) for the purpose of conducting ecological investigations. Five of these areas are located along the Tittabawassee River (one of which is upstream of Dow), and one is located upstream of the Plant along the Chippewa River. Each study area includes a pair of study plots; a terrestrial plot located along the river bank, and an aquatic plot located within the river. The general locations of the six ERA plots are shown in Figure 1-1. More information on the ERA is provided in the Ecological Risk Assessment Work Plan for the Tittabawassee River and Floodplain, April 2004 Draft (Entrix 2004).

1.2 Purpose and Objectives

The purpose of this Sampling and Analysis Plan (SAP) is to collect information on concentrations of dioxins/furans, as well as other potential contaminants of interest (PCOIs) in soil and sediment in the vicinity of the ERA study plots. The primary objective for sampling conducted under this SAP is to collect preliminary information on dioxins/furans and other PCOI concentrations in surface soil and sediment to support the ERA. A second objective is to gather some preliminary information on dioxin/furan and other PCOI concentrations in subsurface soil down to the water table to support the upcoming RI.

1.3 Scope

The scope of the field effort described in this SAP includes soil borings, soil sample collection and sediment sample collection within the vicinity of the ERA study plots. All samples will be analyzed for dioxins/furans and other PCOIs. PCOIs include the USEPA Appendix IX constituents (40 CFR Chapter 1, Part 264) plus some constituents typically analyzed by MDEQ, as identified in the QAPP. Additionally, several constituents currently monitored as part of the Plant's groundwater monitoring program have also been included as PCOIs.

Sampling and analysis will be performed in accordance with the Field SOPs established for the Dow Midland Off-site Corrective Actions (MOCA) program, and the Dow MOCA *Quality Assurance Project Plan* (QAPP) (CH2M HILL 2004c).

1.4 Data Quality Objectives

Data quality objectives (DQOs) are both qualitative and quantitative statements that define the type, quality, and quantity of data necessary to support the decisionmaking process during project activities. The DQO process used for this project follows the USEPA *Guidance for the Data Quality Objectives Process (EPA QA/G-4)* document (USEPA, 2000) and uses the seven-step DQO development process identified in the QAPP. Table 1-1 presents the DQOs associated with the sampling activities in support of the Dow MOCA ERA.

1.5 Project Team

The team members responsible for the effective execution of this SAP are identified by role in Table 1-2. The program management roles are further defined in the Dow MOCA *Program Management Plan* (CH2M HILL, 2004a).

TABLE 1-1
Data Quality Objectives
Soil and Sediment Sampling to Support the Dow MOCA Ecological Risk Assessment
Sampling and Analysis Plan

State the Problem	Identify the Decisions	Identify Inputs to the Decisions	Define the Boundaries to the Study	Develop a Decision Rule	Specify Tolerable Limits on Decision Errors	Optimize the Design for Obtaining Data
1. Gather preliminary information on dioxins/furans in surface soil/sediment along Tittabawassee River and it's floodplain to support the MOCA ecological risk assessment.	What other PCOIs are present in the vicinity of the ERA study plots, beyond dioxins/furans. What range of concentrations are present for dioxins/furans and other PCOIs?	Surface soil and sediment samples for use in the ERA. Analyses for dioxin/furans and Appendix IX constituents	Soil and sediment on the perimeter of the established ERA Study Plots.	For surface soil and sediment samples: decision rules for selecting PCOIs for further evaluation will be presented as part of the ERA.	A false positive decision error occurs when PCOIs are identified in surface soil/sediment above the laboratory detection level, when they are actually not present. This would result in investigating these PCOIs further when they are not present. A false negative decision error occurs when dioxins/furans and other PCOIs are not detected in surface soil/sediment when they actually are present. This could result in not evaluating the PCOI(s) further in the ERA process. Steps will be taken to control decision errors by adhering to sampling, analytical, and decontamination protocol specified in the quality assurance project plan (QAPP) and standard operating procedures (SOPs). Formal statistical evaluation of decision errors is not required for this DQO.	Collect four soil samples per ERA terrestrial plot (one at the midpoint between the plot corners) to a depth of 6" to provide spatial coverage around the zone of potential ecological exposure. Collect four sediment samples per ERA aquatic plot (immediately adjacent to terrestrial plot, parallel to the riverbank, 3 to 5 meters from the bank) to a depth of 2" to represent the zone of ecological exposure. Analyze the samples for dioxins/furans and other PCOIs.
2. Evaluate the vertical profile of dioxins/furans and other PCOI concentrations in soil along the Tittabawassee River floodplain.	Determine the vertical profile of dioxins/furans and other PCOIs in the Tittabawassee River floodplain down to groundwater.	Doxins/furans and other PCOIs concentrations measured at various depths below ground surface at various points along the Tittabawassee River Floodplain.	Sampling locations established to support DQO #1, above. Subsurface soil down to water table. Specific ERA terrestrial plots where access is granted by the landowner for GeoProbe® sampling.	For subsurface soil: sampling is intended only to identify potential presence or absence of PCOIs in subsurface soil. No formal decision rule is required for these data.	Inaccurate profiling of dioxin/furan and other PCOI concentration in subsurface soil could lead to inaccurate inputs for establishing RI sampling design. Steps will be taken to control decision errors by adhering to sampling, analytical, and decontamination protocol specified in the QAPP and SOPs	Perform soil borings to groundwater. Collect discrete samples for dioxin/ furan and other PCOI analysis at two foot intervals.

TABLE 1-2
ERA Support Sampling Project Team
Soil and Sediment Sampling to Support the DOW MOCA Ecological Risk Assessment
Sampling and Analysis Plan

Responsibility	Individual	Affiliation	Contact Information
Senior Environmental Project Leader	Ben Baker	Dow	47 Building Midland, MI 48667 (989) 636-0787
Project Manager Leader/ Client Point-of-Contact	Gary Dyke	CH2M HILL	1111 Washington Street Midland, MI 48640 (989) 835-1187
Ecological Risk Assessment Lead	Alan Blankenship	Entrix	(517) 381-1434
Project Manager	Eric Kroger	CH2M HILL	(937) 228-3180, ext. 207
Field Team Leader	Paul Arps	CH2M HILL	1111 Washington Street Midland, MI 48640 (989) 835-5132
Field Lead	Heather Ziegelbauer	CH2M HILL	(414) 272-1052, ext. 403
MOCA Health and Safety Manager	Lisa Martin	CH2M HILL	(816) 224-6311
GIS Manager	Randy Vanslambrouck	CH2M HILL	1111 Washington Street Midland, MI 48640 (989) 832-2608
Data Manager	Linda Crownover	CH2M HILL	(215) 563-4244, ext. 448
Project Chemist	Herb Kelly	CH2M HILL	(352) 335-5877, ext. 2572
Contract Driller	Dale Elliot	Mateco, Inc.	(616) 863-6890
Contract Sediment Sampling	Tim Dekkar	LimnoTech Inc.	(734) 332-1200
Contract Laboratory—Dioxin/ Furan Analysis	Martha Maier	Alta Analytical Laboratories	1104 Windfield Way El Dorado Hills, CA 95762 (916) 933-1640
Contract Laboratory—Analysis of all other PCOIs	Randy Whittington	Gulf Coast Analytical Laboratories, Inc.	7979 GSRI Avenue Baton Rouge, LA 70820-7402 (225) 769-4900 Fax: (225) 767 - 5717

2 Field Activities

The following provides some information necessary for the field team to locate the established ERA plots. Each of the six terrestrial and aquatic ERA plots measures 35 meters by 35 meters in size. The terrestrial plots are located on the bank of the Tittabawassee (or Chippewa) River, and are marked in the field with flags at each of the four corners. The aquatic plots are located within the river immediately adjacent to the terrestrial plots. They run parallel to the riverbank, beginning approximately 3 to 5 meters from the bank, and are not marked. Refer back to Figure 1-1 for the general location of each.

Two of these plot pairs are located on Dow property; while the other four are located on property owned by another entity. Table 2-1 identifies each plot, its general location, the owner of the property where the plot is located, and contact information. Figures 2-1 to 2-6 show the individual plot locations.

2.1 Access to ERA Plots

Before initiating field work, the appropriate notifications must be made and the necessary access agreements secured at each plot location. Before entering the Dow-owned plots, contact Dow Midland Security (refer to Table 2.1). Before entering the non-Dow owned plots, an Access Agreement with the property owner will be secured. Additionally, the field team lead should notify the property owner of the sampling activities the day before they are to commence. Note that access agreements are not necessary for the sediment plots, so long as they are accessed by boat.

2.1.1 Utility Clearances

Utility clearances will be necessary for the soil borings. The following service is available for identifying and locating underground utilities in Michigan:

Miss Dig System, Inc.
1-800-482-7171

The Miss Dig System should be contacted at least 3 business days prior to beginning this work. If questions arise in the field regarding utility clearances, the numbers of each utility owner are included in the Dow MOCA Program Health, Safety and Environment (HS&E) Plan (CH2M HILL, 2003).

2.2 Sampling Procedures

2.2.1 Soil Sampling at Terrestrial Plots

After taking the necessary steps to access the land where each ERA terrestrial plot is located, locate the plot in the field and verify the location by global positioning system (GPS). Retain the GPS coordinates of each corner, and note the coordinates noted in the field logbook.

Sampling will take place just outside the plot at the midpoint between each corner (four locations per plot). Refer to Figure 2-7 for a conceptual illustration of sampling locations to be used at each ecological risk assessment plot.

Sampling will be conducted using direct push technology (DPT) with a GeoProbe® mounted to an all-terrain vehicle (ATV) in accordance with *Drilling and Sampling Using Direct Push Techniques Field SOP* (CH2M HILL, 2004b). After identifying the sampling location, vegetation/debris will be removed from the surface, taking care not to disturb underlying soil (refer to *Manual Soil Sampling Field SOP* [CH2M HILL, 2004b]). Continuous soil cores will be collected at each location to groundwater.

Upon collection, all cores will undergo geological classification in accordance with *Soil Classification and Logging Field SOP* (CH2M HILL, 2004b). The core liners will then be opened, and VOC samples will then be collected from the surface sample and from every 2-foot interval (e.g,. 2′, 4′, etc), in accordance with *VOC Soil and Sediment Sampling Field SOP* (CH2M HILL, 2004b). Samples will then be collected for all other identified analyses at every other 1-foot depth interval (e.g., 1′-2′ interval, 3′-4′ interval, etc.) down to groundwater. A final sample will be collected at groundwater, regardless of the bottom depth (i.e., if the water table is encountered at 7-feet, collect a sample with a 7-foot bottom depth). If bottom depth is less than one foot from the nearest identified interval, only collect the sample at the water table. For example if groundwater is encountered at 8.5 feet, collect the 7.5′ to 8′ interval in lieu of the 7′-8′ interval. If additional sample materials is needed to acquire the necessary volume, then a second, co-located boring should be performed.

GPS coordinates will be collected at the time of sampling from each location and recorded in the field logbook.

2.2.2 Sediment Sampling at Aquatic Plots

For purposes of ERA support, the sediment samples will be collected from the surface (defined as the top 2 inches [~0.2 feet] of sediment) to provide information on the zone of ecological exposure. These samples will be analyzed for all PCOIs. Surface (0″-2″) sediment samples will be collected by methods specified in *Dredge Sediment Sampling* or *Scoop Sediment Sampling Field SOPs* (CH2M HILL, 2004b). The optimal method of sample collection will be at the discretion of the field team leader after evaluating field conditions. The sediment cores will be collected by the method deemed most appropriate by the field team lead, and consistent with Dow MOCA SOPs.

2.3 Sample Containers, Preservation, and Holding Times

The sample container and preservation requirements are presented in Table 2-2, below. Additional sample container and preservation requirements are given in the QAPP (CH2M HILL, 2004c). All containers should be requested from the contract laboratories for delivery to Midland before the project begins.

The activities associated with the sampling activities must be documented in field logbooks. The procedures and QC procedures for field logbook entries are located in the *Field SOPs* (CH2M HILL, 2004b) and QAPP (CH2M HILL, 2004c).

2.4 Field Quality Control

Field quality control samples will be collected as part of this investigation in accordance with Section 2.5 of the QAPP (CH2M HILL, 2004c). QC samples include the following:

- Field blanks, equipment blanks, and matrix spike/matrix spike duplicates (MS/MSDs) will be collected at a minimum frequency of 1 per 20 samples.
- Field duplicates will be collected at a minimum frequency of 1 per 10 samples.
- One trip blank will be submitted for analysis with each cooler containing samples submitted for analysis of volatile organics.

2.5 Sample Identification

2.5.1 Station Identification

Each sample station (or location) will be assigned a unique identifier according to Dow MOCA program protocol, according to the following scheme:

Area-Sequential Number, where:

Area = Three-letter identifier to represent the segment of the Tittabawassee River/ floodplain where sampling is performed.

Sequential = Sequential 5-digit number, as obtained from the Sample ID Manager during project planning.

All 48 sampling station identifications (IDs) (24 soil, 24 sediment) are listed in Appendix A.

2.5.2 Sample Identification

Each sample will be assigned a unique identifier based on the following scheme:

Media-Sequential Number—Depth (as applicable)—QC (as applicable),* where*:

Date = Date (MMDDYY) of sample collection

Media = SOI = Soil
SED = Sediment
QCW= Quality Control Water Sample (e.g., field blank)

Sequential = Same sequential number as included in the Station ID (see above).

Depth = 3-digit code used to reflect maximum depth of the sampling interval in feet (e.g., 00.5 = 0.5 foot, or 6 inches; 01.0 = bottom depth of 1 foot.)

QC = Field Quality Control sample designator, as appropriate, where:
- D = Duplicate
- R = Equipment Blank
- B = Field Blank
- T = Trip Blank

Field duplicates and MS/MSDs will be assigned the same sequential number as the native sample. Note on the chain-of-custody (COC) form identifying that a particular sample shall be used for the MS/MSD is sufficient as long as sufficient volume is supplied. Equipment blanks can be identified with the same sequential number as the sample collected with the piece of equipment from which the equipment blank was obtained. Field blanks and Trip blanks require another unique identifier so they are not associated with one particular sample.

Examples sample IDs:

- **060304-SOI-02690-00.5** is a soil sample collected on June 3, 2004, at Station 02690, with a bottom depth of 6 inches below ground surface (bgs).
- **060804-SED-02710-00.2-D** is the field duplicate sediment sample collected on June 8, 2004, at Station 02710 with a bottom depth of 2 inches bgs.
- **061004-QCW-02755-B** is a field blank collected during the sampling on June 10, 2004. The sequential number is unique to this QC sample.

2.6 Sample Handling and Chain of Custody

The procedures used for proper packaging, shipping, and documentation of samples being transported from the field to the laboratory for analysis are given in the *Sample Handling and Shipping Custody Procedures Field SOP* (CH2M HILL, 2004b).

After samples are labeled and packaged, those intended for dioxin/furan analysis will be shipped to Alta Analytical Laboratory, Inc., at the following address:

Attn: Sample Receiving
Alta Analytical Laboratory, Inc.
1104 Windfield Way
El Dorado Hills, CA 95762
(916) 933-1640

Samples intended for analysis of other PCOIs (volatile organic compounds, semivolatile organic compounds, metals, pesticides, and polychlorinated biphenyls) will be shipped to Gulf Coast Analytical Laboratories, Inc., at the following address:

Attn: Sample Receiving
Gulf Coast Analytical Laboratories, Inc.
7979 GSRI Avenue
Baton Rouge, LA 70820-7402
(225) 769 - 4900

2.7 Equipment Decontamination

- Personal decontamination procedures will be those given in the Dow MOCA Health, Safety and Environment Plan (HSEP; CH2M HILL, 2003).
- All soil and sediment sampling equipment will be decontaminated in accordance with the *Field Decontamination Procedures Field SOP* (CH2M HILL, 2004b).

- Excess soil, disposable sampling equipment, and decontamination materials and liquids will be disposed of in accordance to the *Handling and Disposal of Investigative-Derived Waste Field SOP* (CH2M HILL. 2004b).

Note that the *Handling and Disposal of Investigative-Derived Waste Field SOP* does not address cuttings related to soil borings. Excess cuttings will be placed into the borehole.

2.8 Borehole Abandonment

After replacing excess soil into the borehole, the remaining void space will be backfilled with bentonite.

TABLE 2-1
Ecological Research Plots for Soil/Sediment Sampling
Soil and Sediment Sampling to Support the Ecological Risk Assessment
Sampling and Analytical Plan

Plot Pair Location	Terrestrial Plot Center Point	Property Owner	Contact Information
Reference Site – Sanford, MI (Gladwin Forest)	N 43°40.12′ W 084°23.0423′	Michigan Dept. of Natural Resources (MDNR)	Cortney Borgendy (989) 426-9205 *The day of sampling, contact:* Jerry Turner Sanford Fire Officer (989) 687-7771
Reference Site - Chippewa Nature Center	N 43° 36.013' W 84° 17.881'	Chippewa Nature Center	Tom Lenon (989) 631-0830
Downstream of Center Rd Bridge (75 m downstream of boat launch	N 43°33.748′ W 084°11.091′	The Dow Chemical Company	Jack Johnson (989) 638-1429
Tittabawassee Township Park	N 43°32.608′ W 084°09.088′	The Dow Chemical Company	Jack Johnson (989) 638-1429
Freeland Festival Park	N 43°31.618′ W 084°07.736′	City of Freeland, Michigan	Mike Schoen (989) 695-5245 (989) 928-5280
Imerman Park	N 43°27.156′ W 084°04.818′	Saginaw County	John Schmude (989) 790-5280 jschmude@saginawcounty.com

TABLE 2-2
Required Analytical Method, Sample Containers, Preservation, and Holding Times
Soil and Sediment Sampling to Support the Dow MOCA Ecological Risk Assessment
Sampling and Analysis Plan

Analyses	Preparatory/ Analytical Method	Sample Matrix[a]	Container[b]	Qty	Preservative[c]	Holding Time [d]
Volatile Organic Compounds	SW-846 5030B/ 8260B	W	40-mL, glass	3	HCl, pH < 2, cool to 4ºC	14 days
	SW-846 5035/8260B	S	5 g–Encore or equivalent sampling technique	2	Cool 4°C, or $NaHSO_4$,and Cool 4°C	48 hours from collection to preservation, 14 days to analysis
			40-mL, glass	1	Methanol, cool to 4ºC	
Semivolatile Organic Compounds	SW-846 3510C/ 3520C/ 8270C	W	1-L amber glass	2	Cool 4°C	7/40 days[e]
	SW-846 3550B/ 8270C	S	4-oz glass	1	Cool 4°C	14/40 days[f]
Organochlorine Pesticides	SW-846 3510C/3520C/ 8081A	W	1-L amber glass	2	Cool 4°C	7/40 days[e]
	SW-846 3550B/8081A Cleanup – 3620B	S	4-oz glass	1	Cool 4°C	14/40 days[f]
Organophosphorous Pesticides	SW-846 3510C/3520C/ 8141A	W	1-L amber glass	2	Cool 4°C	7/40 days[e]
	SW-846 3550B/8141A	S	4-oz glass	1	Cool 4°C	14/40 days[f]
Herbicides	SW-846 3510C/8151A	W	1-L amber glass	2	Cool 4°C	7/40 days[e]
	SW-846 3550B/8151A	S	4-oz glass	1	Cool 4°C	14/40 days[f]
Polychlorinated Biphenyls	SW-846 3510C/3520C/8082	W	1-L amber glass	2	Cool 4°C	7/40 days[e]
	SW-846 3550B/8082 Cleanup – 3665A	S	4-oz glass	1	Cool 4°C	14/40 days[f]
Dioxins/Furans	SW-846 8290/EPA Method 1613	W S	1-L amber glass 8-oz glass	2 1	Cool 4°C Cool 4°C	30/45 days[g]
Metals (total)	SW-846 3010A/3020A-SW60 10B Series	W	500-mL polyethylene	1	HNO_3, pH < 2 Cool 4°C	6 months
	SW-846 3050-SW6010B /7000 Series	S	2-oz glass	1	Cool 4°C,	
Mercury	SW-846 7470A	W	500-mL polyethylene	1	HNO_3, pH < 2 Cool 4°C	28 days
	SW-846 7471A	S	2-oz glass	1	Cool 4°C,	
Cyanide	SW-846 9010B/9012A	W	1-L polyethylene	1	pH>12 NaOH Ascorbic Acid as needed (.6g)	14 days

TABLE 2-2
Required Analytical Method, Sample Containers, Preservation, and Holding Times
Soil and Sediment Sampling to Support the Dow MOCA Ecological Risk Assessment
Sampling and Analysis Plan

Analyses	Preparatory/ Analytical Method	Sample Matrix[a]	Container[b]	Qty	Preservative[c]	Holding Time [d]
		S	4-oz glass	1	Cool 4°C	
Total Organic Carbon (TOC)	EPA 415.1/SW-846 9060	W	250-mL glass	1	H_2SO_4 or HCl pH < 2, Cool 4°C	28 days
			2-oz glass			
		S		1	Cool 4°C	28 days
Percent Moisture	EPA 160.3/ASTM D2216	S	2-oz glass	1	None	NA
Particle Size Analysis	ASTM D422	S	8-oz glass	1	None	NA

Notes:
Sample container and volume requirements will be specified by the analytical laboratory performing the tests.
Three times the required volume should be collected for samples designated as MS/MSD samples.
[a]Sample matrix: S = surface soil, subsurface soil, sediment; W = surface water.
[b]All containers will be sealed with Teflon®-lined screw caps.
[c]All samples will be stored promptly at 4°C in an insulated chest.
[d]Holding times are from the time of sample collection.
[e] 7 days to extraction for water, 40 days for analysis.
[f]14 days to extraction for soil, 40 days for analysis.
[g]30 days to extraction for water, 45 days for analysis.
Source: SW-846, third edition, Update III (June 1997).
ºC = Degrees Centigrade
NaOH = Sodium hydroxide
TCLP = Toxicity characteristic leaching procedure
mL = Milliliter
g = Gram
L = Liter
oz = Ounce
HCl = Hydrochloric acid
HNO_3 = Nitric acid
EPA = U.S. Environmental Protection Agency
H_2SO_4 = Sulfuric acid
ASTM = American Society for Testing and Materials
NA = Not applicable

3 Data Management and Validation

All data collected under this field effort will be managed in accordance with the Data Management Plan for Dow MOCA (CH2M HILL, 2004d).

As specified in the QAPP, all analytical data generated to support the Dow MOCA program will be validated. Ten percent of the data packages will be validated to Level IV by a third party subcontractor to CH2M HILL. All other data packages will be validated to Level III by the CH2M HILL project chemist (or designee).

Based on the planned sampling schedule and the number of samples to be collected, it is anticipated that one data package for each requested analysis will be validated to Level IV by a third party to meet the program requirement.

Following validation, data will be entered into a central database. The data are then accessible for evaluation, interpretation and reporting activities.

4 Health and Safety

4.1 Site Specific HS&E Plan Amendment

A Site-Specific Amendment to the HS&E Plan has been prepared for this project and has been approved by The Health and Safety Manager (HSM). It is included with this SAP as Appendix C. Prior to beginning field work, Field Team members must read and sign the amendment, and follow its requirements.

5 Project Schedule

The soil borings are scheduled for the week of June 1, 2004. Based on that start date, the schedule will be as follows:

Activity	Anticipated Duration	Anticipated Start Date	Anticipated End Date
Work Planning, SAP Development, Contractor Procurement, Access Agreements	4 Weeks	May 3, 2004	May 26, 2004
Soil Sampling	4 Days	June 1, 2004	June 4, 2004
Sediment Sampling	4 Days	June 14, 2004	June 18, 2004
Laboratory Analysis	28 Days*	June 2, 2004	July 16, 2004
Data Validation/Data Entry	21 Days	July 6, 2004	August 6, 2004
ERA Data Available	0 Days	August 6, 2004	NA
Data Interpretation and Reporting	21 Days	August 6, 2004	August 27, 2004
Internal review of Draft Tech Memorandum Summarizing Findings of Depth Profiling	3 Days	August 30, 2004	September 3, 2004
Draft Tech Memorandum to Client	0 Days	September 10, 2004	NA

* From date last samples are received.

6 References

CH2M HILL. 2003. Dow MOCA Health, Safety and Environment Plan. December

CH2M HILL. 2004a. *Dow MOCA Program Management Plan.*

CH2M HILL. 2004b. *Field SOPs.* April

CH2M HILL. 2004c. *Quality Assurance Project Plan (QAPP).* April

CH2M HILL. 2004d. *Dow MOCA Data Management Plan*. March

Entrix, Inc. (Entrix). 2004. Ecological Risk Assessment Work Plan for the Tittabawassee River and Floodplain. April Draft.

USEPA. 2000. Guidance for the Data Quality Objectives Process (EPA QA/G-4). EPA guidance document EPA/600/R-96/055. August.

USEPA. 2001. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. Originally published November 1995. Web site version last updated November 30, 2001: http:// www.epa.gov/region4/waste/ots/ecolbul.htm

Figures

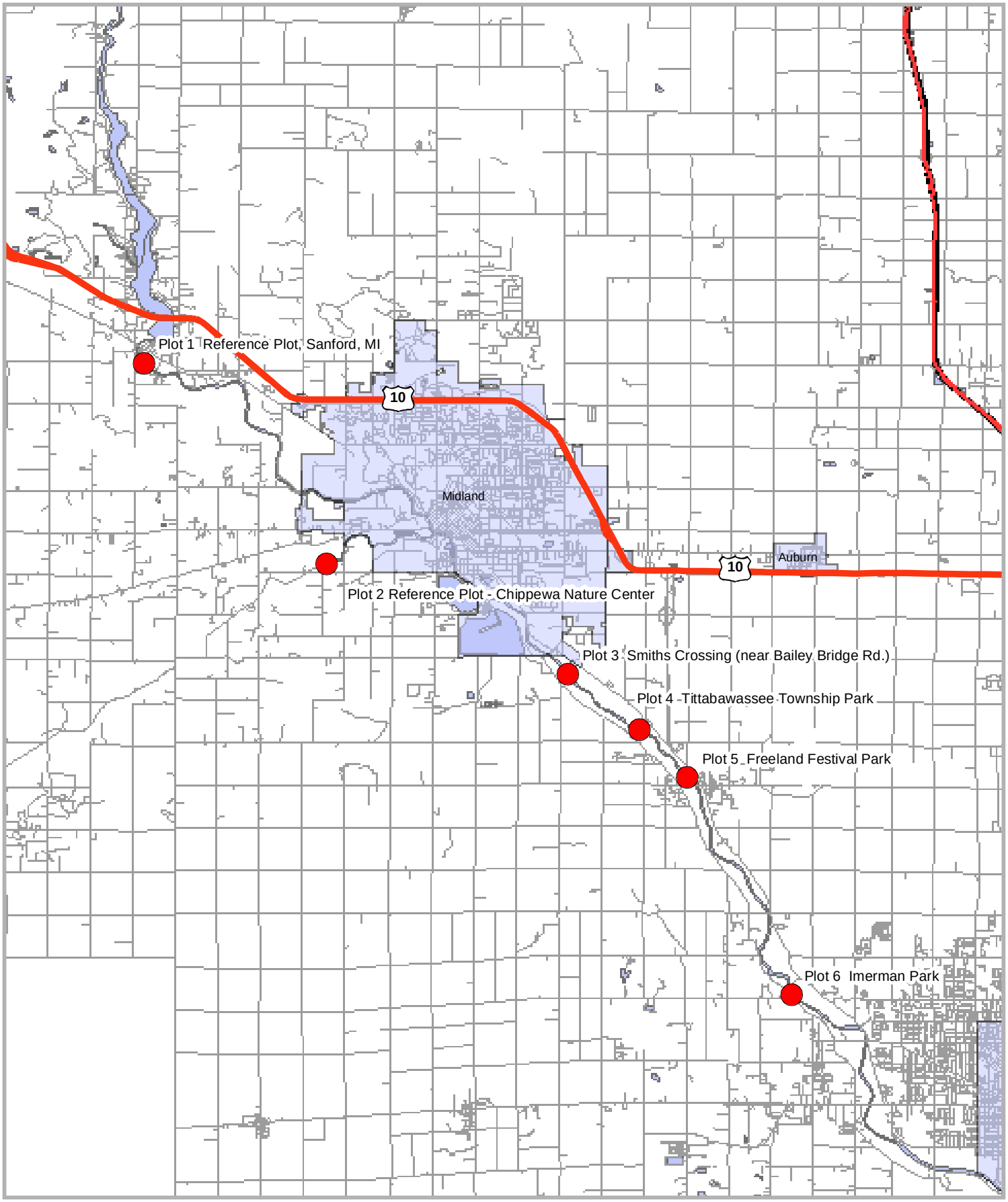


FIGURE 1-1
General Location of ERA Sampling Plots
Sampling and Analysis Plan for Ecological Risk Assessment Support Sampling
Dow Midland Offsite Corrective Actions Program

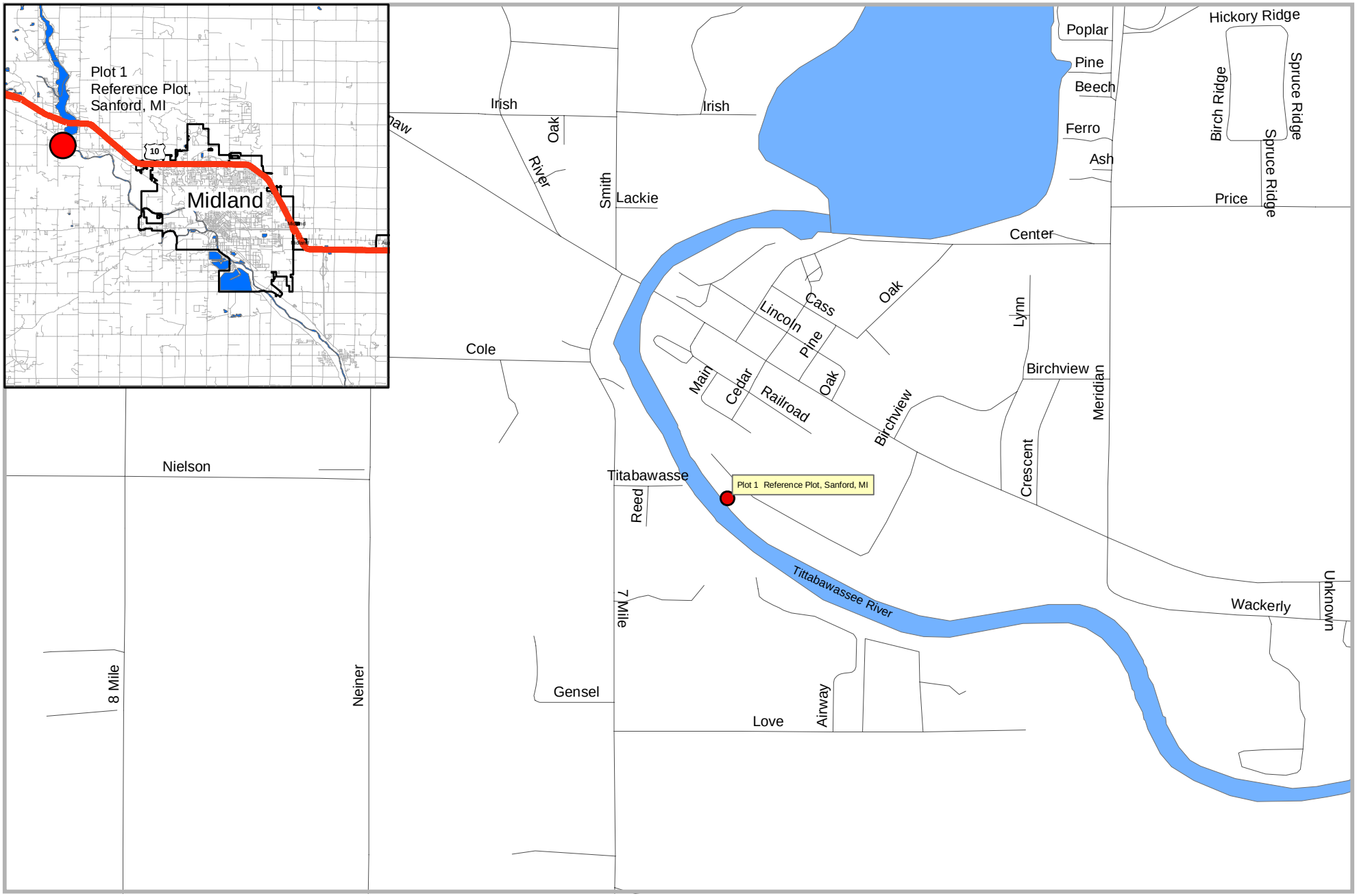


FIGURE 2-1
Location of ERA Plot 1
Reference Plot Sanford, MI (Gladwin Forest)
Sampling and Analysis Plan for Ecological Risk Assessment Support Sampling
Dow Midland Offsite Corrective Actions Program

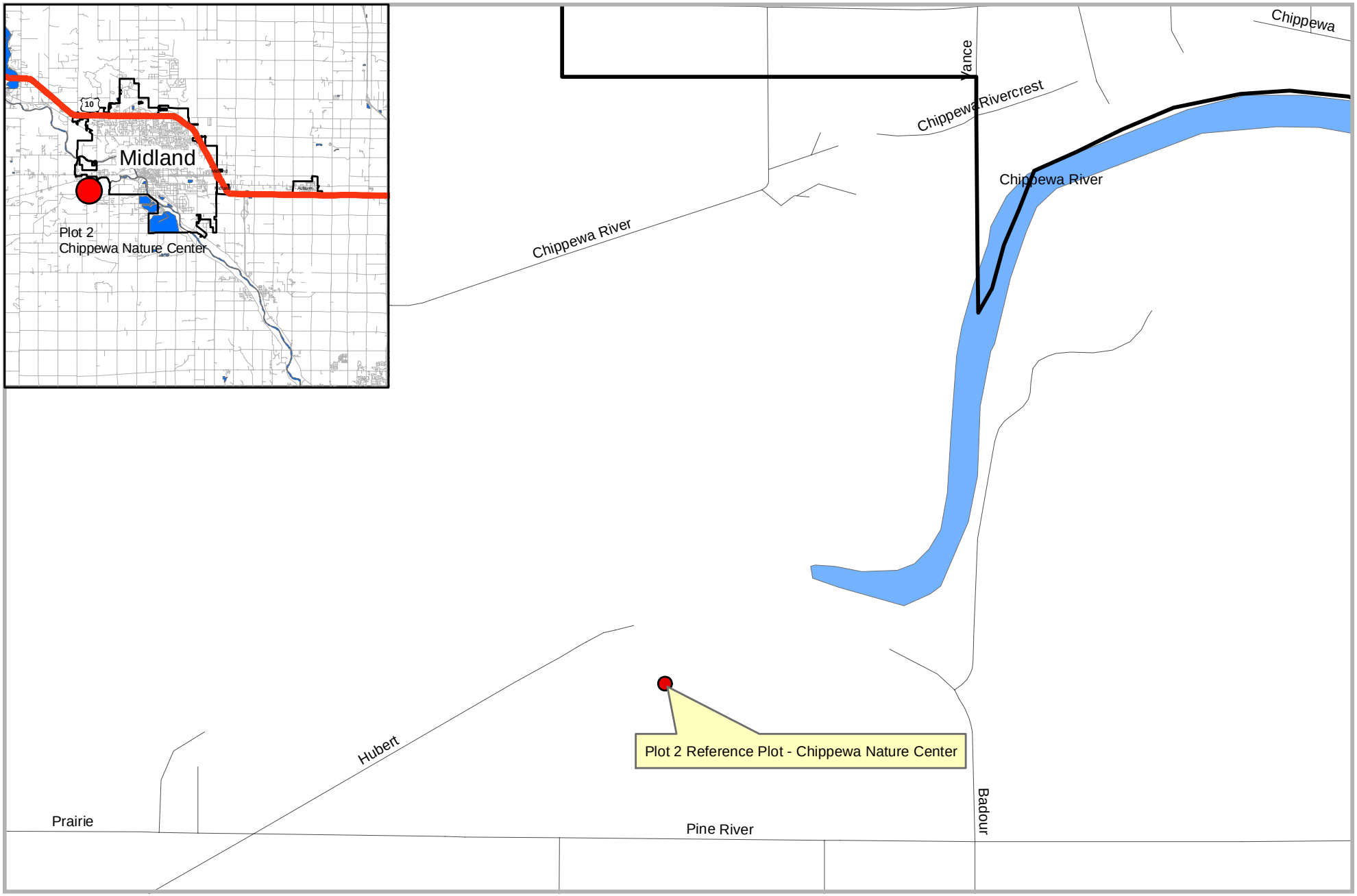


FIGURE 2-2
Location of ERA Plot 2
Reference Plot - Chippewa Nature Center
Sampling and Analysis Plan for Ecological Risk Assessment Support Sampling
Dow Midland Offsite Corrective Actions Program

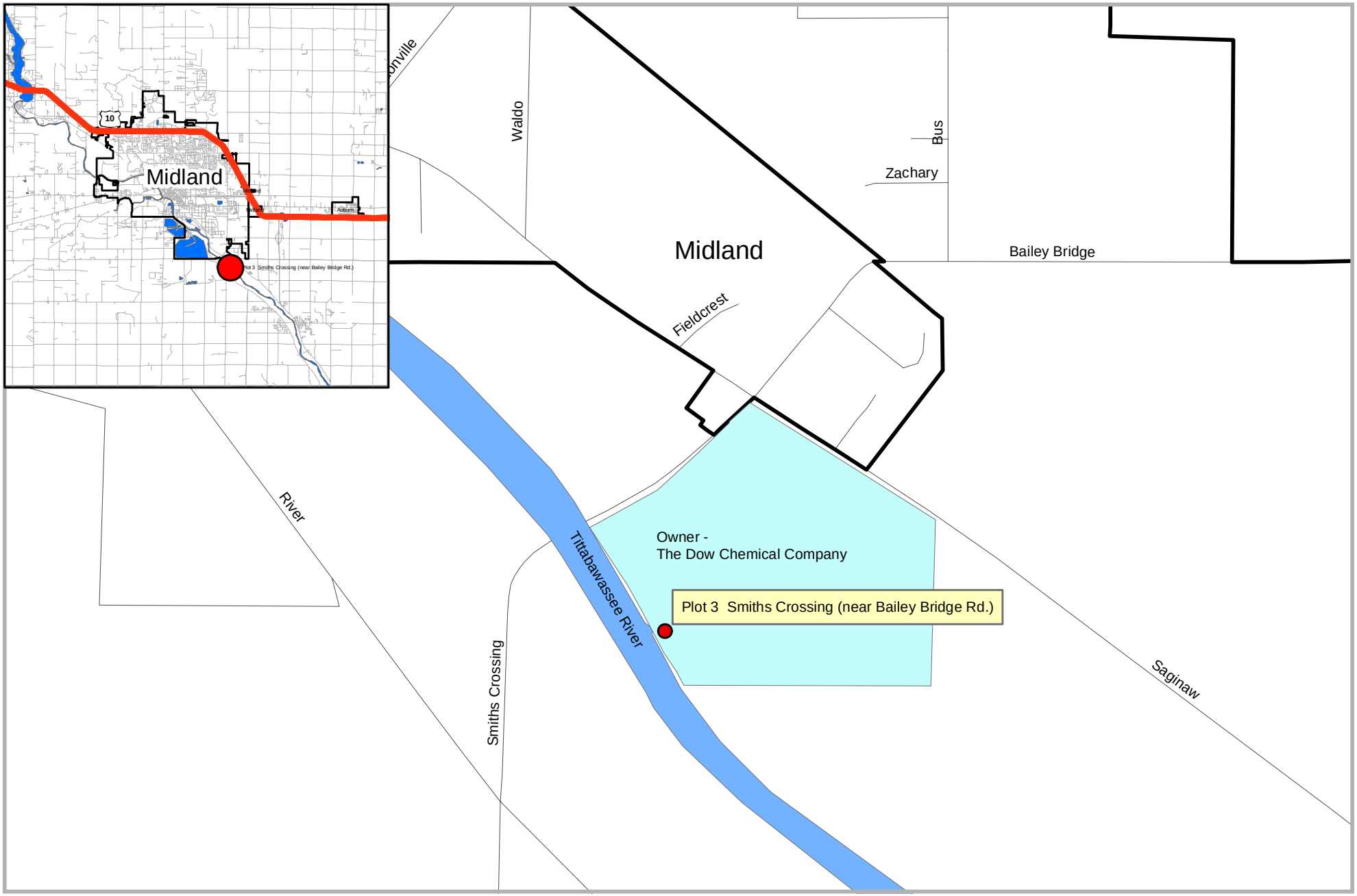


FIGURE 2-3
Location of ERA Plot 3
Smiths Crossing (near Bailey Bridge Rd.)
Sampling and Analysis Plan for Ecological Risk Assessment Support Sampling
Dow Midland Offsite Corrective Actions Program

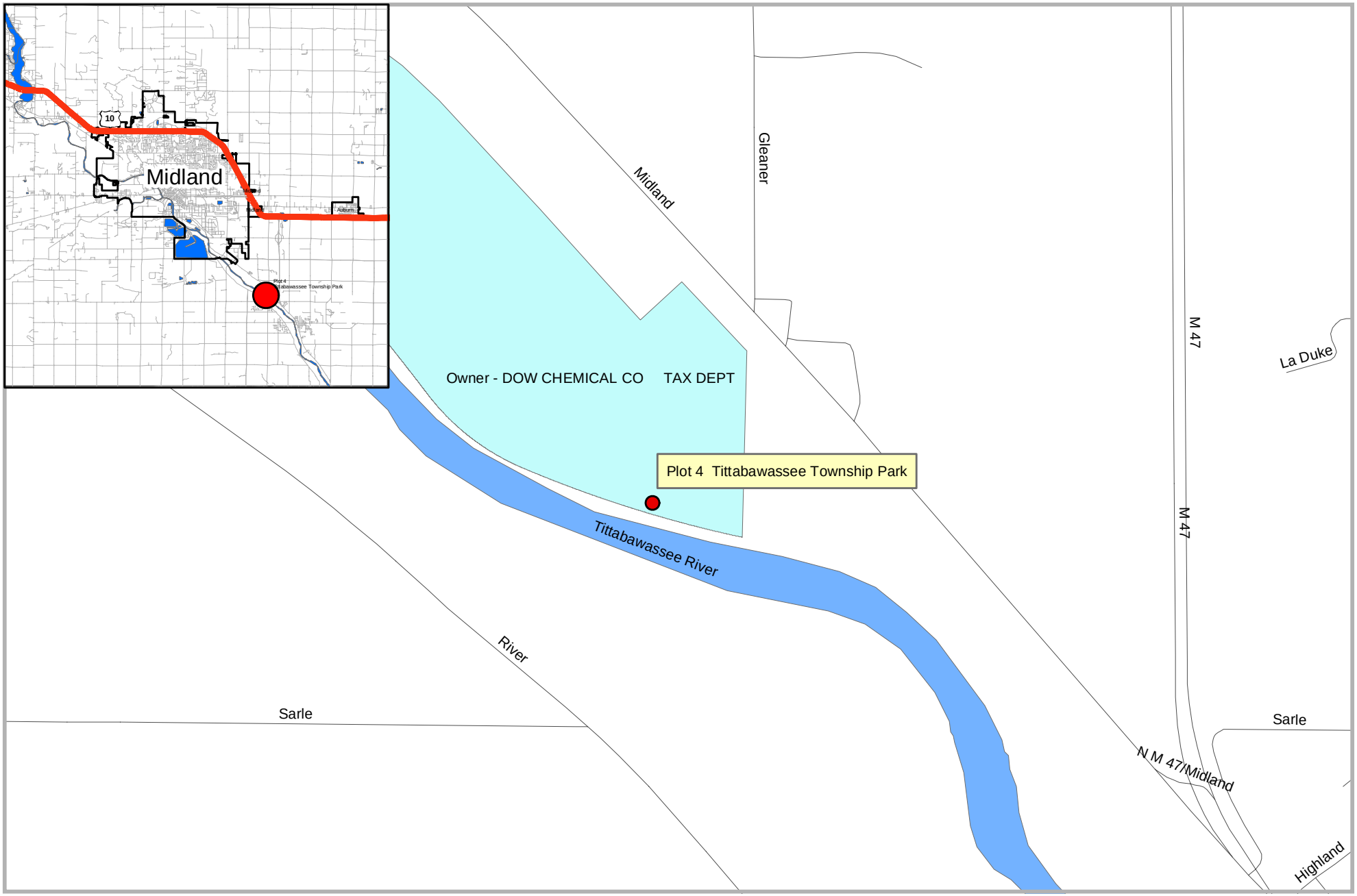


FIGURE 2-4
Location of ERA Plot 4
Tittabawassee Township Park
Sampling and Analysis Plan for Ecological Risk Assessment Support Sampling
Dow Midland Offsite Corrective Actions Program

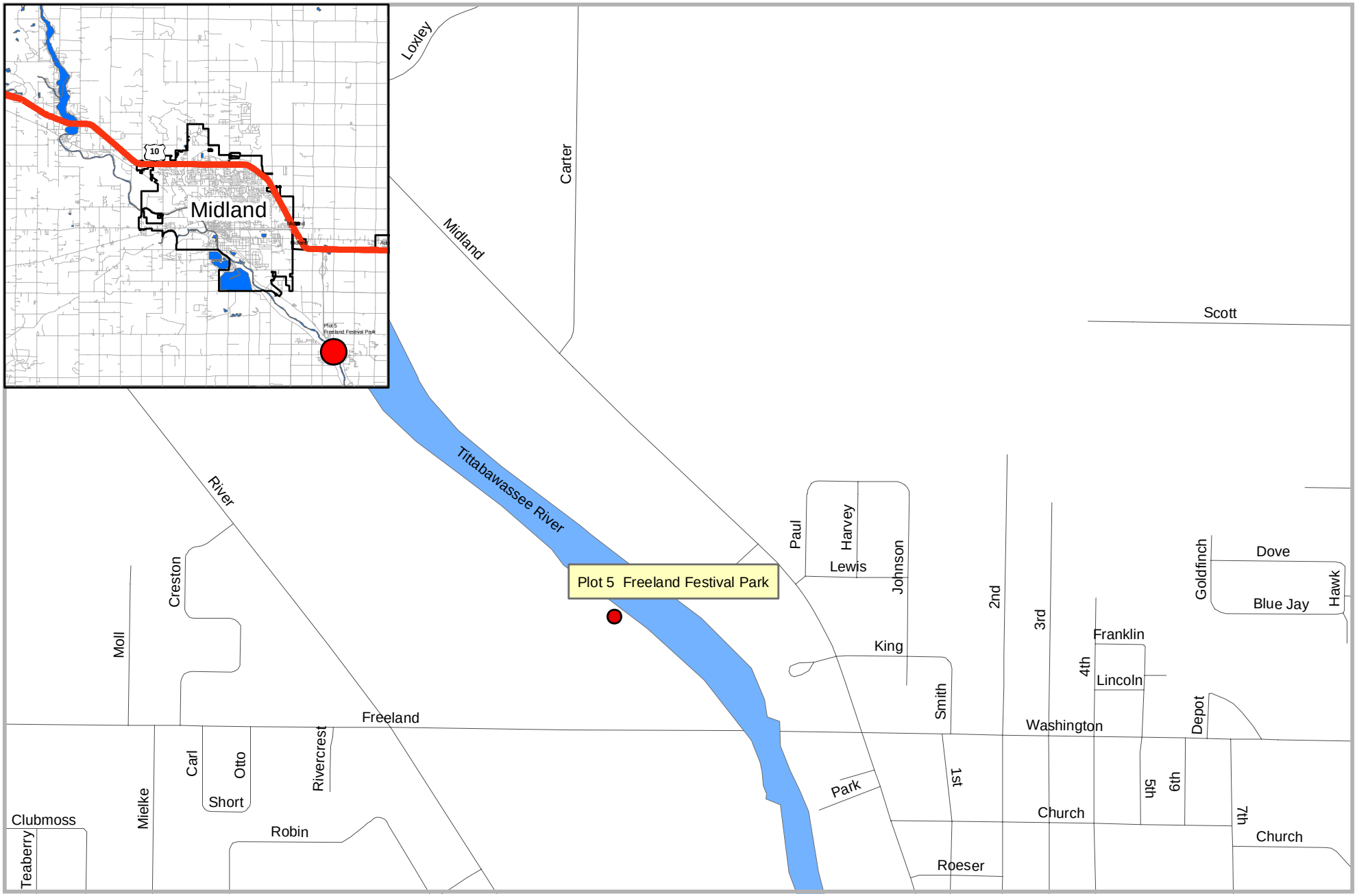


FIGURE 2-5
Location of ERA Plot 5
Freeland Festival Park
Sampling and Analysis Plan for Ecological Risk Assessment Support Sampling
Dow Midland Offsite Corrective Actions Program

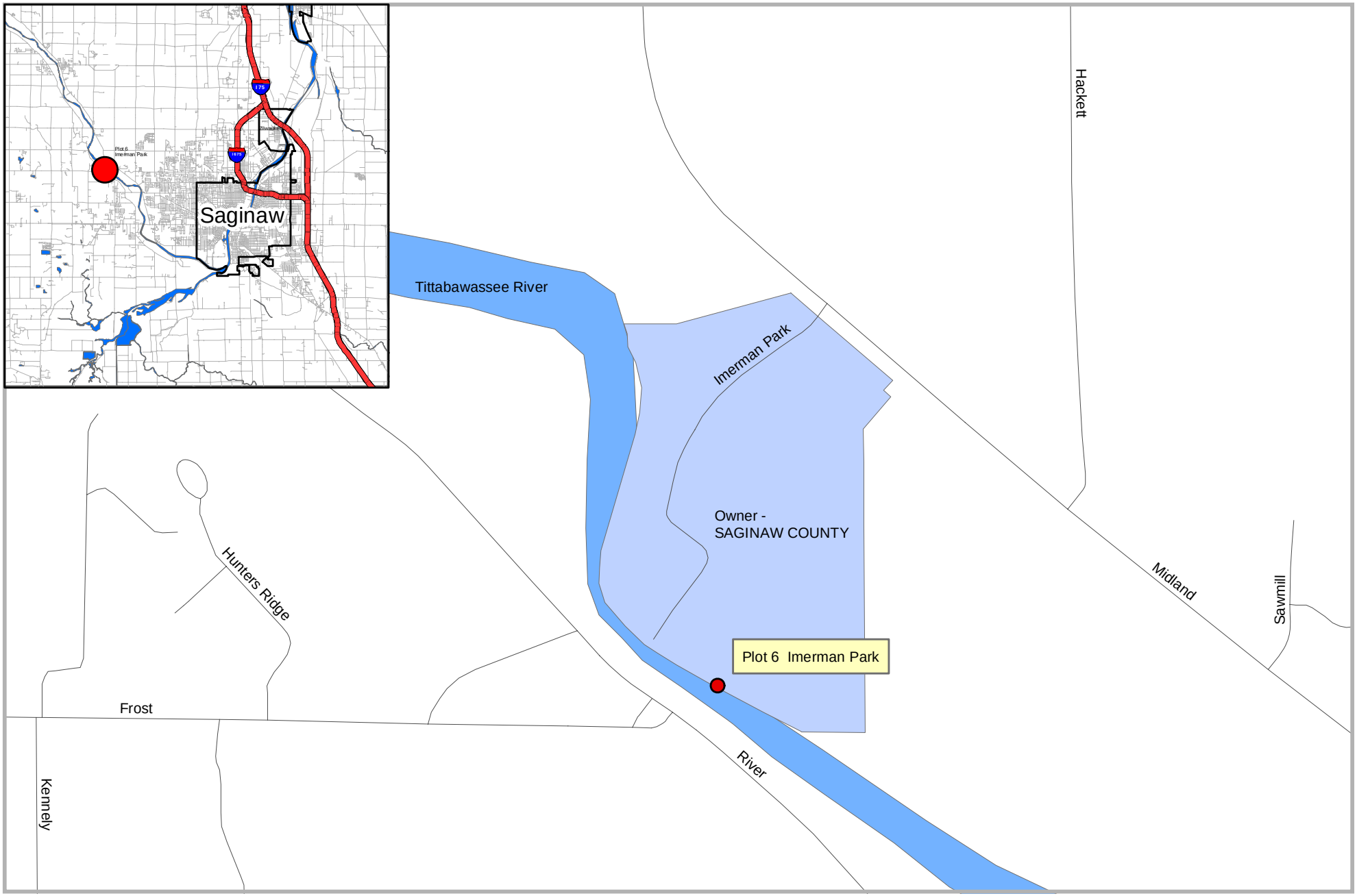
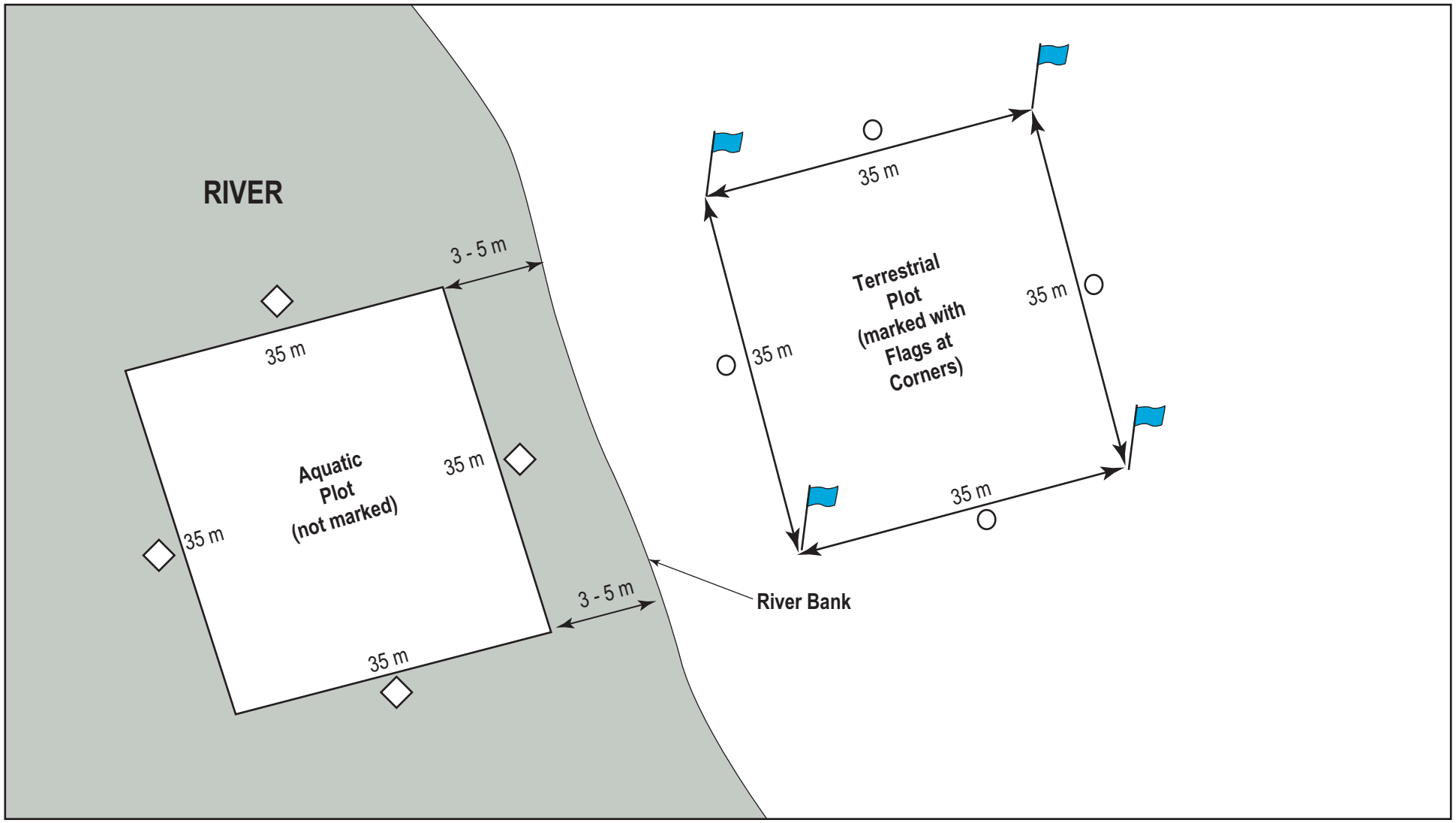


FIGURE 2-6
Location of ERA Plot 6
Imerman Park
Sampling and Analysis Plan for Ecological Risk Assessment Support Sampling
Dow Midland Offsite Corrective Actions Program



LEGEND

- ◇ Aquatic Plot Sample Location
- ○ Terrestrial Plot Sample Location
- Flag locating Terrestrial Plot

NOT TO SCALE

FIGURE 2-7
Conceptual ERA Plot Layout and Sampling Locations
Sampling and Analysis Plan for Ecological Risk Assessment Support Sampling
Dow Midland Offsite Corrective Actions Program

Appendix A
Sample Station IDs

Appendix A
Identification of Samples Collected
ERA Support Soil and Sediment Sampling and Analysis Plan
Dow Midland Off-site Corrective Actions Program

ERA INVESTIGATION PLOTS:		SAMPLES COLLECTED FROM EACH ERA PLOT:				
Plot Name	**Terrestrial Plot Location**	**Station ID**	**Sample Media**	**Bottom Depth (ft)**	**Sample ID[1]**	**TAL[2]**
Plot 1 Reference Site - Sanford, MI Gladwin Forest	N:43° 40.122' W: 84° 23.0423'	TRU-02687	Soil[3]	0.5	mmddyy-SOI-02687-00.5	A,B
		TRU-02687	Soil	2.0	mmddyy-SOI-02687-02.0	A
		TRU-02687	Soil	4.0	mmddyy-SOI-02687-04.0	A
		TRU-02687	Soil	6.0	mmddyy-SOI-02687-06.0	A
		TRU-02687	Soil	8.0	mmddyy-SOI-02687-08.0	A
		TRU-02688	Soil	0.5	mmddyy-SOI-02688-00.5	A,B
		TRU-02688	Soil	2.0	mmddyy-SOI-02688-02.0	A
		TRU-02688	Soil	4.0	mmddyy-SOI-02688-04.0	A
		TRU-02688	Soil	6.0	mmddyy-SOI-02688-06.0	A
		TRU-02688	Soil	8.0	mmddyy-SOI-02688-08.0	A
		TRU-02689	Soil	0.5	mmddyy-SOI-02689-00.5	A,B
		TRU-02689	Soil	2.0	mmddyy-SOI-02689-02.0	A
		TRU-02689	Soil	4.0	mmddyy-SOI-02689-04.0	A
		TRU-02689	Soil	6.0	mmddyy-SOI-02689-06.0	A
		TRU-02689	Soil	8.0	mmddyy-SOI-02689-08.0	A
		TRU-02690	Soil	0.5	mmddyy-SOI-02690-00.5	A,B
		TRU-02690	Soil	2.0	mmddyy-SOI-02690-02.0	A
		TRU-02690	Soil	4.0	mmddyy-SOI-02690-04.0	A
		TRU-02690	Soil	6.0	mmddyy-SOI-02690-06.0	A
		TRU-02690	Soil	8.0	mmddyy-SOI-02690-08.0	A
		TRU-02691	Sediment[4]	0.2	mmddyy-SED-02691-00.2	A
		TRU-02692	Sediment	0.2	mmddyy-SED-02692-00.2	A
		TRU-02693	Sediment	0.2	mmddyy-SED-02693-00.2	A
		TRU-02694	Sediment	0.2	mmddyy-SED-02694-00.2	A
Plot 2 Reference Site - Chippewa Nature Preserve	N: 43° 36.013' W: 84° 17.881'	CHR-02695	Soil	0.5	mmddyy-SOI-02695-00.5	A,B
		CHR-02695	Soil	2.0	mmddyy-SOI-02695-02.0	A
		CHR-02695	Soil	4.0	mmddyy-SOI-02695-04.0	A
		CHR-02695	Soil	6.0	mmddyy-SOI-02695-06.0	A
		CHR-02695	Soil	8.0	mmddyy-SOI-02695-08.0	A
		CHR-02696	Soil	0.5	mmddyy-SOI-02696-00.5	A,B
		CHR-02696	Soil	2.0	mmddyy-SOI-02696-02.0	A
		CHR-02696	Soil	4.0	mmddyy-SOI-02696-04.0	A
		CHR-02696	Soil	6.0	mmddyy-SOI-02696-06.0	A
		CHR-02696	Soil	8.0	mmddyy-SOI-02696-08.0	A
		CHR-02697	Soil	0.5	mmddyy-SOI-02697-00.5	A,B
		CHR-02697	Soil	2.0	mmddyy-SOI-02697-02.0	A
		CHR-02697	Soil	4.0	mmddyy-SOI-02697-04.0	A
		CHR-02697	Soil	6.0	mmddyy-SOI-02697-06.0	A
		CHR-02697	Soil	8.0	mmddyy-SOI-02697-08.0	A
		CHR-02698	Soil	0.5	mmddyy-SOI-02698-00.5	A,B
		CHR-02698	Soil	2.0	mmddyy-SOI-02698-02.0	A
		CHR-02698	Soil	4.0	mmddyy-SOI-02698-04.0	A
		CHR-02698	Soil	6.0	mmddyy-SOI-02698-06.0	A
		CHR-02698	Soil	8.0	mmddyy-SOI-02698-08.0	A
		CHR-02699	Sediment	0.2	mmddyy-SED-02699-00.2	A
		CHR-02700	Sediment	0.2	mmddyy-SED-02700-00.2	A
		CHR-02701	Sediment	0.2	mmddyy-SED-02701-00.2	A
		CHR-02702	Sediment	0.2	mmddyy-SED-02702-00.2	A

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Identification of Samples Collected
ERA Support Soil and Sediment Sampling and Analysis Plan
Dow Midland Off-site Corrective Actions Program

ERA INVESTIGATION PLOTS:		SAMPLES COLLECTED FROM EACH ERA PLOT:				
Plot Name	**Terrestrial Plot Location**	**Station ID**	**Sample Media**	**Bottom Depth (ft)**	**Sample ID[1]**	**TAL[2]**
Plot 3 Smith's Crossing (near Bailey Bridge Rd.)	N: 43° 33.748' W: 84° 11.091'	MIC-02703	Soil	0.5	mmddyy-SOI-02703-00.5	A,B
		MIC-02703	Soil	2.0	mmddyy-SOI-02703-02.0	A
		MIC-02703	Soil	4.0	mmddyy-SOI-02703-04.0	A
		MIC-02703	Soil	6.0	mmddyy-SOI-02703-06.0	A
		MIC-02703	Soil	8.0	mmddyy-SOI-02703-08.0	A
		MIC-02704	Soil	0.5	mmddyy-SOI-02704-00.5	A,B
		MIC-02704	Soil	2.0	mmddyy-SOI-02704-02.0	A
		MIC-02704	Soil	4.0	mmddyy-SOI-02704-04.0	A
		MIC-02704	Soil	6.0	mmddyy-SOI-02704-06.0	A
		MIC-02704	Soil	8.0	mmddyy-SOI-02704-08.0	A
		MIC-02705	Soil	0.5	mmddyy-SOI-02705-00.5	A,B
		MIC-02705	Soil	2.0	mmddyy-SOI-02705-02.0	A
		MIC-02705	Soil	4.0	mmddyy-SOI-02705-04.0	A
		MIC-02705	Soil	6.0	mmddyy-SOI-02705-06.0	A
		MIC-02705	Soil	8.0	mmddyy-SOI-02705-08.0	A
		MIC-02706	Soil	0.5	mmddyy-SOI-02706-00.5	A,B
		MIC-02706	Soil	2.0	mmddyy-SOI-02706-02.0	A
		MIC-02706	Soil	4.0	mmddyy-SOI-02706-04.0	A
		MIC-02706	Soil	6.0	mmddyy-SOI-02706-06.0	A
		MIC-02706	Soil	8.0	mmddyy-SOI-02706-08.0	A
		MIC-02707	Sediment	0.2	mmddyy-SED-02707-00.2	A
		MIC-02708	Sediment	0.2	mmddyy-SED-02708-00.2	A
		MIC-02708	Sediment	0.2	mmddyy-SED-02708-00.2-D	A
		MIC-02709	Sediment	0.2	mmddyy-SED-02709-00.2	A
		MIC-02710	Sediment	0.2	mmddyy-SED-02710-00.2	A
Plot 4: Smith's Crossing	N: 43° 32.608' W: 84° 09.088'	FRE-02711	Soil	0.5	mmddyy-SOI-02711-00.5	A,B
		FRE-02711	Soil	2.0	mmddyy-SOI-02711-02.0	A
		FRE-02711	Soil	4.0	mmddyy-SOI-02711-04.0	A
		FRE-02711	Soil	6.0	mmddyy-SOI-02711-06.0	A
		FRE-02711	Soil	8.0	mmddyy-SOI-02711-08.0	A
		FRE-02712	Soil	0.5	mmddyy-SOI-02712-00.5	A,B
		FRE-02712	Soil	2.0	mmddyy-SOI-02712-02.0	A
		FRE-02712	Soil	4.0	mmddyy-SOI-02712-04.0	A
		FRE-02712	Soil	6.0	mmddyy-SOI-02712-06.0	A
		FRE-02712	Soil	8.0	mmddyy-SOI-02712-08.0	A
		FRE-02713	Soil	0.5	mmddyy-SOI-02713-00.5	A,B
		FRE-02713	Soil	2.0	mmddyy-SOI-02713-02.0	A
		FRE-02713	Soil	4.0	mmddyy-SOI-02713-04.0	A
		FRE-02713	Soil	6.0	mmddyy-SOI-02713-06.0	A
		FRE-02713	Soil	8.0	mmddyy-SOI-02713-08.0	A
		FRE-02714	Soil	0.5	mmddyy-SOI-02714-00.5	A,B
		FRE-02714	Soil	2.0	mmddyy-SOI-02714-02.0	A
		FRE-02714	Soil	4.0	mmddyy-SOI-02714-04.0	A
		FRE-02714	Soil	6.0	mmddyy-SOI-02714-06.0	A
		FRE-02714	Soil	8.0	mmddyy-SOI-02714-08.0	A
		FRE-02715	Sediment	0.2	mmddyy-SED-02715-00.2	A
		FRE-02716	Sediment	0.2	mmddyy-SED-02716-00.2	A
		FRE-02717	Sediment	0.2	mmddyy-SED-02717-00.2	A
		FRE-02718	Sediment	0.2	mmddyy-SED-02718-00.2	A

Appendix A
Identification of Samples Collected
ERA Support Soil and Sediment Sampling and Analysis Plan
Dow Midland Off-site Corrective Actions Program

ERA INVESTIGATION PLOTS:		SAMPLES COLLECTED FROM EACH ERA PLOT:				
Plot Name	**Terrestrial Plot Location**	**Station ID**	**Sample Media**	**Bottom Depth (ft)**	**Sample ID[1]**	**TAL[2]**
Plot 5: Freeland Festival Park	N: 43° 31.618' W: 84° 07.736'	FRE-02719	Soil	0.5	mmddyy-SOI-02719-00.5	A,B
		FRE-02719	Soil	2.0	mmddyy-SOI-02719-02.0	A
		FRE-02719	Soil	4.0	mmddyy-SOI-02719-04.0	A
		FRE-02719	Soil	6.0	mmddyy-SOI-02719-06.0	A
		FRE-02719	Soil	8.0	mmddyy-SOI-02719-08.0	A
		FRE-02720	Soil	0.5	mmddyy-SOI-02720-00.5	A,B
		FRE-02720	Soil	2.0	mmddyy-SOI-02720-02.0	A
		FRE-02720	Soil	4.0	mmddyy-SOI-02720-04.0	A
		FRE-02720	Soil	6.0	mmddyy-SOI-02720-06.0	A
		FRE-02720	Soil	8.0	mmddyy-SOI-02720-08.0	A
		FRE-02721	Soil	0.5	mmddyy-SOI-02721-00.5	A,B
		FRE-02721	Soil	2.0	mmddyy-SOI-02721-02.0	A
		FRE-02721	Soil	4.0	mmddyy-SOI-02721-04.0	A
		FRE-02721	Soil	6.0	mmddyy-SOI-02721-06.0	A
		FRE-02721	Soil	8.0	mmddyy-SOI-02721-08.0	A
		FRE-02722	Soil	0.5	mmddyy-SOI-02722-00.5	A,B
		FRE-02722	Soil	2.0	mmddyy-SOI-02722-02.0	A
		FRE-02722	Soil	4.0	mmddyy-SOI-02722-04.0	A
		FRE-02722	Soil	6.0	mmddyy-SOI-02722-06.0	A
		FRE-02722	Soil	8.0	mmddyy-SOI-02722-08.0	A
		FRE-02723	Sediment	0.2	mmddyy-SED-02723-00.2	A
		FRE-02724	Sediment	0.2	mmddyy-SED-02724-00.2	A
		FRE-02725	Sediment	0.2	mmddyy-SED-02725-00.2	A
		FRE-02726	Sediment	0.2	mmddyy-SED-02726-00.2	A
		FRE-02726	Sediment	0.2	mmddyy-SED-02726-00.2-D	A
Plot 6: Imerman Park	N: 43° 27.156' W: 84° 04.818'	THT-02727	Soil	0.5	mmddyy-SOI-02727-00.5	A,B
		THT-02727	Soil	2.0	mmddyy-SOI-02727-02.0	A
		THT-02727	Soil	4.0	mmddyy-SOI-02727-04.0	A
		THT-02727	Soil	6.0	mmddyy-SOI-02727-06.0	A
		THT-02727	Soil	8.0	mmddyy-SOI-02727-08.0	A
		THT-02728	Soil	0.5	mmddyy-SOI-02728-00.5	A,B
		THT-02728	Soil	2.0	mmddyy-SOI-02728-02.0	A
		THT-02728	Soil	4.0	mmddyy-SOI-02728-04.0	A
		THT-02728	Soil	6.0	mmddyy-SOI-02728-06.0	A
		THT-02728	Soil	8.0	mmddyy-SOI-02728-08.0	A
		THT-02729	Soil	0.5	mmddyy-SOI-02729-00.5	A,B
		THT-02729	Soil	2.0	mmddyy-SOI-02729-02.0	A
		THT-02729	Soil	4.0	mmddyy-SOI-02729-04.0	A
		THT-02729	Soil	6.0	mmddyy-SOI-02729-06.0	A
		THT-02729	Soil	8.0	mmddyy-SOI-02729-08.0	A
		THT-02730	Soil	0.5	mmddyy-SOI-02730-00.5	A,B
		THT-02730	Soil	2.0	mmddyy-SOI-02730-02.0	A
		THT-02730	Soil	4.0	mmddyy-SOI-02730-04.0	A
		THT-02730	Soil	6.0	mmddyy-SOI-02730-06.0	A
		THT-02730	Soil	8.0	mmddyy-SOI-02730-08.0	A
		THT-02731	Sediment	0.2	mmddyy-SED-02731-00.2	A
		THT-02732	Sediment	0.2	mmddyy-SED-02732-00.2	A
		THT-02733	Sediment	0.2	mmddyy-SED-02733-00.2	A
		THT-02734	Sediment	0.2	mmddyy-SED-02734-00.2	A
		THT-02734	Sediment	0.2	mmddyy-SED-02734-00.2-D	A

Notes:
1. The "mmddyy" portion of the Sample ID will be replaced in the field with actual date of sample collection.
2. Target Analyte List (TAL) tables are located in Appedix B.
3. Soil samples will be collected at the surface and every 2' (e.g., bottom depths of 2', 4', 6', etc.) until reaching groundwater. The number of samples collected may be more or less than what is indicated above. Also, field QC samples will also be collected in accordance with the QAPP, including 1/10 field duplicates and 1/20 MS/MSD samples.
4. Sediment samples will be collected form the top 2 inches at each sample location. Three duplicate samples are indicated above and the other field QC samples will be collected as specified in the QAPP.

Appendix B
Target Analyte Lists

TABLE B-1
Target Analyte List A for Soils and Sediments—All Selected Analytes
Soil and Sediment Sampling to Support the Dow MOCA ERA
Sampling and Analysis Plan

Parameter/Method	Analyte	Soil/Sediment		Ecological Screening Value for Soil		Ecological Screening Value for Sediment	
		RL	Unit	Value	Unit	Value	Unit
Mercury SW7471A	Mercury	100	µg/Kg	0.1	mg/Kg	0.13	mg/Kg
Metals SW-846 6010B	Antimony	2000	µg/Kg	3.5	mg/Kg	12	mg/Kg
	Arsenic	1000	µg/Kg	10	mg/Kg	7.24	mg/Kg
	Barium	2000	µg/Kg	165	mg/Kg		
	Beryllium	200	µg/Kg	1.1	mg/Kg		
	Cadmium	500	µg/Kg	1.6	mg/Kg	1	mg/Kg
	Chromium	1000	µg/Kg	0.4	mg/Kg	52.3	mg/Kg
	Cobalt	5000	µg/Kg				
	Copper	2500	µg/Kg	40	mg/Kg	18.7	mg/Kg
	Lead	1000	µg/Kg	50	mg/Kg	30.2	mg/Kg
	Lithium	2000	µg/Kg	2.0	mg/Kg		
	Nickel	1000	µg/Kg	30	mg/Kg	15.9	mg/Kg
	Selenium	500	µg/Kg	0.81	mg/Kg		
	Silver	1000	µg/Kg	2.0	mg/Kg	2	mg/Kg
	Thallium	2000	µg/Kg	1.0	mg/Kg		
	Tin	5000	µg/Kg	53	mg/Kg		
	Vanadium	1000	µg/Kg	2.0	mg/Kg		
	Zinc	2000	µg/Kg	50	mg/Kg	124	mg/Kg
Total Cyanide SW-846 9010B/ 9012A	Total Cyanide	0.5	mg/kg	0.9	mg/Kg		
Pesticides SW8081A	a-BHC	20	µg/Kg	0.0025	mg/Kg		
	b-BHC	20	µg/Kg	0.001	mg/Kg		
	d-BHC	20	µg/Kg				
	g-BHC (Lindane)	20	µg/Kg	0.00005	mg/Kg	3.3	µg/Kg
Additional Compound	BP-6 (PPB)	*	µg/Kg				
	a-Chlordane	25	µg/Kg				
	g-Chlordane	25	µg/Kg				
	4,4'-DDD	20	µg/Kg			3.3	µg/Kg
	4,4'-DDE	20	µg/Kg			3.3	µg/Kg
	4,4'-DDT	20	µg/Kg			3.3	µg/Kg
	Aldrin	20	µg/Kg	0.0025	mg/Kg		
	Dieldrin	20	µg/Kg	0.0005	mg/Kg	3.3	µg/Kg
	Endosulfan I	20	µg/Kg				
	Endosulfan II	20	µg/Kg				
	Endosulfan Sulfate	20	µg/Kg				
	Endrin	20	µg/Kg	0.001	mg/Kg	3.3	µg/Kg
	Endrin Aldehyde	20	µg/Kg				
	Endrin Ketone	20	µg/Kg				
	Heptachlor	20	µg/Kg				
	Heptachlor Epoxide	20	µg/Kg				
	Methoxychlor	50	µg/Kg				
Additional Compound	Mirex	*	µg/Kg				
	Toxaphene	170	µg/Kg				
	Chlordane	25	µg/Kg			1.7	µg/Kg
	Chlorobenzilate	50	µg/Kg				
	Diallate	50	µg/Kg				
	Isodrin	50	µg/Kg				
Additional Compound	Kepone	50	µg/Kg				
PCBs/SW8082	Aroclor-1016	33	µg/Kg			33	µg/Kg
	Aroclor-1221	33	µg/Kg			67	µg/Kg
	Aroclor -1232	33	µg/Kg			33	µg/Kg
	Aroclor -1242	33	µg/Kg			33	µg/Kg
	Aroclor -1248	33	µg/Kg			33	µg/Kg
	Aroclor -1254	33	µg/Kg			33	µg/Kg
	Aroclor -1260	33	µg/Kg			33	µg/Kg
Additional Compound	Aroclor-1262	33	µg/Kg			33	µg/Kg
Additional Compound	Aroclor-1268	33	µg/Kg			33	µg/Kg
Organophosphorus Pesticides SW8141A	Dimethoate	50	µg/Kg				
	Disulfoton	50	µg/Kg				
	Famphur	50	µg/Kg				
	O,O,O-Triethyl phosporothioate	70	µg/Kg				
	O,O-Diethyl O-2-pyrazinyl phosphorthioate (Thionazin)	70	µg/Kg				
	Parathion	50	µg/Kg				
	Parathion, methyl	50	µg/Kg				
	Phorate	50	µg/Kg				
	Tetraethyl dithiopyrophosphate (Sulfotepp)	70	µg/Kg				
Chlorinated Phenoxy Acid Herbicides SW8151A	2,4-D	33	µg/Kg				
	2,4,5-T	33	µg/Kg				
	Silvex (2,4,5-TP)	33	µg/Kg				

TABLE B-1
Target Analyte List A for Soils and Sediments—All Selected Analytes
Soil and Sediment Sampling to Support the Dow MOCA ERA
Sampling and Analysis Plan

Parameter/Method	Analyte	Soil/Sediment		Ecological Screening Value for Soil		Ecological Screening Value for Sediment	
		RL	Unit	Value	Unit	Value	Unit
VOCs	1,1,1,2-Tetrachloroethane	5.0	µg/Kg				
SW8260B	1,1,1-Trichloroethane	5.0	µg/Kg				
	1,1,2,2-Tetrachloroethane	5.0	µg/Kg				
	1,1,2-Trichloroethane	5.0	µg/Kg				
	1,1-Dichloroethane	5.0	µg/Kg				
	1,1-Dichloroethene	5.0	µg/Kg				
	1,2,3-Trichlorobenzene	5.0	µg/Kg				
	1,2,3-Trichloropropane	5.0	µg/Kg				
	1,2,4-Trichlorobenzene	5.0	µg/Kg				
	1,2,4-Trimethylbenzene	5.0	µg/Kg				
	1,2-Dichloroethane	5.0	µg/Kg	0.4	mg/Kg		
	1,2-Dichlorobenzene	5.0	µg/Kg				
	1,2-Dibromo-3-chloropropane	5.0	µg/Kg				
	1,2-Dichloropropane	5.0	µg/Kg	700	mg/Kg		
	1,2-Dibromoethane (EDB)	5.0	µg/Kg				
	1,3,5-Trimethylbenzene	5.0	µg/Kg				
	1,3-Dichlorobenzene	5.0	µg/Kg				
	1,4-Dichlorobenzene	5.0	µg/Kg				
	2-Hexanone	10	µg/Kg				
	4-methyl-2-pentanone	10	µg/Kg				
	Acetone	100	µg/Kg				
	Acrylonitrile	50	µg/Kg	1000	mg/Kg		
	Benzene	5.0	µg/Kg	0.05	mg/Kg		
	Bromobenzene	5.0	µg/Kg				
	Bromochloromethane	5.0	µg/Kg				
	Bromodichloromethane	5.0	µg/Kg				
	Bromoform	5.0	µg/Kg				
	Bromomethane	10	µg/Kg				
	Carbon disulfide	5.0	µg/Kg				
	Carbon tetrachloride	5.0	µg/Kg	1000	mg/Kg		
	Chlorobenzene (each)	5.0	µg/Kg	0.05	mg/Kg		
	Chloroethane	10	µg/Kg				
	Chloroform	5.0	µg/Kg	0.001	mg/Kg		
	Chloromethane	10	µg/Kg				
	Cis-1,2-DCE	5.0	µg/Kg				
	Cis-1,3-Dichloropropene	5.0	µg/Kg				
	Dibromochloromethane	5.0	µg/Kg				
	Dibromomethane	5.0	µg/Kg				
	Dichlorodifluoromethane	10	µg/Kg				
	Diethyl ether	100	µg/Kg				
	Ethylbenzene	5.0	µg/Kg	0.05	mg/Kg		
	Isobutanol	25	µg/Kg				
	Isopropylbenzene	5.0	µg/Kg				
	Methylene chloride	5.0	µg/Kg				
	Methyl t-butyl ether (MTBE)	10	µg/Kg				
	MEK (2-Butanone)	25	µg/Kg				
	n-Butylbenzene	5.0	µg/Kg				
	n-Propylbenzene	5.0	µg/Kg				
	m,p-Xylene	10	µg/Kg				
	o-Xylene	5.0	µg/Kg				
	Methyl Iodide	10	µg/Kg				
	Pentachloroethane	5.0	µg/Kg				
	p-Isopropyltoluene	5.0	µg/Kg				
	Sec-Butylbenzene	5.0	µg/Kg				
	Styrene	5.0	µg/Kg	0.1	mg/Kg		
	Trichloroethene	5.0	µg/Kg	0.001	mg/Kg		
	Tert-Butylbenzene	5.0	µg/Kg				
	Tetrachloroethene	5.0	µg/Kg	0.01	mg/Kg		
	Tetrahydrofuran	1000	µg/Kg	0.1	mg/Kg		
	Toluene	5.0	µg/Kg	0.05	mg/Kg		
	Trans-1,2-Dichloroethene	5.0	µg/Kg				
	Trans-1,3-Dichloropropene	5.0	µg/Kg				
	Trans-1,4-dichloro-2-butene	100	µg/Kg	1000	mg/Kg		
	Trichlorofluoromethane	10	µg/Kg				
	Vinyl chloride	10	µg/Kg	0.01	mg/Kg		
	Acetonitrile	100	µg/Kg				
	Acrolein	50	µg/Kg				
	Allyl Chloride	10	µg/Kg				
	Chloroprene	50	µg/Kg				
	Ethyl Methacrylate	10	µg/Kg				
	Methyl methacrylate	10	µg/Kg				
	Methacrylonitrile	10	µg/Kg				
	Propionitrile, Ethyl Cyanide	100	µg/Kg				
	Vinyl Acetate	10	µg/Kg				
	Xylenes	10	µg/Kg	0.05	mg/Kg		

TABLE B-1
Target Analyte List A for Soils and Sediments—All Selected Analytes
Soil and Sediment Sampling to Support the Dow MOCA ERA
Sampling and Analysis Plan

Parameter/Method	Analyte	Soil/Sediment		Ecological Screening Value for Soil		Ecological Screening Value for Sediment	
		RL	Unit	Value	Unit	Value	Unit
Semivolatile organics	1,2,3,4-Tetrachlorobenzene	330	µg/Kg				
Base/Neutral Extractables	1,2,4,5-Tetrachlorobenzene	330	µg/Kg				
	1,2,4-Trichlorobenzene	330	µg/Kg				
	2,4-Dinitrotoluene	330	µg/Kg				
	2,6-Dinitrotoluene	330	µg/Kg				
	2-Chloronaphthalene	330	µg/Kg				
	2-Methylnaphthalene	330	µg/Kg	1.0	mg/Kg		
	2-Nitroaniline	1700	µg/Kg			330	µg/Kg
	3-Nitroaniline	1700	µg/Kg				
	4-Bromophenyl phenyl ether	330	µg/Kg				
	4-Chlorophenyl phenyl ether	330	µg/Kg				
	4-Nitroaniline	1700	µg/Kg				
	Acenaphthylene	330	µg/Kg				
	Acenapthene	330	µg/Kg			330	µg/Kg
	Anthracene	330	µg/Kg	20	mg/Kg	330	µg/Kg
	Azobenzene	330	µg/Kg	0.1	mg/Kg	330	µg/Kg
	Benzo (a) anthracene	330	µg/Kg				
	Benzo (a) pyrene	330	µg/Kg			330	µg/Kg
	Benzo (k) fluoranthene	330	µg/Kg	0.1	mg/Kg	330	µg/Kg
	Benzo (b) fluoranthene	330	µg/Kg				
	Benzo (g,h,i) perylene	330	µg/Kg				
	Bis (2-chloroethoxy) methane	330	µg/Kg				
	Bis (2-chloroethyl) ether	330	µg/Kg				
	Bis (2-chloroisopropyl) ether	330	µg/Kg				
	Bis (2-ethylhexyl) phthalate	330	µg/Kg				
	Butyl benzylphthalate	330	µg/Kg			182	µg/Kg
	Carbazole	330	µg/Kg				
	Chrysene	330	µg/Kg				
	Di-n-butylphthalate	330	µg/Kg			330	µg/Kg
	Di-n-octylphthalate	330	µg/Kg	200	mg/Kg		
	Dibenz (a,h) anthracene	330	µg/Kg				
	Dibenzofuran	330	µg/Kg			330	µg/Kg
	Diethyl phthalate	330	µg/Kg				
	Dimethyl phthalate	330	µg/Kg				
	Fluoranthene	330	µg/Kg				
	Fluorene	330	µg/Kg	0.1	mg/Kg	330	µg/Kg
Additional Compound	Hexabromobenzene	*	µg/Kg	30	mg/Kg	330	µg/Kg
	Hexachlorobenzene	330	µg/Kg				
	Hexachlorobutadiene	330	µg/Kg	0.0025	mg/Kg		
	Hexachlorocyclopentadiene	330	µg/Kg				
	Hexachloroethane	330	µg/Kg	10	mg/Kg		
	Indeno (1,2,3-cd) pyrene	330	µg/Kg				
	Isophorone	330	µg/Kg				
	n-Nitrosdimethylamine	330	µg/Kg				
	n-Nitrosodiphenylamine	330	µg/Kg				
	n-Nitrosodi-n-propylamine	330	µg/Kg	20	mg/Kg		
	Naphthalene	330	µg/Kg				
	Nitrobenzene	330	µg/Kg	0.1	mg/Kg	330	µg/Kg
	Phenanthrene	330	µg/Kg	40	mg/Kg		
	Pyrene	330	µg/Kg	0.1	mg/Kg	330	µg/Kg
	Pyridine	330	µg/Kg	0.1	mg/Kg	330	µg/Kg
Additional Compound	Ronnel	*	µg/Kg	0.1	mg/Kg		
Semivolatile organics	2,4,5-Trichlorophenol	330	µg/Kg	4.0	mg/Kg		
Acid Extractables	2,4,6-Trichlorophenol	330	µg/Kg	10	mg/Kg		
SW8270C	2,4-Dichlorophenol	330	µg/Kg				
	2,4-Dimethylphenol	330	µg/Kg				
	2,4-Dinitrophenol	1700	µg/Kg	20	mg/Kg		
	2-Chlorophenol	330	µg/Kg				
	2-Methylphenol	330	µg/Kg				
	2-Nitrophenol	330	µg/Kg				
	4,6-Dinitro-2-methylphenol	1700	µg/Kg				
	4-Chloro-3-methylphenol	330	µg/Kg				
	4-Nitrophenol	1700	µg/Kg	7.0	mg/Kg		
	Pentachlorophenol	800	µg/Kg	0.002	mg/Kg		
	Phenol	330	µg/Kg	0.05	mg/Kg		
Additional Compound	4-Tert-Butylphenol	*	µg/Kg				
	1,3-Dinitrobenzene	330	µg/Kg				
	1,4-Dioxane	1700	µg/Kg				
	1-Naphthylamine	1700	µg/Kg				
	2,3,4,6-Tetrachlorophenol	330	µg/Kg				
	2,6-Dichlorophenol	330	µg/Kg				
	2-Naphthylamine	1700	µg/Kg				
	2-Picoline	660	µg/Kg				
	3,3'-Dichlorobenzidine	2000	µg/Kg				
	3,3'-Dimethylbenzidine	1700	µg/Kg				

TABLE B-1
Target Analyte List A for Soils and Sediments—All Selected Analytes
Soil and Sediment Sampling to Support the Dow MOCA ERA
Sampling and Analysis Plan

Parameter/Method	Analyte	Soil/Sediment		Ecological Screening Value for Soil		Ecological Screening Value for Sediment	
		RL	Unit	Value	Unit	Value	Unit
Semivolatile organics	3-Methylcholanthrene	660	µg/Kg				
Acid Extractables	3 & 4-Methylphenol	330	µg/Kg				
(Continued)	1,4-Napthoquinone	1700	µg/Kg				
	4-Aminobiphenyl	330	µg/Kg				
	4-Chloroaniline	330	µg/Kg				
	4-Nitroquinoline 1-oxide	1600	µg/Kg				
	5-Nitro-o-toluidine	660	µg/Kg				
	7,12-Dimethylbenz(a)anthracene	330	µg/Kg				
	a,a-Dimethylphenethylamine	1700	µg/Kg				
	Acetophenone	330	µg/Kg				
	Aniline	1700	µg/Kg				
	Aramite	1700	µg/Kg				
	Benzyl Alcohol	1300	µg/Kg				
	Diphenylamine	330	µg/Kg				
	Ethyl methanesulfonate	330	µg/Kg				
	Hexachlorophene	1700	µg/Kg				
	Hexachloropropene	1700	µg/Kg				
	Isosafrole	660	µg/Kg				
	Methapyrilene	330	µg/Kg				
	Methyl methansulfonate	330	µg/Kg				
	N-Nitrosodiethylamine	330	µg/Kg				
	N-Nitrosodi-n-butylamine	330	µg/Kg				
	N-Nitrosomethylethylamine	330	µg/Kg				
	N-Nitrisomorpholine	330	µg/Kg				
	N-Nitrosopiperidene	330	µg/Kg				
	N-Nitrosopyrrolidine	330	µg/Kg				
	o-Toluidine	330	µg/Kg				
Additional Compound	o-Phenyl phenol	*	µg/Kg				
	p-(Dimethylamino)azobenzene	330	µg/Kg				
	Pentachlorobenzene	330	µg/Kg	0.0025	mg/Kg		
	Pentachloronitrobenzene	330	µg/Kg				
	Phenacetin	660	µg/Kg				
	p-Phenylenediamine	3300	µg/Kg				
	Pronamide	330	µg/Kg				
	Safrole	330	µg/Kg				
	Dinoseb	660	µg/Kg				
	sym-Trinitrobenzene (1,3,5-)	330	µg/Kg				
Dioxins and Furans	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1.0	ng/Kg				
SW8290	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	5.0	ng/Kg				
	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	5.0	ng/Kg				
	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	5.0	ng/Kg				
	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	5.0	ng/Kg				
	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	5.0	ng/Kg				
	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	10	ng/Kg				
	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	1.0	ng/Kg				
	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	5.0	ng/Kg				
	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	5.0	ng/Kg				
	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	5.0	ng/Kg				
	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	5.0	ng/Kg				
	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	5.0	ng/Kg				
	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	5.0	ng/Kg				
	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	5.0	ng/Kg				
	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	5.0	ng/Kg				
	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	10	ng/Kg				

Additional Compound - The laboratory will purchase a standard for this compound and perform Method Detection Limit (MDL) Studies prior to analysis of the samples.
* - Reporting Limits will be determined upon completion of the MDL Studies.

TABLE B-2

Target Analyte List B for Soils and Sediments—All Selected Analytes

Soil and Sediment Sampling to Support the Dow MOCA ERA

Sampling and Analysis Plan

Parameter/Method	Analyte	Soil/Sediment	
		RL	Unit
TOC SW-846 9060	Total Organic Carbon	100	mg/kg
Particle Size ASTM D-422	Particle Size		

TABLE B--3

Target Analyte List for Aqueous Matrix—All Selected Analytes

Soil and Sediment Sampling to Support the Dow MOCA ERA

Sampling and Analysis Plan

Parameter/Method	Analyte	Water	
		RL	Unit
Mercury SW7470A	Mercury	0.2	µg/L
Metals SW-846 6010B	Antimony	20	µg/L
	Arsenic	10	µg/L
	Barium	20	µg/L
	Beryllium	1.0	µg/L
	Cadmium	5.0	µg/L
	Chromium	10	µg/L
	Cobalt	50	µg/L
	Copper	25	µg/L
	Lead	10	µg/L
	Lithium	20	µg/L
	Nickel	25	µg/L
	Selenium	5.0	µg/L
	Silver	10	µg/L
	Thallium	20	µg/L
	Tin	50	µg/L
	Vanadium	10	µg/L
	Zinc	20	µg/L
Cyanide SW-846 9010B/9012A	Total Cyanide	0.01	mg/L
TOC EPA 415.1	Total Organic Carbon	2.0	mg/L
Pesticides SW8081A	a-BHC	0.05	µg/L
	b-BHC	0.05	µg/L
	d-BHC	0.05	µg/L
	g-BHC (Lindane)	0.05	µg/L
Additional Compound	BP-6 (PPB)	*	µg/L
	a-Chlordane	0.05	µg/L
	g-Chlordane	0.05	µg/L
	4,4'-DDD	0.1	µg/L
	4,4'-DDE	0.1	µg/L
	4,4'-DDT	0.1	µg/L
	Aldrin	0.05	µg/L
	Dieldrin	0.1	µg/L
	Endosulfan I	0.1	µg/L
	Endosulfan II	0.1	µg/L
	Endosulfan Sulfate	0.1	µg/L
	Endrin	0.1	µg/L
	Endrin Aldehyde	0.1	µg/L
	Endrin Ketone	0.1	µg/L
	Heptachlor	0.05	µg/L
	Heptachlor Epoxide	0.05	µg/L
	Methoxychlor	0.5	µg/L
Additional Compound	Mirex	*	µg/L
	Toxaphene	1.0	µg/L
	Chlordane	0.5	µg/L
	Chlorobenzilate	5.0	µg/L
	Diallate	3.0	µg/L
	Isodrin	2.0	µg/L
Additional Compound	Kepone	2.0	µg/L
PCBs/SW8082	Aroclor-1016	0.5	µg/L
	Aroclor-1221	0.5	µg/L
	Aroclor -1232	0.5	µg/L
	Aroclor -1242	0.5	µg/L
	Aroclor -1248	0.5	µg/L
	Aroclor -1254	0.5	µg/L
	Aroclor -1260	0.5	µg/L
Additional Compound	Aroclor -1262	0.5	µg/L
Additional Compound	Aroclor -1268	0.5	µg/L
Organophosphorus Pesticides SW8141A	Dimethoate	5.0	µg/L
	Disulfoton	2.0	µg/L
	Famphur	2.0	µg/L
	O,O,O-Triethyl phosporothioate	2.0	µg/L
	O,O-Diethyl O-2-pyrazinyl phosphorthioate (Thionazin)	2.0	µg/L
	Parathion	2.0	µg/L
	Parathion, methyl	2.0	µg/L
	Phorate	2.0	µg/L
	Tetraethyl dithiopyrophosphate (Sulfotepp)	2.0	µg/L
Chlorinated Phenoxy Acid Herbicides SW8151A	2,4-D	1.0	µg/L
	2,4,5-T	1.0	µg/L
	Silvex (2,4,5-TP)	1.0	µg/L

TABLE B--3
Target Analyte List for Aqueous Matrix—All Selected Analytes
Soil and Sediment Sampling to Support the Dow MOCA ERA
Sampling and Analysis Plan

Parameter/Method	Analyte	Water	
		RL	Unit
VOCs	1,1,1,2-Tetrachloroethane	1.0	µg/L
SW8260B	1,1,1-Trichloroethane	1.0	µg/L
	1,1,2,2-Tetrachloroethane	1.0	µg/L
	1,1,2-Trichloroethane	1.0	µg/L
	1,1-Dichloroethane	1.0	µg/L
	1,1-Dichloroethene	1.0	µg/L
	1,2,3-Trichlorobenzene	1.0	µg/L
	1,2,3-Trichloropropane	1.0	µg/L
	1,2,4-Trichlorobenzene	1.0	µg/L
	1,2,4-Trimethylbenzene	1.0	µg/L
	1,2-Dichloroethane	1.0	µg/L
	1,2-Dichlorobenzene	1.0	µg/L
	1,2-Dibromo-3-chloropropane	0.5	µg/L
	1,2-Dichloropropane	1.0	µg/L
	1,2-Dibromoethane (EDB)	1.0	µg/L
	1,3,5-Trimethylbenzene	1.0	µg/L
	1,3-Dichlorobenzene	1.0	µg/L
	1,4-Dichlorobenzene	1.0	µg/L
	2-Hexanone	5.0	µg/L
	4-methyl-2-pentanone	5.0	µg/L
	Acetone	25	µg/L
	Acrylonitrile	10	µg/L
	Benzene	1.0	µg/L
	Bromobenzene	1.0	µg/L
	Bromochloromethane	1.0	µg/L
	Bromodichloromethane	1.0	µg/L
	Bromoform	1.0	µg/L
	Bromomethane	1.0	µg/L
	Carbon disulfide	1.0	µg/L
	Carbon tetrachloride	1.0	µg/L
	Chlorobenzene	1.0	µg/L
	Chloroethane	1.0	µg/L
	Chloroform	1.0	µg/L
	Chloromethane	1.0	µg/L
	Cis-1,2-DCE	1.0	µg/L
	Cis-1,3-Dichloropropene	1.0	µg/L
	Dibromochloromethane	1.0	µg/L
	Dibromomethane	1.0	µg/L
	Dichlorodifluoromethane	1.0	µg/L
	Diethyl ether	10	µg/L
	Ethylbenzene	5.0	µg/L
	Isobutanol	25	µg/L
	Isopropylbenzene	1.0	µg/L
	Methylene chloride	5.0	µg/L
	Methyl t-butyl ether (MTBE)	5.0	µg/L
	MEK (2-Butanone)	10	µg/L
	n-Butylbenzene	1.0	µg/L
	n-Propylbenzene	1.0	µg/L
	m,p-Xylene	2.0	µg/L
	o-Xylene	1.0	µg/L
	Methyl Iodide	1.0	µg/L
	Pentachloroethane	5.0	µg/L
	p-Isopropyltoluene	1.0	µg/L
	Sec-Butylbenzene	1.0	µg/L
	Styrene	1.0	µg/L
	Trichloroethene	1.0	µg/L
	Tert-Butylbenzene	1.0	µg/L
	Tetrachloroethene	1.0	µg/L
	Tetrahydrofuran	100	µg/L
	Toluene	1.0	µg/L
	Trans-1,2-Dichloroethene	1.0	µg/L
	Trans-1,3-Dichloropropene	1.0	µg/L
	Trans-1,4-dichloro-2-butene	10.0	µg/L
	Trichlorofluoromethane	1.0	µg/L
	Vinyl chloride	1.0	µg/L
	Acetonitrile	50	µg/L
	Acrolein	50	µg/L
	Allyl Chloride	5.0	µg/L
	Chloroprene	5.0	µg/L
	Ethyl Methacrylate	5.0	µg/L
	Methyl Methacrylate	5.0	µg/L
	Methacrylonitrile	5.0	µg/L
	Propionitrile, Ethyl Cyanide	50	µg/L
	Vinyl Acetate	10	µg/L
	Xylenes	5.0	µg/L

TABLE B--3
Target Analyte List for Aqueous Matrix—All Selected Analytes
Soil and Sediment Sampling to Support the Dow MOCA ERA
Sampling and Analysis Plan

Parameter/Method	Analyte	Water	
		RL	Unit
Semivolatile organics	1,2,3,4-Tetrachlorobenzene	5.0	µg/L
Base/Neutral Extractables	1,2,4,5-Tetrachlorobenzene	5.0	µg/L
SW8270C	1,2,4-Trichlorobenzene	5.0	µg/L
	2,4-Dinitrotoluene	5.0	µg/L
	2,6-Dinitrotoluene	5.0	µg/L
	2-Chloronaphthalene	5.0	µg/L
	2-Methylnaphthalene	5.0	µg/L
	2-Nitroaniline	20	µg/L
	3-Nitroaniline	20	µg/L
	4-Bromophenyl phenyl ether	5.0	µg/L
	4-Chlorophenyl phenyl ether	5.0	µg/L
	4-Nitroaniline	20	µg/L
	Acenaphthylene	5.0	µg/L
	Acenapthene	5.0	µg/L
	Anthracene	5.0	µg/L
	Azobenzene	5.0	µg/L
	Benzo (a) anthracene	5.0	µg/L
	Benzo (a) pyrene	5.0	µg/L
	Benzo (k) fluoranthene	5.0	µg/L
	Benzo (b) fluoranthene	5.0	µg/L
	Benzo (g,h,i) perylene	5.0	µg/L
	Bis (2-chloroethoxy) methane	5.0	µg/L
	Bis (2-chloroethyl) ether	5.0	µg/L
	Bis (2-chloroisopropyl) ether	5.0	µg/L
	Bis (2-ethylhexyl) phthalate	5.0	µg/L
	Butyl benzylphthalate	5.0	µg/L
	Carbazole	5.0	µg/L
	Chrysene	5.0	µg/L
	Di-n-butylphthalate	5.0	µg/L
	Di-n-octylphthalate	5.0	µg/L
	Dibenz (a,h) anthracene	5.0	µg/L
	Dibenzofuran	5.0	µg/L
	Diethyl phthalate	5.0	µg/L
	Dimethyl phthalate	5.0	µg/L
	Fluoranthene	5.0	µg/L
	Fluorene	5.0	µg/L
Additional Compound	Hexabromobenzene	*	µg/L
	Hexachlorobenzene	5.0	µg/L
	Hexachlorobutadiene	5.0	µg/L
	Hexachlorocyclopentadiene	5.0	µg/L
	Hexachloroethane	5.0	µg/L
	Indeno (1,2,3-cd) pyrene	5.0	µg/L
	Isophorone	5.0	µg/L
	n-Nitrosdimethylamine	5.0	µg/L
	n-Nitrosodiphenylamine	5.0	µg/L
	n-Nitrosodi-n-propylamine	5.0	µg/L
	Naphthalene	5.0	µg/L
	Nitrobenzene	5.0	µg/L
	Phenanthrene	5.0	µg/L
	Pyrene	5.0	µg/L
	Pyridine	10	µg/L
Additional Compound	Ronnel	*	µg/L
Semivolatile organics	2,4,5-Trichlorophenol	5.0	µg/L
Acid Extractables	2,4,6-Trichlorophenol	5.0	µg/L
SW8270C	2,4-Dichlorophenol	5.0	µg/L
	2,4-Dimethylphenol	5.0	µg/L
	2,4-Dinitrophenol	20	µg/L
	2-Chlorophenol	5.0	µg/L
	2-Methylphenol	5.0	µg/L
	2-Nitrophenol	5.0	µg/L
	4,6-Dinitro-2-methylphenol	20	µg/L
	4-Chloro-3-methylphenol	5.0	µg/L
	4-Nitrophenol	20	µg/L
	Pentachlorophenol	20	µg/L
	Phenol	5.0	µg/L
Additional Compound	4-Tert-Butylphenol	*	µg/L
	1,3-Dinitrobenzene	5.0	µg/L
	1,4-Dioxane	10	µg/L
	1-Naphthylamine	50	µg/L
	2,3,4,6-Tetrachlorophenol	5.0	µg/L
	2,6-Dichlorophenol	5.0	µg/L
	2-Naphthylamine	50	µg/L
	2-Picoline	10	µg/L
	3,3'-Dichlorobenzidine	5.0	µg/L
	3,3'-Dimethylbenzidine	50	µg/L

TABLE B--3
Target Analyte List for Aqueous Matrix—All Selected Analytes
Soil and Sediment Sampling to Support the Dow MOCA ERA
Sampling and Analysis Plan

Parameter/Method	Analyte	Water	
		RL	Unit
Semivolatile organics	3-Methylcholanthrene	10	µg/L
Acid Extractables	3 & 4-Methylphenol	10	µg/L
(Continued)	1,4-Napthoquinone	50	µg/L
	4-Aminobiphenyl	5.0	µg/L
	4-Chloroaniline	20	µg/L
	4-Nitroquinoline 1-oxide	50	µg/L
	5-Nitro-o-toluidine	20	µg/L
	7,12-Dimethylbenz(a)anthracene	10	µg/L
	a,a-Dimethylphenethylamine	50	µg/L
	Acetophenone	5.0	µg/L
	Aniline	20	µg/L
	Aramite	50	µg/L
	Benzyl Alcohol	50	µg/L
	Diphenylamine	10	µg/L
	Ethyl methanesulfonate	10	µg/L
	Hexachlorophene	50	µg/L
	Hexachloropropene	50	µg/L
	Isosafrole	10	µg/L
	Methapyrilene	10	µg/L
	Methyl methansulfonate	10	µg/L
	N-Nitrosodiethylamine	10	µg/L
	N-Nitrosodi-n-butylamine	10	µg/L
	N-Nitrosomethylethylamine	10	µg/L
	N-Nitrisomorpholine	10	µg/L
	N-Nitrosopiperidene	10	µg/L
	N-Nitrosopyrrolidine	10	µg/L
	o-Toluidine	10	µg/L
Additional Compound	o-Phenyl phenol	*	µg/L
	p-(Dimethylamino)azobenzene	10	µg/L
	Pentachlorobenzene	5.0	µg/L
	Pentachloronitrobenzene	5.0	µg/L
	Phenacetin	20	µg/L
	p-Phenylenediamine	100	µg/L
	Pronamide	10	µg/L
	Safrole	10	µg/L
	Dinoseb	20	µg/L
	sym-Trinitrobenzene	10	µg/L
Dioxins and Furans	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	0.01	ng/L
SW8290	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	0.05	ng/L
	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.05	ng/L
	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.05	ng/L
	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	0.05	ng/L
	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	0.05	ng/L
	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	0.1	ng/L
	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	0.01	ng/L
	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	0.05	ng/L
	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	0.05	ng/L
	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.05	ng/L
	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	0.05	ng/L
	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	0.05	ng/L
	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.05	ng/L
	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	0.05	ng/L
	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	0.05	ng/L
	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	0.1	ng/L

Additional Compound - The laboratory will purchase a standard for this compound and perform Method Detection Limit (MDL) Studies prior to analysis of the samples.
* - Reporting Limits will be determined upon completion of the MDL Studies.

Appendix C

Site Specific HS&E Plan Amendment

Dow Program

CH2M HILL HEALTH, SAFETY AND ENVIRONMENT PLAN

Site-Specific Amendment No. 2 – Revision 2

This amendment must accompany the Health, Safety and Environment Plan (HS&E Plan) for the **Dow Chemical Company Midland** project approved on **April 1, 2004**. The purpose of the HS&E Plan amendment is to include supplemental information as it becomes available. Supplemental information will be used to specify dates of site work for individual tasks, verify CH2M HILL onsite personnel and responsibilities, list site-specific subcontractors and contractors, and reevaluate hazards associated with the planned activities.

Where the amendment contains information different from the HS&E Plan, the amendment will take precedence for the specified task. The amendment includes new information or revises existing HS&E Plan information. Sections of the HS&E Plan that are not addressed in the amendments do not have changes; therefore, the HS&E Plan will be followed. All employees performing tasks covered by this amendment must read both the HS&E Plan and this amendment and agree to abide by their provisions (see Attachment 1).

Project Information and Description

PROJECT NO:	317710.01.WP (original HS&E Plan 188182 and 188194)
CLIENT:	The Dow Chemical Company
PROJECT/SITE NAME:	Midland
SITE ADDRESS:	This HS&E Plan Amendment is intended to cover activities associated with Offsite Corrective Action fieldwork associated with Dow's Midland Plant, as described under Condition XI.B of Dow's June, 2003 Operating License. Specific areas in which work will occur include: (1) Sediments and floodplain soils of the Tittabawassee River from approximately 1 mile upstream of Dow Midland Plant to approximately 11 miles downstream to the confluence of the Tittabawassee and Saginaw Rivers and also upstream of the Plant along the Chippawa River. Activities covered will consist of investigation, Interim Response Activities, and corrective actions.
CH2M HILL PROJECT MANAGER:	Gary Dyke
CH2M HILL OFFICE:	Midland
DATE HS&E PLAN PREPARED:	04/01/2004
DATE AMENDMENT PREPARED:	May 26, 2004; Revised June 9, 2004
DATE(S) OF SITE WORK:	June 28 – July 2, 2004 (Boating and sediment sampling)

1.1 Description of Tasks

(Reference Field Project Start-up Form)

Description of Tasks for this Site-Specific Amendment:

SEDIMENT SAMPLING. Collect surface sediment samples from 5 locations along the Tittabawassee River , and one location on the Chippawa River by boat (work will be contracted out). Conditions may exist requiring the samplers to leave the boat during the sampling activities to wade through portions of the river.

1.1.1 Hazwoper-Regulated Tasks

- Sediment Sample Collection by boat
- Sediment Sample Collection by wading

1.1.2 Non-Hazwoper-Regulated Tasks

TASKS	CONTROLS
• GPS Surveying	• Brief on hazards, limits of access, and emergency procedures • Post contaminant areas as appropriate (refer to Section 8.2 for details) • Sample and monitor as appropriate (refer to Section 5.0)

2 Control Measures

This section provides safe work practices and control measures used to reduce or eliminate potential hazards and risks.

Each individual must complete a safety task analysis card or STAC (see Attachment 4 of the original HS&E Plan). STACs must be completed daily and updated as site conditions and/or activities change, or potential changes arise.

A Project-Activity Self-Assessment Checklist for "Boating" is contained in Attachment 4 of this amendment. The checklist will be completed at the beginning of boating activities, and once weekly. The self-assessment checklists, including documented corrective actions, should be made part of the permanent project records, and be promptly submitted to the HSM.

Formal observations are not required for the tasks under this amendment since there are fewer than three employees working less than five days onsite for each task; however observations may be done at any time. Interventions are required. Interventions will occur when an unsafe behavior or work condition is observed. Each person conducting 40 or more hours per month of field work must document interventions on the STAC or intervention card at a rate of one per 40 hours worked.

Additionally, as indicated in Section 2.1.1, a Safe Work Permit for "Boating" will be completed on a daily basis for this activity. A Safe Work Permit for "Pressure Washing" will be completed as necessary for decontaminating equipment.

Safe Work Permits are incorporated as Attachment 2 of this HS&E Plan Amendment. Completed Safe Work Permits must be submitted to Jeannie Armstrong/SEA for internal and Dow review.

2.1 Project-Specific Control Measures

2.1.1 Boating

The following control measures are excerpted from Section 2.1.2 of the original HS&E Plan, and apply to subcontractor personnel performing boating and sediment sampling. Additionally, a Safe Work Permit for Boating will be completed on a daily basis, and a Safe Work Permit for Pressure Washing will be completed as necessary for decontaminating equipment (both included in Attachment 2 of this HS&E Plan Amendment). A Job Hazard Analysis (JHA) for sediment sampling activities has been prepared by the subcontractor and is incorporated as Attachment 3 of this HS&E Plan Amendment.

- All operations involving boating will be directed by an experienced boater.
- The Safe Boating Checklist found in Attachment 4 of this amendment will be completed at the beginning of boating activities, and once weekly.
- Michigan boating laws must be adhered to when operating a boat during visual surveying activities. Refer to "The Handbook of Michigan Boating Laws and Responsibilities," which is available online at http://boat-ed.com/mi/handbook/pdf/miguide.pdf.
- All staff must wear U.S. Coast Guard (USCG) approved personnel flotation devices (PFDs) when aboard the boat.
- One Type IV USCG-approved PFD (throwable cushions or ring buoys) must be onboard and readily accessible on vessels 16 feet or longer.
- The boating team will include at least one person qualified in First Aid and CPR.
- All personnel shall wear bright colors (for example: hunter orange, yellow, etc.) to enhance their visibility to one another.
- The SC has final authority on operations with regards to weather and water conditions.
- Safe means of boarding or leaving the boat or platform must be provided to prevent slipping and falling.
- Employees should be instructed on safe use of the boat.
- Never exceed the load limit of the boat.
- The boat must be equipped with a Type B fire extinguisher if the boat has permanently installed fuel tanks, portable fuel tanks, or compartments in which flammable or combustible materials are stored. The extinguisher must be mounted in an accessible area, and labeled "Marine Type USCG Approved," followed by the size and type symbols and the approval number. Refer to "The Handbook of Michigan Boating Laws and Responsibilities" for additional fire extinguisher requirements.
- The boat must be equipped with the appropriate navigation lights for the type of boat being used for nighttime and poor visibility conditions (refer to "The Handbook of Michigan Boating Laws and Responsibilities").
- The boat must be equipped with the appropriate sound producing devices for the type of boat being used (refer to "The Handbook of Michigan Boating Laws and Responsibilities") .
- The boat must be equipped with an anchor and alternative means of locomotion (extra motor, floatable oars).
- Weather and water conditions must be monitored to determine if it is safe to be out on a water body.
- Work requiring the use of a boat will not take place at night or during inclement weather.
- Shut off engine before refueling. Do not smoke while refueling.
- Remain seated in the boat or canoe whenever possible.
- Never stand on the gunwales of a boat except when needed for embarking or disembarking.

2.1.2 Wading

The following physical hazards may exist on this project including hazards associated with wading in 3 to 4 feet of water, and working from a boat or canoe.

- Although the river and lake areas we will be working in are wadeable in places, there may be deep spots. Care will be taken when wading not to proceed beyond waist deep.
- Wading will not be performed without a buddy nearby.
- U.S. Coast Guard-approved PFD, or life jacket, shall be worn by both the person wading and the buddy.
- Inspect PFDs prior to use. Do not use defective PFDs.
- A minimum of one ring buoy with 90 feet of 3/8-inch solid-braid polypropylene (or equal) rope must be provided for emergency rescue.

- Waders will not be worn when personnel are in the boat.
- The sediments may be soft and there is a possibility of sinking. When wading, team members are cautioned to be careful of footing.

3 Project Organization and Personnel

3.1 CH2M HILL Employee Medical Surveillance and Training

(Reference CH2M HILL SOPs HSE-01, *Medical Surveillance,* and HSE-02, *Health and Safety Training)*

Employee Name	Office	Responsibility	SC/FA-CPR
Paul Arps	MOCA Site	Field Team lead	Level C SSC; FA/CPR
Gary Dyke	MOCA Site	Project Manager Leader	
Eric Kroger	DAY	Project Manager	

3.2 Field Team Chain of Command and Communication Procedures

3.2.1 Client

Contact Name: Dow Chemical Company

Facility Contact Name: Ben Baker

Phone: 989/636-0787

The contact at security to notify for work along the river on Dow property is Jack Johnson (989) 638-1429.

3.2.2 CH2M HILL

Project Manager Leader: Gary Dyke/LSG/MOCA Site

Project Manager: Eric Kroger/DAY

Health and Safety Manager: Lisa Martin/DEN

Environmental Compliance Coordinator: Jessica Raphael/DET

Field Team Leader: Paul Arps/LSG/MOCA Site

Safety Coordinator: Paul Arps/LSG

The SC is responsible for contacting the Field Team Leader and Project Manager. In general, the Project Manager will contact the client. The Health and Safety Manager should be contacted as appropriate.

3.2.3 CH2M HILL Subcontractors

(Reference CH2M HILL SOP HSE-55, *Subcontractor, Contractor, and Owner*)

Subcontractor: Limno-Tech, Inc.
Subcontractor Contact Name: Tim Dekkar
Telephone: (734) 332-1200
Subcontractor Tasks(s): Perform surface sediment sample collection.

4 Personal Protective Equipment (PPE)

(Reference CH2M HILL SOP HSE-07, *Personal Protective Equipment*; HSE-08, *Respiratory Protection*)

PPE Specifications [a]

Task	Level	Body	Head	Respirator [b]
GPS Surveying	D	Work clothes; steel-toe, leather work boots; work gloves.	Hardhat [c] Safety glasses Ear protection [d]	None required
Sediment sample collection by boat	Modified D	**Coveralls:** Not required unless work clothes can't be kept reasonably clean, at which time cotton coveralls will be worn **Boots:** Steel-toe, leather work boots; for muddy/wet conditions - steel-toe, chemical-resistant boots **Gloves:** Nitrile gloves. **Personal Flotation Devices (PFDs) must be worn on the boat.**	Hardhat [c] Safety glasses Ear protection [d]	None required.
Sediment sample collection by wading	Modified D	**Coveralls:** Not required unless work clothes can't be kept reasonably clean, at which time cotton coveralls will be worn **Waders:** To be worn only while wading – not while in boat **Gloves:** Nitrile gloves. **Personal Flotation Devices (PFDs) must be worn on the boat.**	Hardhat [c] Safety glasses Ear protection [d]	None required.

Reasons for Upgrading or Downgrading Level of Protection

Upgrade[f]	Downgrade
• Request from individual performing tasks. • Change in work tasks that will increase contact or potential contact with hazardous materials. • Occurrence or likely occurrence of gas or vapor emission. • Known or suspected presence of dermal hazards. • Instrument action levels (Section 5) exceeded.	• New information indicating that situation is less hazardous than originally thought. • Change in site conditions that decreases the hazard. • Change in work task that will reduce contact with hazardous materials.

[a] Modifications are as indicated. CH2M HILL will provide PPE only to CH2M HILL employees.

[b] No facial hair that would interfere with respirator fit is permitted.

[c] Hardhat and splash-shield areas are to be determined by the SC.

[d] Ear protection should be worn when conversations cannot be held at distances of 3 feet or less without shouting.

[e] Cartridge change-out schedule is at least every 8 hours (or one work day), except if relative humidity is > 85%, or if organic vapor measurements are > midpoint of Level C range (refer to Section 5)-, then at least every 4 hours. If encountered conditions are different than those anticipated in this HSP, contact the HSM.

[f] Performing a task that requires an upgrade to a higher level of protection (e.g., Level D to Level C) is permitted only when the PPE requirements[have been approved by the HSM, and an SC qualified at that level is present.

5 Air Monitoring/Sampling

(Reference CH2M HILL SOP HSE-06, *Air Monitoring)*

None Required

11 Approval

This site-specific Health, Safety and Environment Plan has been written for use by CH2M HILL only. CH2M HILL claims no responsibility for its use by others unless that use has been specified and defined in project or contract documents. The plan is written for the specific site conditions, purposes, dates, and personnel specified and must be amended if those conditions change.

11.1 Original Plan

Written By: **Catherine Geiger/CHI** **Date:** **11/24/2003**

Approved By: Lisa G. Martin **Date:** **04/01/2004**

_Lisa Martin _____
RHSPM

_Jessica Raphael_____
ECC

11.2 Revisions

Revisions Made By: **Eric Kroger/DAY** **Date:** **May 26, 2004**

Revisions to Plan: **Amended plan to cover June 2004 geoprobe boring and soil sampling and boating and sediment sampling activities, and updated the associated hazards and controls, project personnel, subcontractors, PPE, and air monitoring requirements for these tasks.**

Revisions Approved By: Lisa G. Martin **Date:** **May 28, 2004**

_Lisa Martin _____
RHSPM

_Jessica Raphael_____
ECC

11.3 Revisions

Revisions Made By: Paul Arps/LSG Date: June 2, 2004

Revisions to Plan: Revised Amendment No. 2 to include raking/clearing activities and chainsaw operations. Updated the associated hazards and controls and PPE requirements for these tasks. Added the JHA template as Attachment 3, and the Project-Activity Self-Assessment Checklist for Chainsaw Operations as Attachment 4.

Revisions Approved By: Lisa D. Martin **Date: June 2, 2004**

_Lisa Martin _____
RHSPM

_Jessica Raphael_____
ECC

11.4 Revisions

Revisions Made By: Paul Arps/LSG Date: June 9, 2004

Revisions to Plan: Revised Amendment No. 2 to cover sediment sampling activities from a boat and while wading. Updated the associated hazards and controls and PPE requirements for these tasks. Added the Limno-Tech, Inc. JHA for sediment sampling as Attachment 3.

Revisions Approved By: Lisa D. Martin **Date: June 25, 2004**

_Lisa Martin _____
RHSPM

_Jessica Raphael_____
ECC

12 Attachments

Attachment 1: **Employee Signoff Form – Health & Safety Plan**

Attachment 2: **Safe Work Permits - Boating and Pressure Washing**

Attachment 3: **Limno-Tech, Inc. Job Hazard Analysis for Sediment Sampling**

Attachment 4: **HS&E Self-Assessment Checklist - Boating**

Attachment 1

Employee Signoff Form – Health & Safety Plan

CH2MHILL

EMPLOYEE SIGNOFF FORM

Health and Safety Plan

Amendment No. 2 – Revision 2

The CH2M HILL project employees and subcontractors listed below have been provided with a copy of this HSP, have read and understood it, and agree to abide by its provisions.

Project Name: Dow, Midland, Michigan **Project Number:** 317710.01.WP

EMPLOYEE NAME (Please print)	EMPLOYEE SIGNATURE	COMPANY	DATE

Attachment 2

Safe Work Permits – Boating and Pressure Washing

Attachment 3

Limno-Tech, Inc. Job Hazard Analysis for Sediment Sampling

Attachment 4

HS&E Self-Assessment Checklist – Boating

Health and Safety Self Assessment Checklist - BOATING

This self assessment is only to be used at locations where CH2M HILL controls the work. It is not to be used at locations where others control the work.

Project Name: _____ Project No.: _____

Location: _____ PM: _____

Auditor: _____ Title: _____ Date: _____

If an assessment item is complete/correct the "Yes" box should be checked. If an item is incomplete or deficient the "No" box should be checked. Items that are considered to be imminently dangerous must be corrected immediately or all exposed personnel must be removed from the hazard. All deficiencies shall be brought to the attention of the appropriate party that is responsible for correcting the deficiency. If an item is not applicable, the "N/A" box should be checked. If an item is applicable but was not observed during the assessment, the "N/O" box should be checked.

	Yes	No	NA	N/O
GENERAL				
Weather forecast checked.	☐	☐	☐	☐
At Least one Team Member is trained in First Aid/CPR.	☐	☐	☐	☐
Lights, horn, battery, fuel, steering, bilge pump, anchor & propeller checked.	☐	☐	☐	☐
Daily safety briefing/meeting conducted with crew	☐	☐	☐	☐
5. Personal Floatation Devices (PFD's) inspected daily.	☐	☐	☐	☐
6. Fire extinguisher available, charged and accessible.	☐	☐	☐	☐
First aid kit available	☐	☐	☐	☐
Project Instructions and H&S Plan available	☐	☐	☐	☐
Potable water available	☐	☐	☐	☐
Sunscreen & Bug Spray available	☐	☐	☐	☐
Distress communications available (flare gun, air horn, Cell phone, CB)	☐	☐	☐	☐
An oar is available on board the boat in the event of mechanical failure	☐	☐	☐	☐
BOAT TRANSPORT				
13. Boat motor secured prior to boat transport	☐	☐	☐	☐
14. Turn signals and brake lights verified as operable.	☐	☐	☐	☐
15. Safety chains available on trailer and secured in a criss-cross fashion	☐	☐	☐	☐
16. Trailer winch engaged	☐	☐	☐	☐
17. Ball hitch seated and latch pin installed	☐	☐	☐	☐
18 Tools and equipment secured prior to boat movement	☐	☐	☐	☐
19 Personnel not allowed ride on boat as it is being towed	☐	☐	☐	☐
20. Safe distance is maintained with traveling around power lines	☐	☐	☐	☐
21. Backup alarm or spotter used when backing boat	☐	☐	☐	☐
22. Boat is unhitched on a level and stabile surface	☐	☐	☐	☐
BOAT OPERATION				
23. Boat holds appropriate size load	☐	☐	☐	☐
24. Personnel cleared during boat start-up	☐	☐	☐	☐
Kill switch clearly identified and operational	☐	☐	☐	☐
26. Personnel wearing appropriate PPE	☐	☐	☐	☐
27. All personnel wearing PFD's	☐	☐	☐	☐
28. Boat will not be used for recreational purposes	☐	☐	☐	☐

DRAFT

DRAFT BASELINE ECOLOGICAL RISK ASSESSMENT WORK PLAN FOR POLYCHLORINATED DIBENZO-*p*-DIOXINS (PCDDS) AND DIBENZOFURANS (PCDFS) IN THE TITTABAWASSEE RIVER AND ASSOCIATED FLOODPLAINS

Prepared by:
ENTRIX, Inc.
East Lansing, Michigan

Prepared for:
The Dow Chemical Company
Midland, Michigan

July 2005

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Definitions and Acronyms

AhR	Aryl hydrocarbon receptor
ADDpot	Average potential daily dose
ATL	Aquatic Toxicology Laboratory
BERA	Baseline ecological risk assessment
COPECs	Chemicals of potential ecological concern
DDT	Dichlorodiphenyltrichloroethane
DQOs	Data quality objectives
EEC	Estimated exposure concentration
EPC	Exposure point concentration
ERA	Ecological risk assessment
FSP	Field sampling plan
GBH	Great blue heron
HQ	Hazard quotient
ID	Identification
LCS	Laboratory control spike
LCSD	Laboratory control spike duplicate
LOAEL	Lowest observable adverse effect level
LOD	Limit of detection
MATC	Maximum allowable tissue concentration
MDCH	Michigan Department of Community Health
MDEQ	Michigan Department of Environmental Quality
MDL	Method detection limit
MDNR	Michigan Department of Natural Resources
MS	Matrix spike
MSD	Matrix spike duplicate
MSU	Michigan State University
NFSTC	National Food Safety and Toxicology Center
NOAEL	No observable adverse effect level
PCBs	Polychlorinated biphenyls

PCDDs	Polychlorinated dibenzo-*p*-dioxins
PCDFs	Polychlorinated dibenzofurans
QAPP	Quality assurance project plan
QA	Quality assurance
QC	Quality control
RPD	Relative percent difference
RPF	Relative potency factor
RI	Remedial investigation
ROC	Receptor of concern
RSD	Relative standard deviation
S-HASP	Site specific health and safety plan
SLERA	Screening level ecological risk assessment
SMDP	Scientific management decision points
SOP	Standard operating procedure
SPMD	Semi permeable membrane device
SRM	Standard reference material
SSL	Soil screening levels
TEFs	Toxic equivalency factors
TEQs	TCDD equivalents
TFV	Toxicity reference values
TCDD	2,3,7,8-Tetrachlorodibenzo-*p*-dioxin
TRV	Toxicity reference value
UCL	Upper confidence limit
UF	Uncertainty factor
URCF	University Research and Containment Facility
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
WHO	World Health Organization

1.0 INTRODUCTION

The Tittabawassee River study area, hereafter referred to as the "Site", includes sediments and floodplain soils for approximately 23 miles of the Tittabawassee River downstream of Midland, Michigan. Specifically, the Site includes the Tittabawassee River from the upstream boundary of The Dow Chemical Company to the confluence of the Tittabawassee and Shiawassee Rivers downstream of Greenpoint Island, as defined in the Hazardous Waste Management Facility Operating License, which was issued on June 12, 2003 by Michigan Department of Environmental Quality (MDEQ) to The Dow Chemical Company (Dow). This baseline ecological risk assessment (BERA) workplan is designed to satisfy the requirements under the Operating License to conduct an ecological risk assessment (ERA) as part of the Remedial Investigation (RI) process, specifically Condition XI.B.3.v of the Operating License.

Based on historical data, it is assumed that polychlorinated dibenzo-*p*-dioxins (PCDDs) and dibenzofurans (PCDFs) will continue to be (COPECs) and are thus the main focus of this BERA workplan. Previous documents have reported concentrations of PCDDs and PCDFs in the sediments, floodplain soils, and fish of the Tittabawassee Rivers that exceed some state generic criteria (Taylor et al., 2002, Hilscherova et al., 2003, MDEQ, 2003). Currently, there is minimal information on the presence or concentration of PCDDs and PCDFs in the tissues or diets of avian and mammalian wildlife species that reside within the study or reference areas. In addition, there is very little information on the population health of key species in the study area. A search of the published scientific literature revealed that available models are fraught with uncertainty and are typically site-specific. As recognized by the USEPA (USEPA, 1997; USEPA 1998), site-specific field studies are almost always required for sound decision making. This is especially true for complex systems such as the Tittabawassee River. As a result, this BERA Work Plan is designed to provide a survey of species-specific dietary exposure concentrations and tissue residue concentrations in wildlife that are potentially exposed to PCDDs and PCDFs in the Tittabawassee River and floodplain soils. Several studies are described in this Work Plan to address data gaps and reduced uncertainty in the risk assessment process.

1.1 Purpose and Scope

The overall purpose of this Work Plan is to present a detailed approach for conducting a BERA for the Tittabawassee River and associated floodplain. More specifically, this Work Plan outlines a framework for evaluating relevant lines of evidence and identifies key data that need to be collected in order to evaluate the potential risks toward key ecological receptors in the Site from exposure to chemicals of COPECs. The primary COPECs addressed in the BERA based on historical knowledge of the site are PCDDs and PCDFs. However, the iterative nature of the BERA process will accommodate any additional COPECs that are identified in the screening level ecological risk assessment (SLERA). The SLERA process is covered in detail in a separate SLERA Work Plan (ENTRIX 2005). The results from this BERA will be used to:

- Determine the dietary composition of key receptors and the concentrations of PCDDs and PCDFs in site-specific and receptor-specific dietary items;
- Compare dietary exposure concentrations to literature-based TRVs;
- Determine how tissue residue concentrations from the site compare to similar samples collected from reference areas, and how those concentrations compare to literature-based toxicity reference values (TRVs);
- Provide information necessary for evaluation of wildlife populations potentially at risk so that appropriate actions can be taken;

- Inform the public and other interested stakeholders of concentrations of PCDDs and PCDFs and total TEQs (based on PCDDs and PCDFs as described later) in selected tissues of food web items and wildlife species collected from the Tittabawassee River and floodplain;
- Perform a pathway analysis to provide the information necessary to mitigate exposure;
- Satisfy the RI requirement (Rule 299.5528(3)(m)) to consider natural resource injury evaluation; and
- Evaluate the need for further study or risk mitigation for the protection of ecological receptors.

Included in this BERA Work Plan are site-specific studies to be performed by Michigan State University's (MSU) Aquatic Toxicology Laboratory (ATL). In 2003 and 2004, The Dow Chemical Company provided grants to the MSU ATL to conduct ecological studies along the Tittabawassee River and associated floodplains (MSU, 2003). These studies will focus on PCDD and PCDF accumulation into terrestrial and aquatic foodwebs and also focus on measures of population and reproductive health of key receptors. Anticipated data availability from the MSU-ATL studies is presented in Table 1-1 for each of three lines of evidence. All relevant and available data will be evaluated for quality and usefulness in the BERA.

Table 1-1. Anticipated availability of datasets from MSU-ATL studies.

Receptor	Dietary-based exposure analysis	Receptor tissue concentrations	Productivity measurements
Shrew	2006	2006	ND
Mink	2006	2006	2007
Tree swallow	2006	2007	2008
Eastern bluebird	2006	2007	2008
House wren	2006	2007	2008
American robin	2006	2007	ND
Great horned owl	2006	2007	2008
Great blue heron	2006	2008	2008
Belted kingfisher	2006	2007	2008

"ND" – no data are being collected on this topic
Details of the MSU ATL studies are presented in Appendices C through G.
Some portions of datasets may be available prior to completion.

1.2 Regulatory Guidance and Outline of Proposed Approach

This BERA Work Plan is based upon USEPA ERA guidance (Figure 1-1; USEPA 1997, USEPA 1998, USEPA 1999, USEPA 2001a and b), applicable state regulatory guidance including Part 201 of Act 451, and the conditions of the Operating License. In addition, this Work Plan considered the recent "Draft Framework for Application of the Toxicity Equivalence Methodology for Polychlorinated Dioxins, Furans, and Biphenyls in Ecological Risk Assessment" (USEPA, 2003).

The general proposed approach for this ERA follows the USEPA ERA guidance for Superfund (USEPA, 1997). The eight step process within the USEPA ERA guidance for Superfund sites is designed to focus resources on key chemicals, pathways of exposure, and receptors and to eliminate from further consideration those chemicals, pathways, and receptors that are clearly not at risk (Figure 1-1). The approach for this BERA will include the following processes and data collections:

- **Pre-ERA Planning**
  - Planning meetings with MDEQ, USEPA, USFWS, MSU, Dow, and other potential stakeholders
  - Development of preliminary data quality objectives (DQOs)
- **Screening-Level ERA (Described in detail in the Screening-Level ERA Work Plan)**
  - Site visit - including site-specific biota inventory and habitat suitability characterization for the aquatic and terrestrial resources along the Tittabawassee River
  - Compilation of existing information on the COPECs and receptor species at the site
  - Screening-level problem formulation, exposure estimation, and risk characterization
- **Baseline ERA Problem Formulation**
  - Integrate available information to identify exposure pathways and COPECs that will be evaluated in the BERA
  - Selection of assessment endpoints
  - Development of a conceptual site model
  - Development of risk questions and hypotheses
- **Baseline ERA Study Design Phase**
  - Development of data quality objectives (DQOs) for the ERA
  - Selection of measurement endpoints
  - Development of sampling and analysis plans
- **Baseline ERA Analysis Phase – Exposure Assessment**
  - Determine site use and exposure pathways for key receptors or appropriate surrogates
  - Determine concentrations of PCDDs and PCDFs in the aquatic and terrestrial food webs
  - Assess site-specific bioavailability of PCDDs and PCDFs from soils and sediments
  - Estimate potential dietary exposures of receptors to PCDDs and PCDFs
  - Determine concentrations of PCDDs and PCDFs in key receptor tissues
  - Determine the extent to which selected receptor species may be exposed to other COPECs
- **Baseline ERA Analysis Phase – Effects Assessment**
  - Review literature for dietary-based and tissue-based effect levels
- **Risk Characterization**
  - Characterize potential ecological risks using dietary-based exposure assessment

1.3 Schedule

Several major elements, proposed sequencing, and estimated timelines for activities related to conducting a BERA for the Tittabawassee River and floodplain (Figure 1-1) were identified. The planning and exposure analysis phases of the ERA will be coordinated with other elements of the RI to the extent possible, such that information can be appropriately integrated and the RI process can proceed. The duration of the screening-level ERA, baseline ERA problem formulation, baseline ERA study design, and baseline ERA exposure assessment phases will be approximately two years. Most of the data pertaining to the exposure assessment phase will be available as input to focus the ecological effects assessment phase for key ecological receptors for decision making. For the BERA activities, bimonthly progress updates will be provided to MDEQ. For a more detailed discussion of the BERA schedule and proposed BERA reports, refer to section 7.0.

1.4 Work Plan Organization

The remainder of this BERA Work Plan is organized into the following sections and appendices:

Section 2.0. Screening-Level ERA

This section describes how the results of the SLERA will be integrated in the BERA process. For more details, refer to the Draft SLERA workplan (ENTRIX 2005).

Section 3.0. Baseline ERA Problem Formulation Phase

This section provides details concerning selection of assessment endpoints and development of a conceptual site model.

Section 4.0. Baseline ERA Study Design Phase

This section provides information on the overall study design including a description of the data quality objective process, analytical methodology, and data analysis and interpretation.

Section 5.0. Baseline ERA Analysis Phase – Exposure and Effects Assessment

This section provides details concerning the various approaches that will be utilized to determine exposure and effects on ecological receptors of concern and will discuss the uncertainties associated with each approach.

Section 6.0. Baseline ERA Risk Characterization Phase

This section provides details concerning the risk characterization process for each ecological receptor.

Section 7.0. Schedule and Reporting

This section provides an overview of the project schedule.

Section 8.0. References

Appendix A. Quality Assurance Project Plan (QAPP)

The QAPP provides the details governing the quality assurance (QA) and quality control (QC) procedures that will be followed in conducting the studies. It also describes the specific protocols concerning sample acquisition, handling and storage, chains-of-custody, and laboratory analysis.

Appendix B. Site Specific Health and Safety Plan (S-HASP)

A site-specific health and safety plan (S-HASP) will be developed before implementing work described in the BERA Work Plan. This plan clearly states the relevant health and safety requirements for individuals working during this investigation.

Appendices C - G. Baseline ERA Study Plans

These appendices provide data quality objectives for each of the studies and includes details concerning the chemical, physical, and biological measurements that will be made while conducting the studies described.

Appendix H. Standard Operating Procedures (SOPs)

The Standard Operating Procedures provide specific instructions for the procedures that will be followed in the field and laboratory.

Appendix I. Permits in support of MSU study plans

The MSU study plans require numerous university, state, and federal permits to conduct the research appropriately.

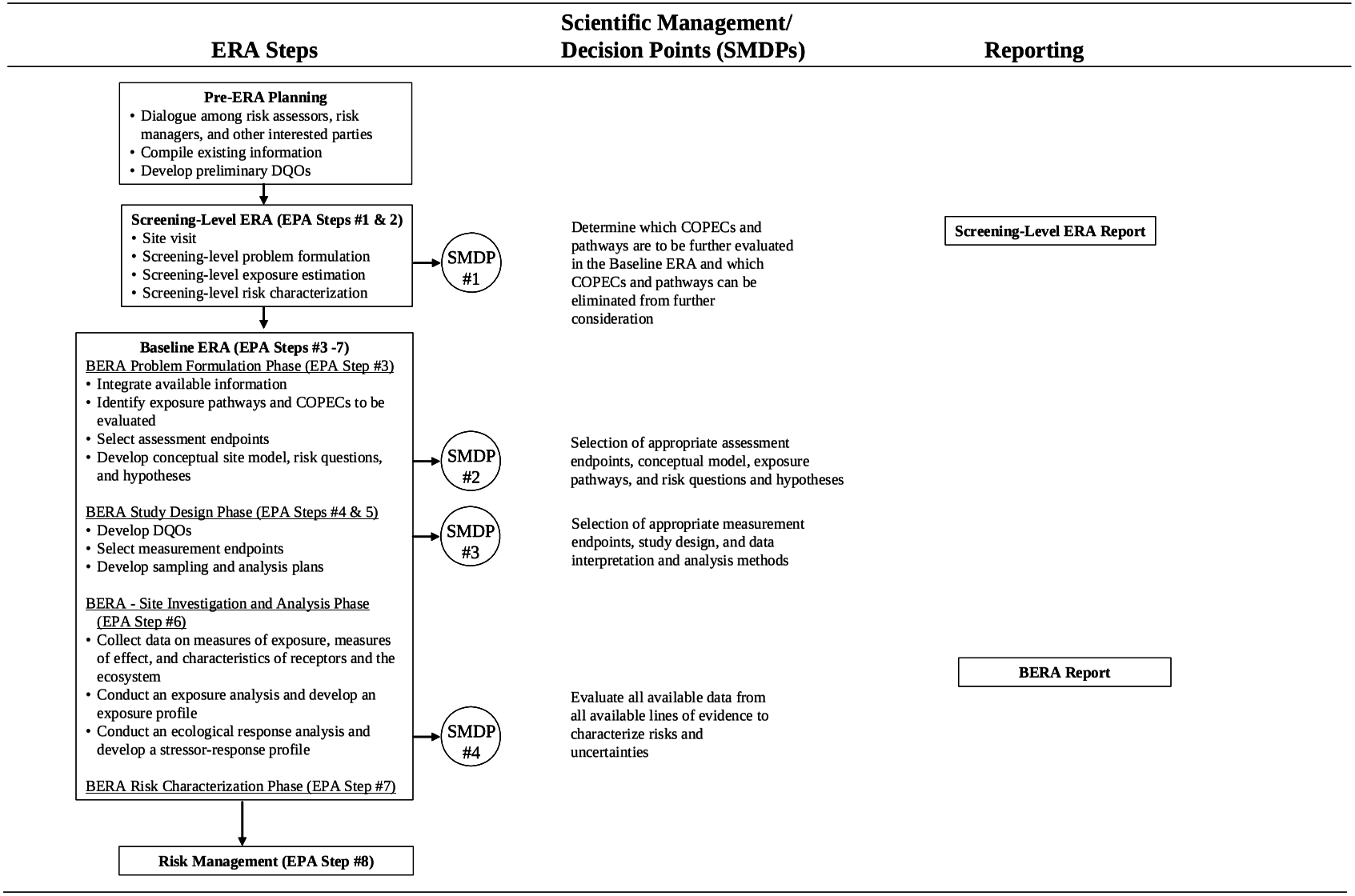

Figure 1-1. ERA steps, scientific management decision points and reporting (based on Superfund ERA Guidance; USEPA, 1997)

2.0 SCREENING-LEVEL ERA (SLERA)

2.1 Introduction

As specified by USEPA guidance, the first step in the ERA process is a screening-level or Tier I ERA in which the objective is to identify and document conditions that do *not* warrant further evaluation in a more refined baseline ERA (BERA). A screening-level ERA (SLERA) is a simple, worst-case estimation that is accomplished by assuming conservative values for parameters that are scarce or lacking. For a SLERA, it is important to minimize the chances of concluding that there is no risk when in fact a risk exists, i.e., the technique assures that the probability of a false negative is very low. Thus, for exposure and toxicity or effect parameters for which site-specific information is minimal, assumed values, such as area-use and bioavailability, should be consistently biased in the direction of overestimating risk. This ensures that sites that might pose an ecological risk are studied further, i.e., a SLERA is deliberately designed to be protective in nature, not predictive of effects. If any potentially significant exposure pathways are indicated from the SLERA, then these pathways are further evaluated in a more refined BERA.

2.2 Scientific Management Decision Point #1

Following the SLERA, decisions will be made in consultation with MDEQ regarding the determination of potential ecological risks. These decisions will be made in consultation with the MDEQ and other appropriate stakeholders. Three possible decisions can be reached following the SLERA:

- There is enough information to conclude that ecological risks are low or non-existent and there is no need to clean up the site on the basis of ecological risk; or
- There is not enough information to make a decision and the ERA will proceed; or
- The information indicates a potential for adverse ecological effects, and a higher tiered BERA is required.

The details of the SLERA procedures are presented separately in the SLERA Work Plan (ENTRIX 2005). Based on historical data, it is assumed that PCDDs and dibenzofurans PCDFs will continue to be COPECs and are thus the focus of BERA studies presented herein. The conclusions of the SLERA will be used to evaluate which chemicals, in addition to PCDDs and PCDFs should be carried through to the BERA as COPECs. If additional COPECs are identified, the potential ecological risks associated with each COPEC will be further evaluated and characterized as part of the BERA.

3.0 BASELINE ERA PROBLEM FORMULATION PHASE

3.1 Introduction

The problem formulation phase of a BERA provides a framework for a higher tiered risk assessment (USEPA 1992, USEPA 1997, USEPA 1998) in which ecological endpoints are identified and relevant features of the environment and sources of contamination are described. This process includes a description of fate and transport characteristics of the COPECs, a brief evaluation of the potential toxicological effects of the COPECs, an identification of exposure pathways and receptors, the development of a conceptual site model, and the identification of assessment endpoints. Assessment endpoints that are clear, specific expressions of the actual value that is to be protected are the ultimate focus in risk characterization, and act as a link to the risk management process (such as the policy goals).

3.2 Fate and Transport Characteristics of COPECs, and Potential Ecological Effects

Due to historical inputs to the Site, the screening-level evaluation described in the previous section is important in the selection of COPECs. This section describes the characteristics and toxic effects of COPECs known at the time of development of this BERA Work Plan.

3.2.1 Polychlorinated Dibenzo-*p*-Dioxin (PCDD) and Dibenzofuran (PCDF) Congeners

In one study, concentrations of PCDDs and PCDFs were measured in sediments and floodplain soils collected along the Tittabawassee River (Hilscherova et al., 2003). Additionally, concentrations of PCDDs and PCDFs have been measured in several fish species inhabiting the Tittabawassee River, and an initial risk assessment based on these measurements found that there are potential risks toward piscivorous avian and mammalian species (Galbraith, 2003).

There are 75 PCDD congeners and 135 PCDF congeners that vary in the degree and position of chlorine substitution. Despite their structural relatedness, each of these congeners has different physico-chemical properties that affect their fate, transport, and bioavailability in the environment. In general, many PCDD and PCDF congeners in the environment are predominantly associated with particulate material, such as sediments, suspended material, and soils. Of the 210 PCDD and PCDF congeners, 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (2,3,7,8-TCDD, also referred to as TCDD) is considered to be the most potent and is the one most studied. For example, the potency of TCDD and related compounds in avian and mammalian wildlife has been evaluated in laboratory and field studies (Murray et al., 1979; Gilbertson et al., 1991; Giesy et al., 1994a and 1994b; Ludwig et al., 1996; Powell et al., 1997). Observed effects of TCDD and related chemicals in wildlife and laboratory animals include biochemical adaptive changes such as enzyme induction, developmental deformities, reproductive failure, liver damage, wasting syndrome, and death. The mechanism of action of TCDD and related compounds at the cellular level is primarily mediated through the aryl hydrocarbon receptor (AhR). Because of this assumed similarity in the mechanism of action, concentrations of 17 PCDD and PCDF congeners substituted with chlorines at positions 2, 3, 7, and 8 are routinely converted to TCDD equivalents (TEQs) using the 1998 World Health Organization (WHO) toxic equivalency factors (TEFs), (Table 3-1, Van den Berg et al., 1998) (Equation 3-1). WHO TEF values are not precise measures of relative potencies for PCDD and PCDF congeners. Rather, they are half-order of magnitude, conservative estimates of relative potency across a taxonomic class. As such, they are uncertain and may vary by species and endpoint. Thus, relative potency factors (RPFs) from the scientific literature may be used in place of WHO TEFs in instances where related or same species data are available in order to reduce uncertainty (USEPA, 2003).

$$TEQ = \sum_{i \to n} [(Congener_i \times TEF_i) + ...(Congener_n \times TEF_n)] \qquad \textbf{Eq. 3-1}$$

Table 3-1. Mammal, fish, and bird-specific toxic equivalency factors (TEFs) from the World Health Organization (WHO) for the 2,3,7,8-chlorine substituted PCDD and PCDF congeners.

	WHO 1998 TEF Values		
	Mammals/ Humans	**Fish**	**Birds**
Polychlorinated dibenzo-*p*-dioxins			
2,3,7,8-TCDD	1	1	1
1,2,3,7,8-PeCDD	1	1	1
1,2,3,4,7,8-HxCDD	0.1	0.5	0.05
1,2,3,6,7,8-HxCDD	0.1	0.01	0.01
1,2,3,7,8,9-HxCDD	0.1	0.01	0.1
1,2,3,4,6,7,8-HpCDD	0.01	0.001	< 0.001
OCDD	0.0001	< 0.0001	0.0001
Polychlorinated dibenzofurans			
2,3,7,8-TCDF	0.1	0.05	1
1,2,3,7,8-PeCDF	0.05	0.05	0.1
2,3,4,7,8-PeCDF	0.5	0.5	1
1,2,3,4,7,8-HxCDF	0.1	0.1	0.1
1,2,3,6,7,8-HxCDF	0.1	0.1	0.1
1,2,3,7,8,9-HxCDF	0.1	0.1	0.1
2,3,4,6,7,8-HxCDF	0.1	0.1	0.1
1,2,3,4,6,7,8-HpCDF	0.01	0.01	0.01
1,2,3,4,7,8,9-HpCDF	0.01	0.01	0.01
OCDF	0.0001	< 0.0001	0.0001

Source: Van den Berg et al., 1998

3.2.2 Polychlorinated Biphenyls (PCBs)

Polychlorinated biphenyls (PCBs) have been measured at detectable concentrations in the Saginaw River and Saginaw Bay downstream from the Tittabawassee River (Froese et al., 1998; Giesy et al., 1997; Verbrugge et al., 1995; Ludwig et al., 1993). However, concentrations of PCBs in soil and sediments along the Tittabawassee River have been determined to be generally low (<0.150 mg/kg, dry wt; Hilscherova et. al. 2003).

PCBs are a family of 209 chemicals, which differ in the number and position of chlorine atom substitution. Each of these PCB congeners has a unique profile of fates and effects in the environment. The biological effects of PCBs are highly congener-specific and can be expressed primarily through the AhR pathway (Okey et al., 1994). As a result, PCB toxicity, like PCDD and PCDF toxicity, can be assessed by converting congener-specific data to TEQs using appropriate TEF or RPF values (Table 3-2, Van den Berg et al., 1998). The toxic effects of PCBs include biochemical adaptive changes such as enzyme induction, developmental deformities, reproductive failure, hormonal changes, liver damage, wasting syndrome, and death (Gilbertson et al., 1991; Heaton et al., 1995; Brunstrom et al., 2001; Restum et al., 1998). Since the primary mechanism of action for PCBs involves activation of the AhR pathway,

similarly to PCDDs and PCDFs, congener-specific analysis of PCBs will be conducted on a portion of the samples to gain an understanding of the relative contribution of PCBs to the total TEQ concentrations.

Table 3-2. Mammal, fish, and bird-specific toxic equivalency factors (TEFs) from the World Health Organization (WHO) for the non-*ortho* and mono-*ortho* substituted PCBs.

	WHO 1998 TEF Values		
	Mammals/ Humans	**Fish**	**Birds**
non-*ortho* PCBs			
3,3',4,4'-TCB (77)	0.0001	0.0001	0.05
3,4,4',5-TCB (81)	0.0001	0.0005	0.1
3,3',4,4',5-PeCB (126)	0.1	0.005	0.1
3,3',4,4',5,5'-HxCB (169)	0.01	0.00005	0.001
mono-*ortho* PCBs			
2,3,3'4,4'-PeCB (105)	0.0001	< 0.000005	0.0001
2,3,4,4',5-PeCB (114)	0.0005	< 0.000005	0.0001
2,3',4,4',5-PeCB (118)	0.0001	< 0.000005	0.00001
2',3,4,4',5-PeCB (123)	0.0001	< 0.000005	0.00001
2,3,3',4,4',5-HxCB (156)	0.0005	< 0.000005	0.0001
2,3,3',4,4',5'-HxCB (157)	0.0005	< 0.000005	0.0001
2,3',4,4',5'-HxCB (167)	0.00001	< 0.000005	0.00001
2,3,3',4,4',5,5'-HpCB (189)	0.0001	< 0.000005	0.00001

Source: Van den Berg et al., 1998

3.2.3 Organochlorine Pesticides

DDT (dichlorodiphenyltrichloroethane) is an organochlorine insecticide that was used in the United States prior to 1972 and is still used in parts of Africa, Asia, and South America mainly to control mosquito-borne malaria. DDT is highly persistent in the environment, with a reported half-life of between 2-15 years (Augustijn-Beckers et al., 1994). DDT and its metabolites have been shown to cause eggshell thinning and consequent adverse effects on development and reproduction in various bird populations (Blus et al., 1997; Lundholm, 1997; King et al., 2003).

From approximately 1936 until the early 1970s, Michigan Chemical/Velsicol Corporation produced various brominated and chlorinated chemicals, which were released into Pine River, an upstream tributary of the Tittabawassee River. DDT was released into the Pine River environment due to activities at the Velsicol Chemical Company and consequently became a primary contaminant of concern in this area. Elevated concentrations of DDT and its metabolites, have been measured in Pine River sediments and various fish species resulting in fish consumption advisories (MDEQ, 2000). Because of the continued presence of DDT and its metabolites within this system and possible additional inputs via atmospheric deposition, organochlorine pesticides, especially DDT and its metabolites, may pose risks toward avian wildlife in the Tittabawassee River study area. Therefore, DDT and its metabolites are COPECs that will be evaluated in this investigation.

3.3 Identification of Potential Ecological Receptors

It is not feasible to evaluate exposures and risks for each avian and mammalian species potentially present within the study area. For this reason, specific, representative wildlife species are identified as receptors

of concern (ROCs) for the purpose of estimation of quantitative exposures (doses) in the BERA. USEPA ERA guidance recommends selecting receptors that have a great likelihood of exposure and sensitivity to COPECs, ideally with home ranges that are of similar magnitude to the size of the site. The selection of receptors for consideration in this BERA Work Plan was based on compliance with USEPA ERA guidance (as stated above) and consideration of other factors such as life history parameters, presence or likely presence at the site, representativeness of receptor class (e.g., mink as a representative species for piscivorous mammals), and availability of toxicological data for these and similar species.

3.3.1 Species Selected as Receptors of Concern or Assessment Endpoint Species

Receptors that are the focus of this BERA Work Plan are summarized in Table 3-3. Both aquatic and terrestrial ecological receptors have been selected. However, it is important to note that some of these receptors are opportunistic predators that can occasionally have site-specific diets that include a mixture of aquatic and terrestrial pathways. For example, great horned owls typically eat terrestrial-based diets but have been known to consume muskrats and great blue herons which are linked to aquatic based exposures. Thus, site-specific dietary composition will be characterized for each of the selected ecological receptors when possible. All of the specific target species have been confirmed to be present at the site.

By collecting a wide and diverse array of food web items in both the terrestrial and aquatic habitats, the BERA Work Plan is flexible and can readily accommodate other ROCs as they are identified.

Table 3-3. Proposed receptors for the ERA Work Plan

Receptor Group	Food Web	Representative Species
Small herbivorous mammals	Terrestrial	Meadow vole (*Microtus pennsylvanicus*)
Small carnivorous mammals	Terrestrial	Short-tailed shrew (*Blarina brevicauda*)
Box nesting passerine	Terrestrial	House wren (*Troglodytes aedon*)
Passerine	Terrestrial	American robin (*Turdus migratorius*)
Carnivorous birds	Terrestrial	Great horned owl (*Bubo virginianus*)
Piscivorous mammals	Aquatic	Mink (*Mustela vison*)
Box nesting passerine	Aquatic	Tree swallow (*Tachycineta bicolor*)
Piscivorous birds	Aquatic	Belted kingfisher (*Ceryle alcyon*)
	Aquatic	Great blue heron (*Ardea herodias)*
	Aquatic	Bald eagle (*Haliaeetus leucocephalus*)

3.3.2 Species Not Selected as Receptors of Concern or Assessment Endpoint Species

Other receptors that were considered but were not included as ROCs in this BERA Work Plan include benthic invertebrates, terrestrial invertebrates, reptiles, and amphibians, for the reasons discussed below.

3.3.2.1 Terrestrial and Aquatic Invertebrates

Terrestrial and aquatic invertebrates are critical dietary components of food webs. In addition, since they are in direct contact with and ingest relatively great quantities of soils and sediments, respectively, they affect the bioavailability of particulate-bound COPECs to higher level receptors. Therefore, terrestrial and aquatic invertebrates will be collected in order to estimate COPEC exposures to organisms that feed

on them. However, since such invertebrate organisms lack a functional AhR-mediated pathway, they are not expected to be directly affected by COPECs, such as PCDDs and PCDFs. Thus, the main reason for exclusion of terrestrial and aquatic invertebrates as ROCs is their lack of sensitivity to PCDDs and PCDFs.

3.3.2.2 Reptiles and Amphibians

Reptiles and amphibians, while present at the site, were not selected as receptors of concern because of a lack of toxicity data. Although basic ecological information is available for a large number of reptiles, "it is often the lack of sufficient toxicity data in the literature that precludes the use of reptiles as receptors in ecological risk assessments" (Sparling et al., 2000, p. 799). Literature-based information for reptiles and COPECs is limited to tissue residue data with no emphasis on actual effects on individuals or populations. Although toxicity benchmark or threshold values are available for a number of organisms, such values do not exist for reptiles, although research efforts are currently focusing on this data gap. For amphibians, there is toxicological data to indicate that they are not particularly sensitive to AhR-mediated effects (Beatty et al., 1976; Korfmacher et al., 1986). Nevertheless, amphibians will be collected and analyzed for COPECs as a dietary item for other wildlife.

3.4 Selection of Assessment Endpoints

Assessment endpoints are explicit expressions of the environmental values that are to be protected. Assessment endpoints are general, large-scale expressions of environmental components or characteristics that may be at risk, and therefore, require protection. The assessment endpoints selected in this ERA are based on the protection of the reproductive success and population sustainability of the selected receptor species of concern (Table 3-4). For several species, measures of reproductive success are sensitive response endpoints indicating contaminant toxicity (Tillitt et al., 1996; Foster, 1995). In addition, reproductive success endpoints are influential indicators of population sustainability.

Table 3-4. Proposed receptor species and associated assessment endpoints for the BERA.

Receptor Species	Assessment Endpoint
Small mammals - Meadow vole, short-tailed shrew	Reproductive success and population sustainability
Mink	Reproductive success and population sustainability
Raptors - Bald eagle, great horned owl	Reproductive success and population sustainability
Passerine birds – Tree swallow, house wren, American robin	Reproductive success and population sustainability
Piscivorous birds – Belted kingfisher, great blue heron	Reproductive success and population sustainability

3.5 Identification of Potential Exposure Pathways and Development of a Conceptual Site Model

The previously described parameters, including fate and transport characteristics of COPECs, have been combined into a conceptual model that represents potential exposure pathways of COPECs from potential sources to relevant biological receptors (Figure 3-1 and Figure 3-2). These pathways include a number of ingestion and direct contact pathways.

The primary exposure pathways for aquatic food chain receptors identified in this evaluation include:

- Direct exposure to COPECs in surface water and sediment via primary producers (e.g., aquatic plants), and
- Direct exposure to COPECs in surface water, sediment, and dietary items by primary, secondary, and tertiary consumers (e.g., aquatic and benthic invertebrates, muskrats, fish, and avian and mammalian wildlife).

The primary exposure pathways for terrestrial food chain receptors identified in this evaluation include:

- Direct exposure to COPECs in floodplain soils via primary producers (e.g., plants), and
- Direct exposure to COPECs in surface water, soil, terrestrial plants, and other dietary items by primary, secondary, and tertiary consumers (e.g., earthworms and other terrestrial invertebrates, and avian and mammalian wildlife).

3.6 Risk Questions

Ecological risk questions establish the relationship between assessment endpoints and their expected responses when exposed to contaminants. Measurement endpoints are then used to answer risk questions for each COPEC and ROC exposure pathway. Measurement endpoints are responses that may be more easily measured than assessment endpoints but are, however, related quantitatively or qualitatively to the assessment endpoints. In the case of this BERA, the risk question is:

- Do site-related COPECs cause adverse effects on the reproductive success and population sustainability of selected receptor species of concern?

In this BERA, multiple lines of evidence will be used to answer questions of risk. Evaluation of multiple lines-of-evidence has been defined as "*the process by which multiple measurement endpoints are related to an assessment endpoint to evaluate whether significant risk of harm is posed to the environment*" (Massachusetts Weight-of-Evidence Workgroup, 1995). A lines-of-evidence approach may either be quantitative or qualitative. The first step in the multiple lines of evidence approach is to evaluate measurement endpoints for each of the following three attributes:

1. Strength of association between assessment and measurement endpoints;
2. Data quality; and
3. Study design and execution.

The second step in the multiple lines-of-evidence approach is to evaluate the outcome of each measurement endpoint with respect to indication of risk of harm (e.g., positive, negative, and undetermined) and magnitude of the outcome (e.g., high or low). The third step in the multiple lines-of-evidence approach is to integrate the measurement endpoint weight and magnitude of response on a matrix, in order to determine whether the overall evidence indicates a risk of harm.

The lines-of-evidence approach will be applied only in situations for which multiple measurement endpoints are utilized for a single assessment endpoint. Risk calculations based on dietary exposure estimates and tissue residue concentration in receptors of concern, along with productivity data for receptor species of concern will constitute a multiple lines-of-evidence evaluation for ecological risk questions posed for the Site (Millsap et. al., 2004). Many of the ATL study plans are multi-year studies that include collection of data relevant to multiple lines of evidence for individual receptors. The timeframe for the BERA is intended to provide the most pertinent information to decision makers. Information that is available from the studies within the BERA reporting timeframe will be included in the risk assessment analysis. It is anticipated that all relevant data will be available for the dietary based exposure assessment; while only certain tissue data will be available for ROC to support a tissue residue-based analysis, and certain measures of reproductive success will be available for a very limited selection of receptors (Table 1-1).

3.7 Scientific Management Decision Point #2

As part of the problem formulation phase of the BERA several decision points will be reached. These decisions will be made in consultation with the MDEQ and other appropriate stakeholders and pertain to:

- The refined selection of COPECs for the BERA;
- The selection of assessment endpoints to be evaluated in the BERA;
- The formulation of the relevant contaminant exposure pathways at the site under investigation; and
- The overall risk question to be evaluated in the BERA.

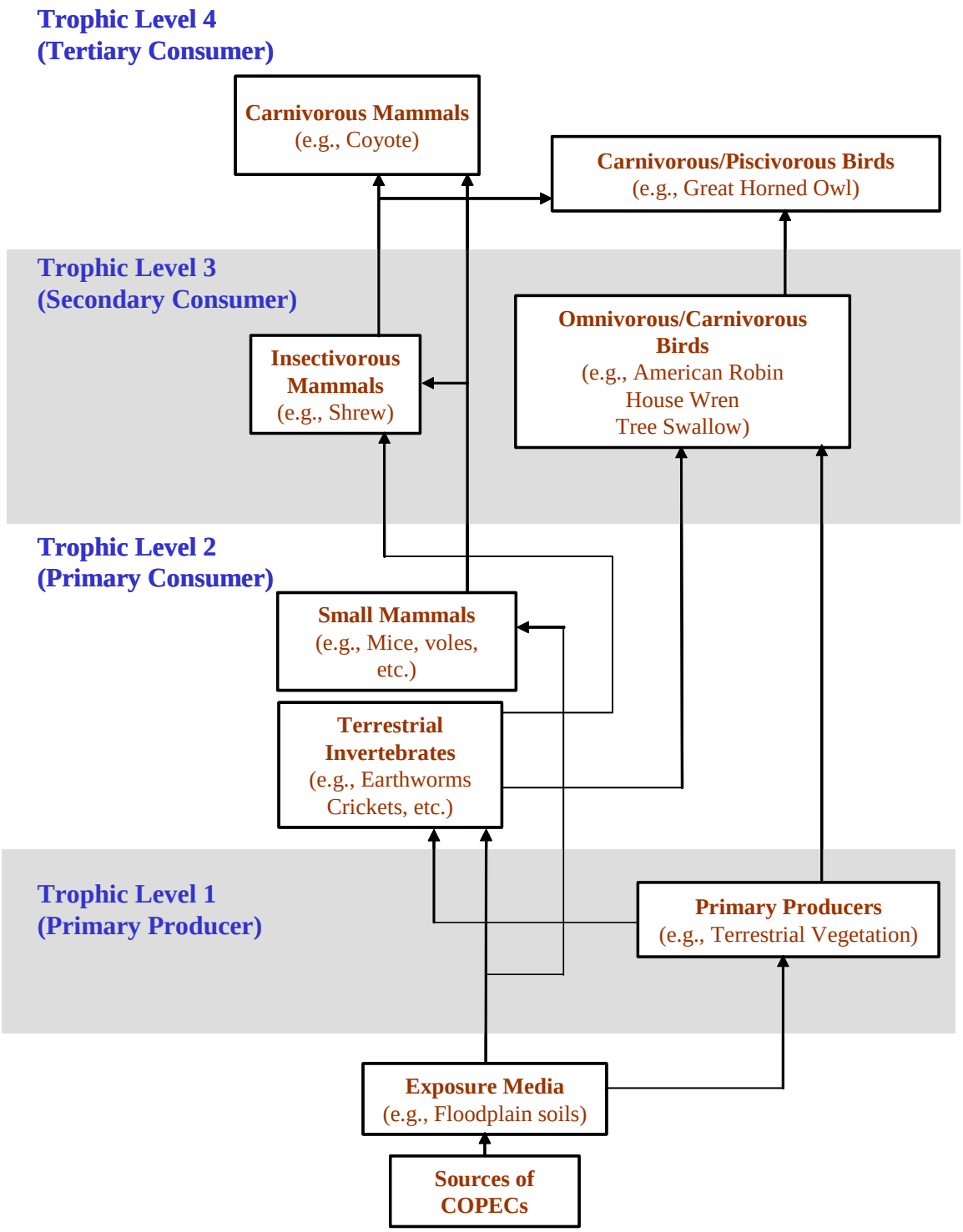

Figure 3-1. Conceptual model schematic of potential terrestrial exposure pathways.

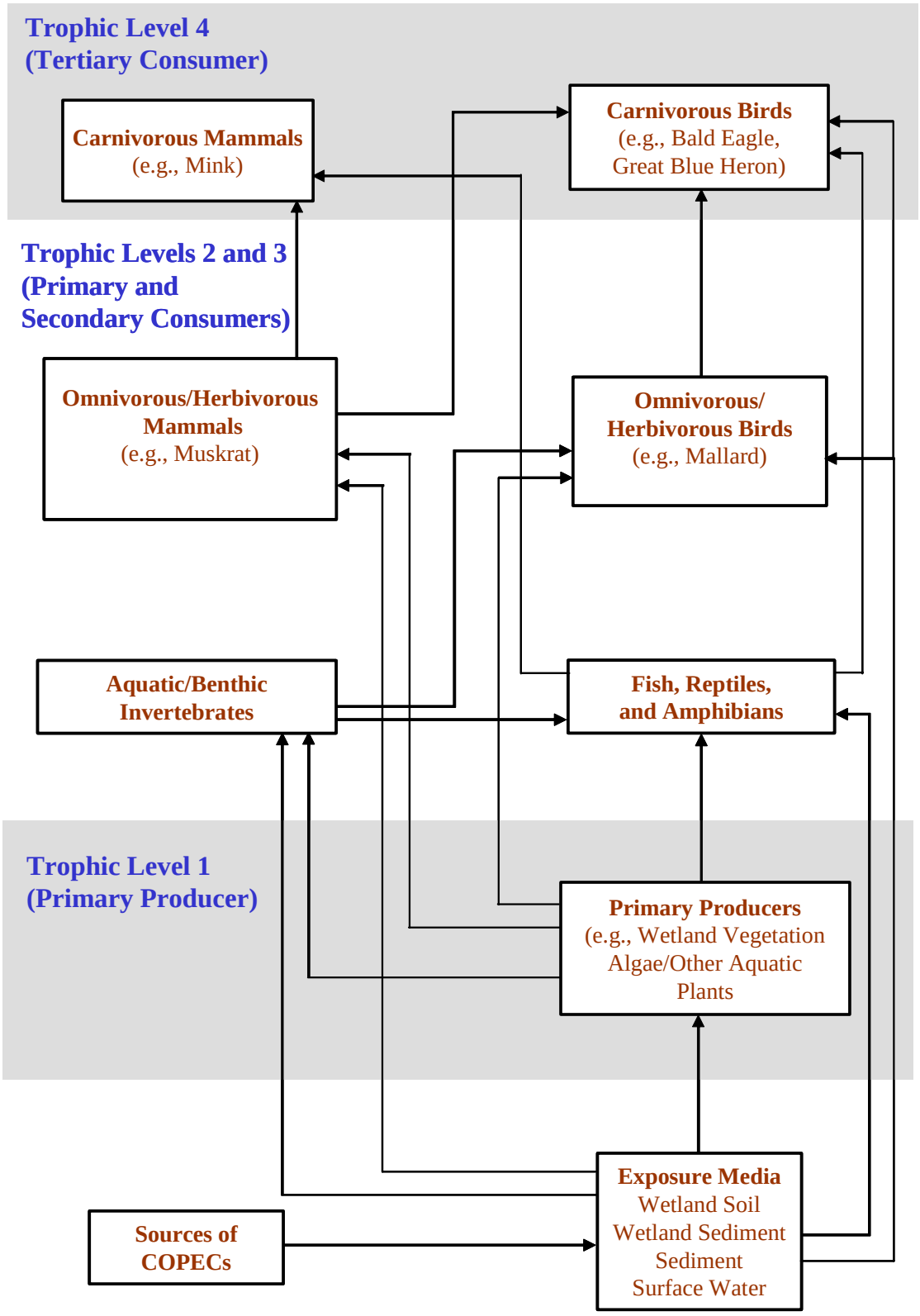

Figure 3-2. Conceptual model schematic of potential aquatic exposure pathways.

4.0 BASELINE ERA STUDY DESIGN PHASE

4.1 Introduction

During the study design phase, data quality objectives are developed for the BERA, measurement endpoints are selected, and sampling and analysis plans are developed based on decisions made in the problem formulation phase of the assessment. The exposure pathway and receptor-specific investigations in this study are presented in appendices D-G as separate study plans.

4.2 Data Quality Objective Process

The DQO process is a planning tool involving a series of steps designed to ensure that the type, quantity, and quality of environmental data used for decision-making purposes are appropriate for the intended application (USEPA 2000a and 2000b). The DQO process, as defined by USEPA, is "...a strategic planning approach based on the Scientific Method that is used to prepare for a data collection activity. It provides a systematic procedure for defining the criteria that a data collection design should satisfy, including when to collect samples, where to collect samples, the tolerable level of decision errors for study, and how many samples to collect." The steps in the DQO process, as established by USEPA, are as follows:

1. Formulation of Problem Statements. This step concisely describes the problems to be studied.
2. Identification of Decisions. This step consists of accurately describing the questions to be answered that will solve the specified problems, including any actions that may result.
3. Identification of Inputs to Decisions. This step focuses on identifying qualitative and quantitative information that will support decision-making, including the types of measurements that will be required.
4. Definition of Study Boundaries. This step delineates the spatial and temporal boundaries that will be encompassed by the study and describes when and where data shall be obtained. This includes specifying characteristics of the (statistical) population of interest, defining the geographical extent of the area and timeframes to which decisions will apply, and identifying constraints on obtaining data.
5. Development of Decision Rules. This step defines the statistical measures relevant to the study and specifies the conditions by which decision-makers will choose among alternative actions.
6. Specification of Decision Error Limits. This step specifies tolerable false positive and false negative decision errors and develops statements concerning the consequences of making incorrect decisions.
7. Optimization of Sampling Design. This step considers information obtained in the previous six steps to formulate an optimal sampling design, including (if possible) estimates of the number of samples necessary to meet acceptable decision errors.

Barnthouse and Suter (1996) point out the difficulties in applying the last three steps in the DQO process to ERAs since:

1. there are no officially approved standards or environmental goals for ecological endpoints,
2. an assessment may have multiple endpoints, and

3. ecological risk assessments often involve weight-of evidence evaluations of qualitatively different types of measurements (e.g., contaminant concentrations, population or community measurements, biomarkers, toxicity tests).

Barnthouse and Suter (1996) also state that because of the complexity of the data, the decision alternatives cannot be formulated as probabilistic hypotheses with confidence limits; therefore, simple optimization rules cannot be followed. Given these constraints, the DQOs are discussed in this BERA Work Plan to the extent that is possible at this stage of the process. Each of the steps in the DQO process, including problem statement, decision identification, decision inputs, spatial and temporal boundaries, decision rules, limits for decision errors, and optimized sampling design, produce qualitative and quantitative statements that are used to develop a scientifically sound and resource-effective sampling design.

A detailed DQO section, including the seven steps in the process, is presented within each individual study plan (Appendices C-G).

4.3 Sample Collection Methods

Receptor-specific sampling and analysis plans in Appendices C through G provide individual study details for preparation, monitoring, and collection methods for the various target species. Study Plan I - Exposure Pathway Analysis (Appendix C) describes the rationale and sampling methods for lower food web organisms that will be collected from reference areas and from the Site such that dietary exposure can be estimated for receptor species of concern. Study Plan II – Evaluation of Mink - Abundance, Health, Stressor Exposure, and Habitat Suitability (Appendix D) presents the rationale and methods for mink population investigations at the Site. Study Plan III – Evaluation of Passerines – Stressor Exposure, Reproductive Success, and Habitat Suitability (Appendix E) presents the rationale and methods for passerine population investigations at the Site. Study Plan IV – Evaluation of Raptors – Stressor Exposure and Reproductive Success (Appendix F) presents the rationale and methods for bald eagle and great horned owl population investigations at the Site. Finally, Study Plan V – Evaluation of Piscivorous Birds – Stressor Exposure, Reproductive Success, and Habitat Suitability (Appendix G) presents the rationale and methods for belted kingfisher and great blue heron population investigations at the Site.

4.4 Analytical Methods

4.4.1 Selection of Analytical Suite

Based on available historical data, the primary COPECs at the Site are the 17 PCDD and PCDF congeners that have chlorine substitution at the 2,3,7,8 positions. Thus, analyses of all biotic and abiotic samples will include this suite of 17 PCDD and PCDF congeners. In addition, a subset of avian tissue samples will be analyzed for DDT and its metabolites. Other COPECs, including PCBs, may be analyzed in samples based on findings from the SLERA.

4.4.2 Analytical Methodology and Detection Limits

Samples collected during this Work Plan will be processed and homogenized at the ATL. Analyses will be conducted at the ATL and also at AgriQuality Limited, 1B Bell Road, PO Box 31-242, Lower Hutt, New Zealand. The Limits of Detection (LODs) are based on currently acceptable laboratory performance for certified EPA standard methods 1613 and 8290. The analysis of PCDD and PCDF congeners is particularly susceptible to matrix-based interferences that can significantly alter sample-specific detection limits. Therefore, the data quality objectives provided in Table 4-1 must be considered as ‘targets’ and not absolute criteria. All efforts shall be made by the laboratory to attain these detection limits. In addition, exceedance of any of these targets for a laboratory (reagent) blank sample could require

reanalysis of that batch of samples. Standard reference materials will be included in the samples analyzed. However, when standard reference materials do not exist for these specific tissue types, the most suitable available substitutes will be used. In addition, matrix spike samples based on the collected tissues will also be analyzed.

Table 4-1. Target detection limits for PCDDs and PCDFs

Chemical	LOD (pg/g)	Chemical	LOD (pg/g)
2378-TCDD	0.1	PCB#77	0.05
2378-TCDF	0.1	PCB#81	0.05
12378-PeCDD	0.3	PCB#126	0.005
12378-PeCDF	0.3	PCB#169	0.02
23478-PeCDF	0.3	PCB#105	0.05
123478-HxCDD	0.5	PCB#114	0.05
123678-HxCDD	0.5	PCB#118	0.05
123789-HxCDD	0.5	PCB#123	0.05
123478-HxCDF	0.5	PCB#156	0.05
123678-HxCDF	0.5	PCB#157	0.05
234678-HxCDF	0.5	PCB#167	0.5
123789-HxCDF	0.5	PCB#189	0.05
1234678-HpCDD	0.5		
1234678-HpCDF	0.5		
1234789-HpCDF	0.5		
OCDD	1		
OCDF	1		
TOTAL WHO-TEQ	0.9	TOTAL WHO-TEQ	0.8

LOD = Limit of detection.

4.5 Data Analysis and Interpretation

As part of the BERA, sample information, analytical results, and results of statistical comparisons will be reported.

4.5.1 Sample Information

Sample-specific information will be reported for each specimen or sample composite collected during BERA investigations (Table 4-2). Reported information will include both field and laboratory data, such as matrix or tissue type, location and time of sample collection, environmental conditions during field collections, sex and age (if applicable) of the collected specimen, as well as percent lipid content and COPEC concentration in the analyzed sample.

Table 4-2. Field and laboratory information for ERA samples

Sample Information	Specifically Reported Parameter
Sample Descriptions	• Laboratory and field ID • Species and scientific name • Classification of specimen (order reported for insects) • Matrix and tissue type • Sex (if applicable and determinable) of specimen collected • Age of specimen (if determinable)
Location of Field Collection	• Reach location • Grid location • GPS coordinates (Northing and Westing)
Date and Time of Field Collection	• Round of collection • Date of collection • Time of collection
Other Conditions of Field Collections	• Temperature and weather conditions when collected • Method of field collection
Analytical information	• Percent lipids (for biota) • Percent moisture (if applicable) • Percent organic carbon (for soils and sediments) • PCDD and PCDF congener specific concentration • Wet weight and lipid normalized TEQ concentrations (based on either mammalian, avian, or fish TEFs)

4.5.2 Analytical Data Packages

In addition to the reported sample information, laboratory data will be reported in an analytical data package. This package will, at a minimum, include a narrative that will discuss any problems or discrepancies, and sufficient calibration and QC information to determine that the method was in control at the time that the samples were analyzed. The laboratory records included in an analytical data package will include:

- Case narrative;
- COC documentation (external);
- Laboratory sample ID, field sample ID, location, matrix, and dilution factors;
- Sample receipt, extraction, and analysis dates for holding time verification;
- Percent recovery of each surrogate;
- Final analyte concentration including reporting limit, laboratory qualifiers, and re-analyses;
- Surrogate recovery control limits;
- Percent recovery of each compound in the MS sample;

- Matrix spike(MS) recovery control limits;
- Relative percent difference (RPD) for all MS/MS Duplicate (MSD) and/or laboratory control sample (LCS)/LCS Duplicate (LCSD) reports;
- RPD control limits for MS/MSD and/or LCS/LCSD reports;
- Laboratory control sample results when analyzed;
- Recovery control limits for LCS or Standard reference material (SRM) recoveries and RSD;
- Blank results for method blanks, field blanks, equipment blanks, and trip blanks; and
- Method blank summary indicating associated samples.

In addition to the hard-copy report requirements, the laboratory will provide (1) electronic deliverables conforming to an ASCII comma-delimited format for all data reported and (2) an electronic back up for all laboratory data generated.

4.5.3 Descriptive Statistics

Descriptive statistics of the results will be reported for all samples collected from the reference and downstream locations. Descriptive statistics will include at a minimum, the sample size, arithmetic mean, the upper 95 percent confidence interval of the mean, standard deviation of the mean, and minimum and maximum values. When calculating descriptive statistics, one-half of the method detection limit (MDL) will be substituted for non-detect concentrations. One-half the MDL will be used only for those compounds and congeners otherwise detected in the relevant area. Descriptive statistics will be provided for concentrations of individual PCDD, PCDF, other potential COPECs, and total TEQs (on a wet weight and lipid normalized basis) and will be stratified by site, species (or matrix), and tissue (if applicable).

4.5.4 Comparative Statistics

Comparative statistical tests will be conducted and results of these analyses will be reported as part of the BERA investigation. Table 4-3 summarizes the statistical comparisons that will be conducted in the BERA.

Before hypothesis tests are conducted, data sets will be evaluated to determine if parametric or non-parametric statistics will be used in the analyses. Parametric statistics assume that the data distribution is normal or bell-shaped and the variances of each population are homogeneous (equal). Non-parametric statistical tests are not dependent on a specific distribution; rather, they are “distribution-free” and can be used to test the distribution of data relative to different types of distribution functions. The data from each site will first be tested for a normal distribution by using the One Sample Kolmogorov-Smirnov test with Lillifor’s transformation (Table 4-3; Wilkinson, 2000). If data for a species and or tissue type at a location are not normally distributed, then the data will be log-transformed and the data set re-tested. To determine if the variances are homogeneous in the data sets, one of two tests will be used depending on the number of locations being evaluated. For two locations, the variances of samples collected from each of the reference and downstream locations will be tested by an F-Test. If greater than 2 locations are to be evaluated, a Levene’s Test will be conducted to evaluate variance homogeneity (Table 4-3; Wilkinson, 2000). If the data are not normally distributed or do not have homogeneous variances, then the use of parametric statistics becomes suspect and the results difficult to interpret. Under this scenario, a non-parametric statistical test would be used.

If data meet the requirements for parametric tests, then a Student’s t-test (equal sample sizes) or the tabled t-test (unequal sample sizes) will be used to compare TEQ concentrations between two locations. If more

than two locations are compared, an ANOVA with Tukey's Honestly Significant Difference (HSD) will be used to compare TEQs among locations (Table 4-3; Wilkinson, 2000).

If data are not normally distributed and/or do not meet the criteria for homogeneous variances, then non-parametric statistical tests will be used to evaluate differences between or among locations. If only two locations are to be tested, a Mann-Whitney U test will be used to evaluate differences between locations. If greater than 2 locations are to be evaluated, then the Kruskal-Wallis test will be used for statistical analyses (Table 4-3; Wilkinson, 2000).

Table 4-3. Statistical evaluations and statistical tests that will be used in the BERA investigation

Statistical Evaluations	Statistical Test
Normalcy	One sample Kolmogorov-Smirnov with Lillifor's transformation
Variance homogeneity	F-test or Levene's test
Comparison between two data sets (parametric assumptions met)	Student's t-test or tabled t-test
Comparison between two data sets (parametric assumptions not met)	Mann-Whitney U
Comparison among three or more data sets (parametric assumptions met)	ANOVA with Tukey's HSD
Comparison among three or more data sets (parametric assumptions not met)	Kruskal-Wallis
Congener pattern analysis	Principal components analysis (PCA)

4.6 Scientific Management Decision Point #3

At the close of the study design phase of the BERA, several decision points will have been reached that will address the endpoints and methodologies for data collection and interpretation. These decisions wil be made in consultation with the MDEQ and other appropriate stakeholders and pertain to:

- Measurement endpoints;
- Investigative methods; and
- Data interpretation and analysis techniques.

5.0 BASELINE ERA ANALYSIS PHASE – EXPOSURE AND EFFECTS ASSESSMENT

During the analysis phase, exposure to stressors and the relationship between stressor concentrations and ecological effects are evaluated.

5.1 Exposure Assessment

The purpose of the exposure assessment phase is to evaluate exposure of receptors to chemical stressors. This phase involves collection and integration of information on COPECs, COPEC concentrations and spatial distribution, and exposure conditions (temporal and spatial patterns). Exposure point concentrations of COPECs will be determined and compared to toxicity reference values (TRVs) in order to calculate the potential for adverse effects. In general, there are two primary approaches, dietary-based and receptor tissue-based, for assessing exposure and effects of persistent, bioaccumulative COPECs in wildlife assessments (Fairbrother, 2003; Millsap et. al., 2004). Each of these approaches will be discussed in the following sections.

5.1.1 Dietary Exposure Modeling Approach

The dietary-based method is one of the most widely used approaches to assess wildlife exposure, ranging from simplistic to complex. In general, an average daily dose is calculated by food web modeling in which one makes assumptions regarding dietary composition, applies bioaccumulation models (if necessary), and utilizes concentrations of residues measured at lower levels of the food chain, soil, and sediment. In a screening level ERA, this can be based on very limited data. However, as one moves into a BERA, this approach accommodates more site-specific data including dietary composition data for individual receptors and concentrations of residues in dietary items. The exposure that is calculated from this dietary-based approach can then be compared to dietary-based toxicity reference values (TRVs) derived from dietary exposures (Refer to section 5.2.1.1 for a discussion of dietary-based TRVs).

5.1.1.1 Exposure Characteristics of Avian and Mammalian Wildlife Receptors

Characteristics of key receptors will be clearly presented in the BERA, including exposure assumptions for body weight, ingestion rate, dietary composition, area use factor, etc. The primary source of exposure assumptions is the USEPA Exposure Factors Handbook (USEPA, 1993). Additional sources of information include primary peer-reviewed scientific literature, site surveys, and professional judgment, and other compendia of region-specific and species-specific information (Sample and Suter, 1994). Whenever available, site-specific and/or region-specific exposure information will be utilized. The selected species might be exposed to COPECs through contact with and/or ingestion of contaminated media (e.g., primarily through dietary exposure). Exposure estimates for all species will be calculated for COPECs detected in dietary items and incidental soil ingestion.

Exposure calculations will be conducted with exposure concentrations derived from either measured concentrations of COPECs or concentrations predicted from models in the relatively rare case when no measured concentrations are available. Bioaccumulation models are often fraught with uncertainty because bioavailability depends upon highly variable site-specific considerations such as soil type, pH, moisture, clay content, organic carbon, cation exchange capacity, exposure duration, and receptor-specific considerations such as uptake mechanisms. In particular, available information suggests that bioavailability from soil to biota is limited for many COPECs. Thus, to minimize uncertainty, concentrations of COPECs will be measured in the dietary exposure pathways of herbivorous and carnivorous wildlife utilizing the site. Exposure to COPECs from water ingestion, inhalation and dermal

contact were considered negligible for the purposes of this BERA based on the fate and transport characteristics of site-related COPECs (Travis and Hattemer-Frey, 1991). Direct ingestion of soil or sediment was considered for certain wildlife since wildlife may experience substantial contaminant exposure through direct ingestion of soil or sediment.

5.1.1.2 Estimation of Oral Exposure for Avian and Mammalian Wildlife Receptors

Estimates of daily contaminant exposure experienced by individual receptor species are calculated using a modification of the generalized exposure model presented by Sample and Suter (1994). The generalized exposure model is depicted (Eq. 5-1):

Eq. 5-1

$$ADD_{pot} = \frac{[(IR_{diet} \, x \, C_{diet} \, x \, FAV_{diet}) + (IR_{soil} \, x \, C_{soil} \, x \, FAV_{soil}) + (IR_{sed} \, x C_{sed} \, x FAV_{sed})] x \, SUF}{BW}$$

Where:

ADD_{pot} = potential average daily dose (*e.g.*, mg/kg-d)

IR_{diet} = Amount of prey or vegetation ingested (kg/d)

C_{diet} = Concentration of COPECs in prey or vegetation (mg/kg)

FAV_{diet} = Fractional absorption value for COPECs in dietary items

IR_{soil} = Amount of soil ingested (kg/d)

C_{soil} = Concentration of COPECs in soil (mg/kg)

FAV_{soil} = Fractional absorption value for COPECs in soil

IR_{sed} = Amount of sediment ingested (kg/d)

C_{sed} = Concentration of COPECs in sediment (mg/kg)

FAV_{sed} = Fractional absorption value for COPECs in sediment

SUF = Site use factor (unitless) (foraging area/site area)

BW = Body weight (kg)

A site use factor will be included in the exposure model for some species since some wildlife species may forage in only a portion of the site and/or there may be limitations on the availability of suitable habitat for a given receptor.

In addition, a fractional absorption value will be included in the exposure model to account for the fraction of the oral dose that is absorbed through the gastrointestinal tract. The fractional absorption values will be determined from the scientific literature or from site-specific data for each class of COPECs and for each exposure medium (*e.g.*, soil and sediment ingestion versus food). This fractional absorption factor is especially important for incidental ingestion of sediments and soils. It has been shown that sorption of COPECs to soil may substantially reduce its bioavailability (Alexander, 2000; Menzie, *et. al*., 2000).

5.1.2 Receptor Tissue Exposure Approach

In addition to the dietary-based approach, exposure of some of the receptors will be evaluated based on concentrations of residues in receptor tissues. Such an approach is presumably a more accurate measure of exposure since assumptions of area use factor, foraging range, dietary composition, and bioavailability are inherently accounted for when one measures concentrations of residues in the tissues of a receptor. Furthermore, since receptors integrate their exposure over a given area of river or floodplain, concentrations of residues in receptor tissues more accurately reflect exposures over an area that corresponds to their foraging range. This approach reduces the uncertainty in an exposure evaluation as compared to an approach based only on an evaluation of concentrations of COPECs in soils and sediments due to the heterogeneity of COPEC concentrations in such media. Receptor tissues that will be collected are discussed in the receptor-specific study plans (Appendices C - G). The exposure that is calculated from this receptor tissue residue-based approach can then be compared to residue-based toxicity reference values (TRVs) (refer to section 5.2.1.2 on tissue residue based toxicity reference values).

5.1.3 Exposure Point Concentrations

Exposure point concentrations (EPCs) for avian and mammalian wildlife will be presented in the BERA for both foodweb items and receptor tissues. USEPA ERA guidance provides for the determination of EPCs and states that the use of upper percentiles or maximum concentrations is appropriate when conducting a screening-level assessment and/or when insufficient data are available to adequately characterize the site. However, in a BERA, guidance recommends the use of both a measure of central tendency and an upper percentile exposure point concentration or a distribution of concentrations. Statistical evaluation of data, including an evaluation of the normality of the data, will be used to determine the most appropriate summary statistics for each data set. For normally distributed data, the arithmetic mean and 95% upper confidence limit (UCL) of the arithmetic mean will be utilized as EPCs. For environmental concentration data that are lognormally distributed (as is the case with most environmental data), a geometric mean and 95% UCL of the geometric mean may be a more appropriate statistic to represent the central tendency of the data. Additionally, the geometric mean is less sensitive to a single elevated value in a data set than the arithmetic mean.

The lower food web data collected within proposed sampling grids, both terrestrial and aquatic, will be used to develop EPCs and grid-specific bioaccumulation factors from soils and sediments. The grid-specific bioaccumulation factors will be applied to comparable habitats within the study area based on COPEC concentrations in soil and sediment samples from the nature and extent investigations. In this way, exposures (and risks) can be estimated for a given receptor (e.g., great horned owls) in a way that includes areas for which food web data are not available. The target number of samples to be collected at the proposed sampling grids are presented in Table 5-1. These target sample numbers are not designed to be sufficient to do statistical comparisons between sampling locations within the area of concern. However, preliminary results indicate that these sample sizes will likely be sufficient for statistical comparisons between sampling grids in the area of concern and those in the reference areas. As analytical results become available, data gaps will be identified and further sampling will be conducted where necessary.

Table 5-1. Target number and type of samples for the exposure pathway analysis.

Matrix	# of Locations[A]	# of Samples Per Sampling Event	# Sampling Event(s)	Total # of Samples
Sediments	6	1 composite	2	14
Aquatic macrophytes	6	1 composite	2	14
Benthic invertebrates	6	3 composites separated by orders	2	42
Crayfish	6	1 composite	2	14
Aquatic emergent insects	6	3 composites separated by orders	2	42
Fish	3	6	1	18
Forage fish	6	1 composite (500 g)	2[B]	14
Floodplain soils	6	1 composite	2	14
Depurated earthworms	6	1 composite	2	14
Non-depurated earthworms	6	1 composite	2	14
Frogs	6	1 composite by species	2	14
Terrestrial macrophytes (consumable leaves)	6	1 composite by species	2	14
Terrestrial macrophytes (fruiting bodies)	6	1 composite by species	2	14
Terrestrial invertebrates	6	3 composites separated by orders	2	42
Small mammals	6	12	2	168

[A] The sampling locations include Sanford, Chippewa Nature Center, Smiths Crossing, Tittabawassee Township Park, Freeland Festival Park, and Imerman Park.

[B] Number of sampling events may vary based on availability of equipment and dietary analyses of great blue herons

5.1.4 Uncertainties

Uncertainties in the dietary-based approach are mostly due to either limited data on dietary composition and concentrations in dietary items. For example, exposure assessments that are based on only one dietary item are likely to be more uncertain than assessments that incorporate data for more of the dietary items that a receptor is known to consume. Uncertainties in the tissue residue-based approach are mostly due to limitations in sample size. Uncertainties in the exposure assessment will be discussed in the BERA.

5.2 Effects Assessment

The purpose of the effects assessment phase is to summarize available toxicological data, establish toxicity reference values (TRVs) and benchmarks for COPECs for the ERA, and present ecologically relevant field observations. The availability of both dietary exposure and tissue residue-based toxicological data will be evaluated for COPECs and the limitations of these toxicity data discussed. This information will be utilized with exposure data and other field observations to conduct the risk characterization (Section 6.0).

5.2.1 Development of Toxicity Reference Values

A TRV is a concentration of a chemical in water, food, or tissues of a receptor below which toxicological effects are not expected. Ideally, TRVs are derived from chronic toxicity studies in which a dose-response relationship has been observed for ecologically-relevant endpoint(s) in the species of concern, or a closely related species. Specifically, some of the ideal characteristics of high quality toxicity studies that can be used to derive TRVs include:

1. Relatedness of the test species to the receptor of concern;
2. Chronic duration of exposure including sensitive life stages to evaluate potential developmental and reproductive effects;
3. Measurement of ecologically relevant endpoints; and
4. Minimal impact of co-contaminants.

In regards to the relatedness of the test species and the receptor of concern, there is a wide range of species sensitivities to COPECs, especially to TCDD and other Ah receptor (AhR)-active chemicals (Gasiewicz et al. 1991). Thus, the less related the test species is relative to the receptor of concern, the more uncertainty is associated with the TRV. Mustelid and gallinaceous species are among the most sensitive mammalian and avian species, respectively, for reproductive and developmental effects of TCDD and related chemicals. Using mink as an example, several studies have been conducted with this species, which make a species uncertainty factor unnecessary. As for exposure duration, acute studies are of little use when trying to establish NOAELs and LOAELs for chronic effects in mink. Similarly, subtle biochemical effects may have little or no relevance to the long-term reproductive success of mink. As for co-contaminants, their presence in test diets can substantially confound the toxicity results relative to a single chemical or class of chemicals. In particular, assignment of causality, which is key to risk assessment, can be problematic when elevated levels of co-contaminants are present. Thus, such studies should be evaluated carefully to determine the potential impact of co-contaminants. Such studies can be very useful and are most appropriate to answer site-specific questions (i.e., mink feeding studies using fish from Saginaw Bay are appropriate to answer questions related to Saginaw Bay but may not be applicable to the Tittabawassee River since the suite of COPECs is likely different between sites). Since few studies were designed to fulfill all of the ideal characteristics of a high quality study that match the needs of an ecological risk assessment, it is sometimes necessary to apply uncertainty factors (discussed later) or to reject a study from further consideration. In either case, the rationale should be clearly documented for applying uncertainty factors or for rejecting a study.

Sources of toxicological data that will be reviewed to develop TRVs include primary peer-reviewed scientific literature, pertinent reviews of TCDD and related chemicals and other COPECs, Oak Ridge National Laboratory report on benchmarks for wildlife, miscellaneous USEPA reports, and other relevant sources of information. In the ERA, endpoints such as effects on reproductive and developmental toxicity and reduced survival will be evaluated and used whenever possible.

5.2.1.1 Dietary-Based TRVs

While ecological receptors can be exposed to COPECs through ingestion, dermal, and inhalation exposure pathways, the predominant exposure pathway for bioaccumulative COPECs such as TCDD is typically through ingestion. Thus, a literature search will be conducted to identify studies from which dietary TRVs can be derived. Typically, dietary toxicity studies are conducted by adding known concentrations of COPECs to the diet. If the body weights and ingestion rates of the test animals are known or can be estimated, then the dietary concentrations can be converted to a daily dose in the units of mg COPEC/kg body weight/d. The resulting TRVs can be compared to site-specific estimates of exposure through the calculation of an ADDpot.

5.2.1.2 Tissue Residue-Based TRVs

In addition to dietary TRVs for COPECs, tissue residue-based TRVs are being used increasingly to evaluate the potential for adverse effects due to bioaccumulative COPECs such as TCDD. For the purposes of the BERA, the term "tissue residue-based TRV" will be synonymous with "maximum allowable tissue concentration (MATC)", a term that is sometimes used by agencies and reported in the literature. In the BERA, tissue residue-based TRVs will be compiled for ecological receptors.

Tissue residue-based TRVs can be compared to site-specific, measurements of tissue concentrations in receptors of concern. When food chain models are used to estimate tissue residues in receptor tissues, caution should be exercised due to the inherent uncertainty associated with such modeling. Some of the uncertainty relating to food chain modeling includes factors such as site foraging frequency, dietary composition, and concentrations of COPECs in dietary items. Tissue residue effect level data are gaining increasing regulatory acceptance as evidenced by the "Framework for Application of the Toxicity Equivalence Methodology for Polychlorinated Dioxins, Furans and Biphenyls in Ecological Risk Assessment" (USEPA 2003).

5.2.1.3 Uncertainty

It is essential to perform a critical evaluation of the applicability of the toxicological data to the site-specific receptors of concern and exposure pathways. TRVs derived in the same species are generally not available for the majority of wildlife receptors and, therefore, it is necessary to derive TRVs using toxicological data for surrogate species in combination with uncertainty factors. Uncertainty concerning interpretation of the toxicity test information among different species, different laboratory endpoints, and differences in experimental design, age of test animals, duration of test, etc., are addressed by applying uncertainty factors (UFs) to the toxicology data to derive the final TRV. For this BERA, general recommendations of Sample et al., (1996), USEPA (1995), and USEPA Region 8 (Henningsen and Hoff, 1997) will be considered for the derivation and use of uncertainty factors. In addition, there is uncertainty concerning the use of WHO TEFs since these are order of magnitude, conservative estimates of relative potency.

5.2.1.3.1 Exposure Duration Extrapolation (UF_A)

This factor is used to estimate the LOAEL or NOAEL dose of a chemical when only acute (short-term) toxicity test data are available. In situations where a chronic NOAEL value for an ecologically relevant endpoint is not available, the NOAEL can be estimated by a LOAEL to NOAEL uncertainty factor ranging between 1 and 10 (USEPA, 1995). In this BERA, NOAEL and LOAEL values will be identified from several toxicological studies on relevant avian and mammalian species. However, in some cases, a LOAEL may not be available and may need to be estimated from a NOAEL and vise versa. As for duration and timing of exposure, the definition of chronic exposure is adapted from Sample et al., (1996). In this definition, exposures that occur during critical life stages, such as reproductive and developmental time points, will be considered to represent chronic exposures since these life stages are very sensitive to

adverse effects because of the coordination of multiple pathways of differentiation and proliferation of cells occurring within the embryo.

5.2.1.3.2 Intertaxon Variability Extrapolation (UF_B)

This factor is used to estimate an effect concentration or dose for a receptor from laboratory test species and extrapolate this data to the receptor of concern. In the case of mink, for example, studies are available with mink as a test species such that a direct comparison can be made. Thus, for mink, an intertaxon variability extrapolation will not be necessary.

5.2.1.3.3 Toxicological Endpoint Extrapolation (UF_C)

This factor is used to estimate NOAEL and/or LOAEL values from studies that report other endpoints. An effort will be made to identify studies for which ecologically relevant endpoints were assessed.

5.2.1.3.4 Other Modifying Factors (UF_D)

These factors incorporate other sources of uncertainty, including: relevance of endpoint to ecological health, extrapolation from laboratory to field, study conducted with relevant co-contaminants, endpoint is mechanistically unclear (vs. clear), study species is either highly sensitive or highly resistant, ratios used to estimate whole body burden from tissue, intraspecific variability, other applicable modifiers. After consideration of the available data and necessary uncertainty factors, the TRV is calculated using the equation:

$$TRV = \frac{\text{Study Dose}}{(UF_A * UF_B * UF_C * UF_D)} \qquad \textbf{Eq. 5-2}$$

5.2.2 Evaluation of Productivity Data and Other Field-Determined Effects Data

Site-specific measures of productivity and other field-effects data for the receptors of concern provide a direct assessment of the effects of COPECs on receptor species inhabiting the study Site. In the multiple lines of evidence approach taken in this BERA, productivity data are a third data set, in conjunction with the dietary-based and tissue concentration-based exposure assessments, which will be used to assess risk of COPECs toward receptors of concern. Unlike both the dietary-based and tissue concentration-based exposure assessments, site-specific measures of receptor productivity directly assess the effects of COPECs on receptor species, and therefore, the uncertainties associated with exposure estimations and comparisons to TRVs are eliminated. Site-specific measures of productivity, if they are adjusted for habitat suitability and other interfering factors, are therefore the most realistic estimations of the COPEC-associated risks that are posed to receptor species inhabiting the study site. Although the ATL study plans include measures of productivity and reproductive health, all the data may not be available for this BERA (Table 1-1).

6.0 BASELINE ERA RISK CHARACTERIZATION PHASE

In this section, approaches to characterize risk will be presented. In brief, risks will be estimated in the BERA through integration of exposure and stressor-response profiles, and risks will be described by discussing lines of evidence and determining ecological adversity. The measurement results are evaluated to determine whether they support a conclusion of no significant risk for each assessment endpoint. In some cases, more than a single measurement will have been conducted to evaluate an assessment endpoint. If the results of those measurements do not agree, those results will be considered in combination, and a conclusion will be based on multiple lines-of-evidence.

6.1 Risk Estimation

6.1.1 Hazard Quotient or Toxicity Quotient Method

The basic approach for most assessment endpoints in the BERA will be a hazard quotient (HQ) approach. HQ values will be calculated for each species under different exposure scenarios and contaminant concentrations in prey by the use of equation 6-1 for comparison to benchmarks or criteria, equation 6-2 for tissue residue data, and equation 6-3 for dietary exposure.

$$\text{HQ} = \frac{\text{Exposure (mg/kg)}}{\text{Benchmark or screening value (mg/kg)}} \qquad \textbf{Eq. 6-1}$$

$$\text{HQ} = \frac{\text{Tissue concentration (mg/kg)}}{\text{Toxicity reference value (mg/kg)}} \qquad \textbf{Eq. 6-2}$$

$$\text{HQ} = \frac{\text{ADDpot (mg/kg - d)}}{\text{Toxicity reference value (mg/kg - d)}} \qquad \textbf{Eq. 6-3}$$

Because of the conservativeness of the exposure calculations, benchmarks and TRVs, HQ values less than 1.0 indicate that unacceptable risks are not likely to occur. For HQ values greater than 1.0, some potential for risk is inferred and there may be a need for further evaluation. While the screening-level ERA does not attempt to quantify the nature and extent of potential risks, results from the BERA will attempt to quantitatively and qualitatively describe the risks to the environment to the extent possible.

ERA guidance (USEPA 1997 and 1998) recommends that when the hazard quotient approach is utilized for characterizing risk to wildlife, that HQs are derived for both the lowest observable adverse effect level (LOAEL) and the no observable adverse effect level (NOAEL). Furthermore, the following guidelines provide a framework to characterize risk using NOAEL- and LOAEL-based HQs:

- When the site exposure (dose) exceeds the LOAEL and the LOAEL-based HQ is greater than 1.0, it is reasonable to conclude that the quotient evaluation method provides evidence of potential risk.
- When the site exposure (dose) is less than the NOAEL and NOAEL-based HQ is less than 1.0, the risk assessor may reasonably conclude that the quotient evaluation method does not provide evidence of potential risk.

- When the site exposure (dose) is greater than the NOAEL but less than the LOAEL, no conclusion may be reached based on the predictive method alone, and additional assessment efforts are necessary to determine whether there is potential risk associated with exposure to the COPEC(s).

6.1.2 Probabilistic ERA Approaches

In addition to the stochastic HQ approach, probabilistic risk assessment, incorporating probability distribution function data on key exposure and effect parameters, may be used to assess potential risk of site-related COPECs to ecological receptors.

6.2 Uncertainty Approaches

There are several sources of uncertainties associated with risk characterization estimates. First, there is uncertainty associated with the initial selection of COPECs based on sampling data and available toxicity information. There are also uncertainties associated with the conceptual model used as a basis to investigate the site, since the development of a conceptual model relies greatly on professional judgments and assumptions. In addition, when estimating exposures to receptors of concern, assumptions such as ingestion rates, bioavailability, and area use factors add uncertainty to the exposure estimate. Finally, there are uncertainties associated with effect assessments when exposure data are compared to literature-derived TRVs. Differences in study design, duration, and species studied add uncertainty to the effects assessment. Sources of uncertainty will be tracked and discussed throughout the risk assessment process.

6.3 Scientific Management Decision Point #4

Following the risk characterization phase of the BERA, all available data from the multiple lines of evidence approach will be evaluated in consultation with MDEQ to characterize ecological risk at the Site.

7.0 SCHEDULE AND REPORTING

7.1 Schedule

Once MDEQ provides comments on the draft BERA work plan, Dow and ENTRIX will respond to comments and prepare a revised BERA work plan within 60 days. Following approval of the BERA workplan and once consensus has been reached for scientific management decision points (SMDPs) #1 (section 2.2), #2 (section 3.7), #3 (section 4.6), and #4 (section 6.3), Dow and ENTRIX will submit a draft BERA report within 365 days. Once MDEQ provides comments on the draft BERA report, Dow and ENTRIX will respond to comments and prepare a revised BERA report within 60 days.

7.2 Reporting

If any major deviations from the approved Work Plan are necessary because of unanticipated field conditions, the MDEQ (and MDNR and USFWS, if appropriate) will be notified as soon as possible for approval and modification of the Work Plan, if needed. In addition, bimonthly progress reports will be provided to MDEQ beginning after approval of this Work Plan.

Reports from this project will include data obtained from the field and laboratory phases of the study. At the termination of the study, MDEQ will be provided with an electronic copy of both laboratory and field data packages. For a detailed list of items that will be included in data packages refer to section 4.5.2.

The major reports that will be prepared and submitted are listed in Table 7-1. The results of the MSU studies will also be published in scientific peer-reviewed literature in order to provide useful data for health professionals, risk assessors and individuals interested in this information.

Table 7-1. Major reports to be submitted as part of the BERA

Report	Contents
BERA Report	• COPEC concentrations in soils, sediments, and lower food web organisms, • Estimates of exposure to receptors of concern, • Hazard quotient calculations of risk based on dietary-based exposure estimates and toxicity reference values. • COPEC concentrations in tissues of receptor species where available, • Hazard quotient calculations of risk based on receptor tissue concentration-based exposure estimates and toxicity reference values where data is available, • Productivity data for receptors of concern where data are available, • Risk characterization based on multiple lines of evidence.

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Appendix A. Quality Assurance Project Plan (QAPP)

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Appendix B. Site Specific Health and Safety Plan (S-HASP)

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Appendix H. Standard Operating Procedures (SOP)

TR203r1	Homogenization of Tissue Samples
TR210r1	Extraction and Analysis of PCBs and Non-ortho Coplanar PCBs in Biological and Environmental Matrices
TR211r1	Mono-and-Non *ortho* PCB Analysis by GC-MSD using Chrompack CP SIL 5/C18
TR212r1	Glassware Cleaning: General and Trace Organic Analysis
TR213r1	Extraction and Analysis of 2,3,7,8 Substituted Polychlorinated dibenzo-p-dioxin (PCDD) and dibenzofurans (PCDF) in Sediment & Biota Samples Using the High Resolution Gas Chromatography High Resolution Mass Spectrometry
TR214r1	Documentation, Preservation, Handling, And Tracking of Samples For Analysis
TR220r1	Standard Method for Field Collection of Soils for Chemical Analyses
TR221r1	Standard Method for Field Collection of Sediments for Chemical Analyses
TR222r1	Protocol for Sampling the Edible Portions of Aquatic Vegetation
TR223r1	Protocol for Freshwater Benthic Invertebrate Sampling and Analysis (for the Separate Collection and Analysis of Sediment Associated and Surface Mobile Species)
TR224r1	Protocol for Emergent Aquatic Insect Sampling and Analysis
TR225r1	Protocol for Fish Sampling
TR226r1	Protocol for Terrestrial Invertebrate Sampling and Analysis
TR227r1	Protocol for Sampling the Edible Portions of Terrestrial Vegetation (Fruiting Bodies, Seeds and Consumable Leaves)
TR228r1	Protocol for Terrestrial Small Mammal Sampling and Analysis
TR240r1	Mink Habitat Suitability
TR241r1	Trappers Kit
TR242r1	Dietary Analysis of Scat and Stomach Contents
TR243r1	Track Board Surveys for Mink Abundance Estimation
TR244r1	Placental Scar Identification
TR246r1	Protocol for Conducting Field Sign Surveys of Mink Scat and Tracks during the Summer and Winter
TR247r1	Field Survey of Mink Trapping Pressure
TR248r1	Mink Tooth Extraction and Cleaning for Cementum Aging
TR249r1	Dissection of Mink Carcasses
TR262r1	Protocol for Monitoring and Collection of Box-Nesting Passerine Birds
TR264r1	Protocol for Bird Necropsy, Egg and Shell Examination, and Tissue Archive
TR265r1	Protocol for belted Kingfisher (Ceryle alcyon) Monitoring and Tissue Collection
TR266r1	Great Blue Heron (Ardea herodias) Adult Handling, Banding, and Collection of Blood
TR267r1	Great blue heron (Ardea herodias) Nest Monitoring and Egg and Nestling Tissue Collection
TR270r1	Bald Eagle Observation, Prey Remains Analysis, and Collection of Addled Eggs and Eggshell Fragments
TR271r1	Bald Eagle Nestling Handling, Banding, and Collection of Blood
TR272r1	Great Horned Owls- Location of Natural Nests, Hooting Call Surveys, and Construction and Placement of Artificial Platforms
TR273r1	Great Horned Owl Observation, Prey Remains Analysis, and Collection of Addled Eggs and Eggshell Fragments
TR274r1	Great Horned Owl Nestling Handling, Banding, and Collection of Blood
TR280r1	Protocol for Avian Radio Tagging and Tracking
TR401r1	Sample Management: Receiving, Preservation, Storage, Documentation, Decontamination, and Disposal
TR402r1	Maintenance of Sample Integrity, and Proper Usage of Refrigerators, Freezers, and Liquid Nitrogen Dewars
TR802r1	Data Package Review

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Appendix I. Permits in support of MSU study plans

QUALITY ASSURANCE PROJECT PLAN FOR THE ECOLOGICAL RISK ASSESSMENT OF DIOXINS PRESENT IN THE TITTABAWASSEE RIVER AND FLOODPLAIN

Prepared by:
Aquatic Toxicology Laboratory
Michigan State University
East Lansing, MI 48824

And

ENTRIX, Inc.
Okemos, Michigan 48864

Prepared for:
The Dow Chemical Company
Midland, Michigan

July 2005

APPROVAL PAGE

Approved by: _____ Date: _____
[Quality Assurance Manager]

Approved by: _____ Date: _____
[MSU, Principal Investigator]

Approved by: _____ Date: _____
[ENTRIX, Inc. Project Director]

Approved by: _____ Date: _____
[Sponsor Project Manager]

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Definitions and Acronyms

95% UCL	95-percent upper confidence limit
ASTM	American Society for Testing and Materials
COC	Chain-of-custody
CUR	Condition upon receipt report
DQO	Data quality objective
Dup	Duplicate
EDD	Electronic data deliverable
ERB	Equipment rinsate blank
FTL	Field team leader
GC	Gas chromatograph
GIS	Geographic Information Systems
HASP	Health and safety plan
HRGC/HRMS	High Resolution Gas Chromatography/High Resolution Mass Spectrometry
IDL	Instrument detection limit
LCS	Laboratory control samples
LOQ	Limit of Quantitation
MCL	Maximum contaminant levels
MDEQ	Michigan Department of Environmental Quality
MDL	Method detection limit
µg	Microgram
mg	Milligram
mL	Milliliter
MS	Mass spectrometer
MS/MSD	Matrix spike/matrix spike duplicate
MSU	Michigan State University
NIST	National Institute of Standards and Technology
PARCCS	Precision accuracy representativeness comparability completeness sensitivity
PCBs	Polychlorinated biphenyls
PCDD/F	Polychlorinated dibenzo-*p*-dioxins and polychlorinated dibenzofurans
QA	Quality assurance
QAMP	Quality assurance management plan
QAPP	Quality Assurance Project Plan
QC	Quality control
RL	Reporting limit
RPD	Relative percent difference
RRT	Record retention time
SDG	Sample delivery group
SOP	Standard operating procedure
SRM	Standard reference material
SSO	Site safety officer
TAL	Target analyte list
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

The purpose of this document is to present the quality assurance/quality control (QA/QC) requirements for the investigations described herein. This Quality Assurance Project Plan (QAPP) has been prepared in accordance with the guidance manuals "EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations" (EPA QA/R-5) (USEPA, 1994a), "Guidance for Quality Assurance Project Plans" (EPA QA/G-5) (USEPA 1998), and "Guidance for the Data Quality Objectives Process" (EPA QA/G-4) (USEPA, 1994b).

To provide a consistent framework, the format of this document closely follows the specifications and instructions for information as presented in EPA QA/R-5, which identifies four elements that must be addressed in a QAPP. The four elements (termed "groups") and their locations in this document are:

- **Group A, Project Management.** A discussion of this element can be found in Section 2.0 of the QAPP. The objective of this section is to provide an overview of project management, including project history and objectives, roles and responsibilities.
- **Group B, Measurement/Data Acquisition.** This element is presented in Section 3.0 of the QAPP. This section covers all aspects of measurement systems design and implementation.
- **Group C, Assessment/Oversight.** This element addresses the activities associated with assessing the effectiveness of the implementation of the project and associated QA/QC. It is discussed in Section 4.0 of the QAPP.
- **Group D, Data Validation and Usability.** Section 5.0 of the QAPP covers the QA activities that occur after the data collection phase of the project is completed.

2.0 PROJECT MANAGEMENT

This section provides the overall approach to managing the investigations and addresses the following:

- Project organization and roles and responsibilities.
- Problem definition.
- Problem description.
- Project Data Quality Objectives (DQOs) and criteria for measurement data.
- Special training requirements or certificates required for work performed.
- Documentation and records management.

2.1 Project Organization and Roles and Responsibilities

This section contains descriptions of the project roles and responsibilities for the principal project team members. The combined strengths of MSU and ENTRIX, Inc. is presented in Figure 2-1. Figure 2-2 and Figure 2-3 presents the project organization charts for ENTRIX and MSU, respectively.

The project team assembled for these studies combines the skills and expertise of both the Aquatic Toxicology Laboratory (ATL) at Michigan State University (MSU) and ENTRIX Inc (Figure 2-1). ATL personnel have a wealth of experience in conducting the field studies and chemical analyses required to carry out the project. ENTRIX Inc. brings a wealth of skills and experience in project management, document control, data analysis and risk assessment.

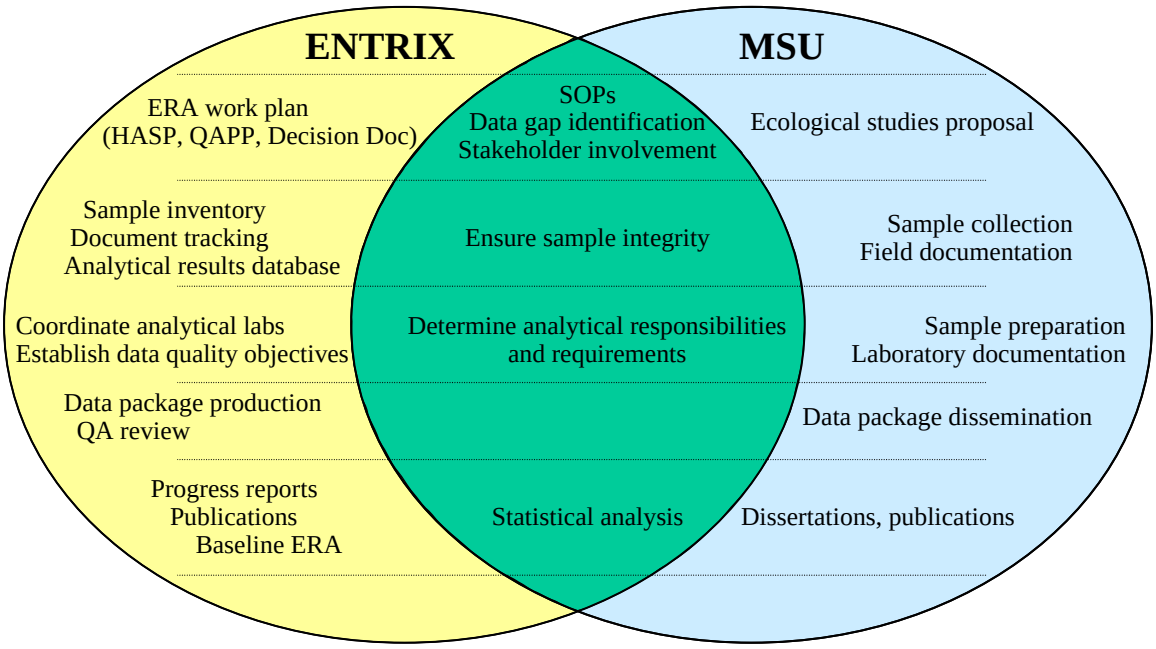

Figure 2-1. Combined Strengths of Michigan State University and ENTRIX Personnel

Project Manager — Prof. John P. Giesy (MSU) will oversee and approve all project activities; review QA reports; approve final project QA needs; authorize necessary actions and adjustments related to Michigan State University activities to accomplish program QA objectives; and act as liaison between agencies, field staff, and the sponsor Project Manager.

Quality Assurance (QA) Auditor — (To Be Named) An independent advisor will review all QA activities to ensure compliance with contract specifications. The auditor will review all data deliverables to ensure data quality and usability. The identity of this person or persons will be determined by discussion with the sponsor and all involved stakeholders.

Field Team Leader (FTL) — Dr. Matthew Zwiernik (MSU) will oversee field activities and supervise the field crews. The FTL will ensure that proper sample collection, preservation, storage, transport, and COC QC procedures are followed will inform the Project QA Manager when field problems occur, and will communicate and document corrective actions taken. The FTL will discuss field activities with the Project Manager.

Laboratory Project Manager — Mr. Patrick Bradley (MSU) is responsible for assuring that the analysis of all samples collected is performed in accordance with the QAPP and the laboratory's quality assurance manual. The Laboratory Project Manager is the liaison between the laboratory staff and is responsible for keeping the project director and the laboratory informed of project status. In addition, the Laboratory Project Manager performs the final laboratory review of project data packages for completeness and compliance with project requirements.

Quality Assurance (QA) Manager – Prof. Paul Jones (MSU) will initiate audits on work completed by project personnel and subcontractors, including analytical laboratories and independent data validation contractors. The manager will review program QA activities, quality problems, and quality-related requests. In response to field and analytical findings, the QA manager will approve corrective actions. The QA manager will report quality non-conformances to the Project Manager and review all pertinent portions of the both MSU and ENTRIX deliverables before they are transmitted to ensure conformance with QA/QC procedures and quality work product.

Project Coordinator/Data Manager – Dr. Denise Kay (ENTRIX) will coordinate ENTRIX activities on the project. These will include data and documentation preparation and dissemination. She will be responsible for the structure, organization, format, implementation, and operation of the study plan databases. A central project database will be constructed using object linking and embedding by accessing the individual study plan databases. She will also be responsible for preparation of data deliverables.

ENTRIX Inc. Project Director – Dr. Alan Blankenship (ENTRIX) will be responsible for compilation of summary results and project final reports. He will also be responsible for statistical analysis and risk assessment.

Data Interpretation - Dr John Newsted (ENTRIX) will be responsible for statistical analysis, reporting of data and risk assessment.

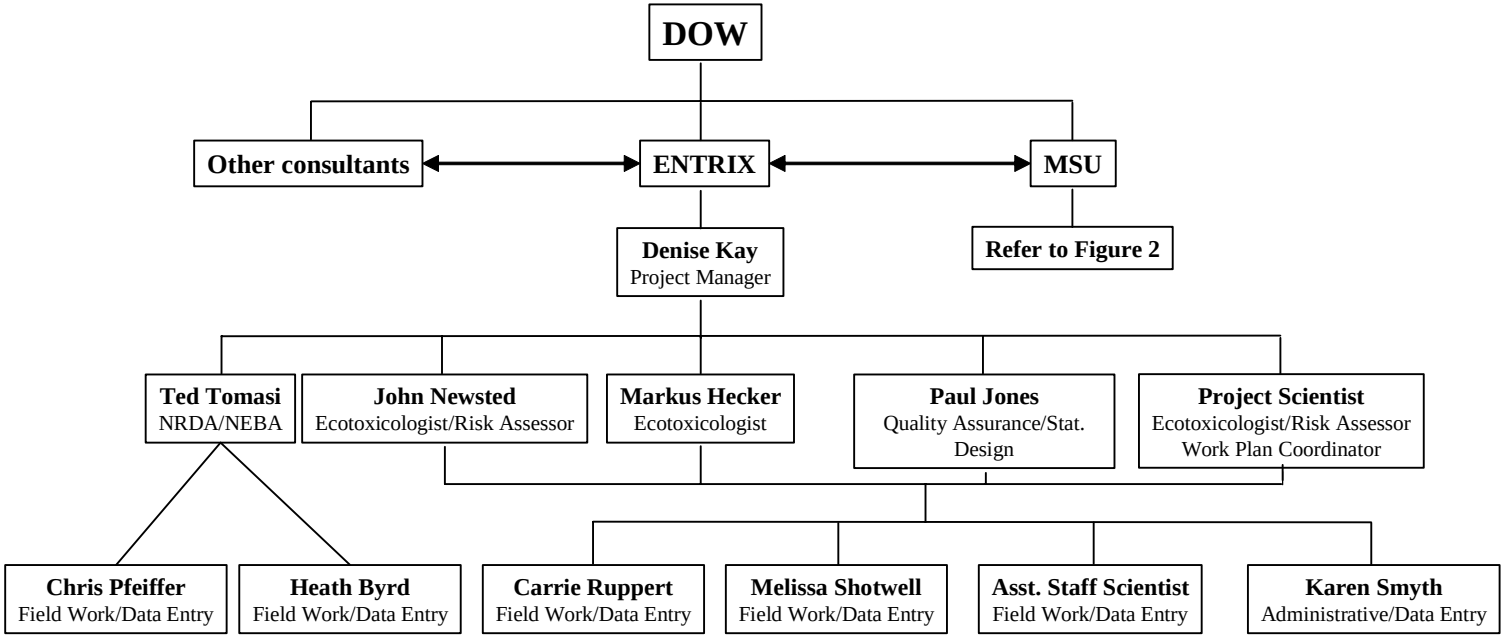

Figure 2-2. Project Organizational Chart - ENTRIX

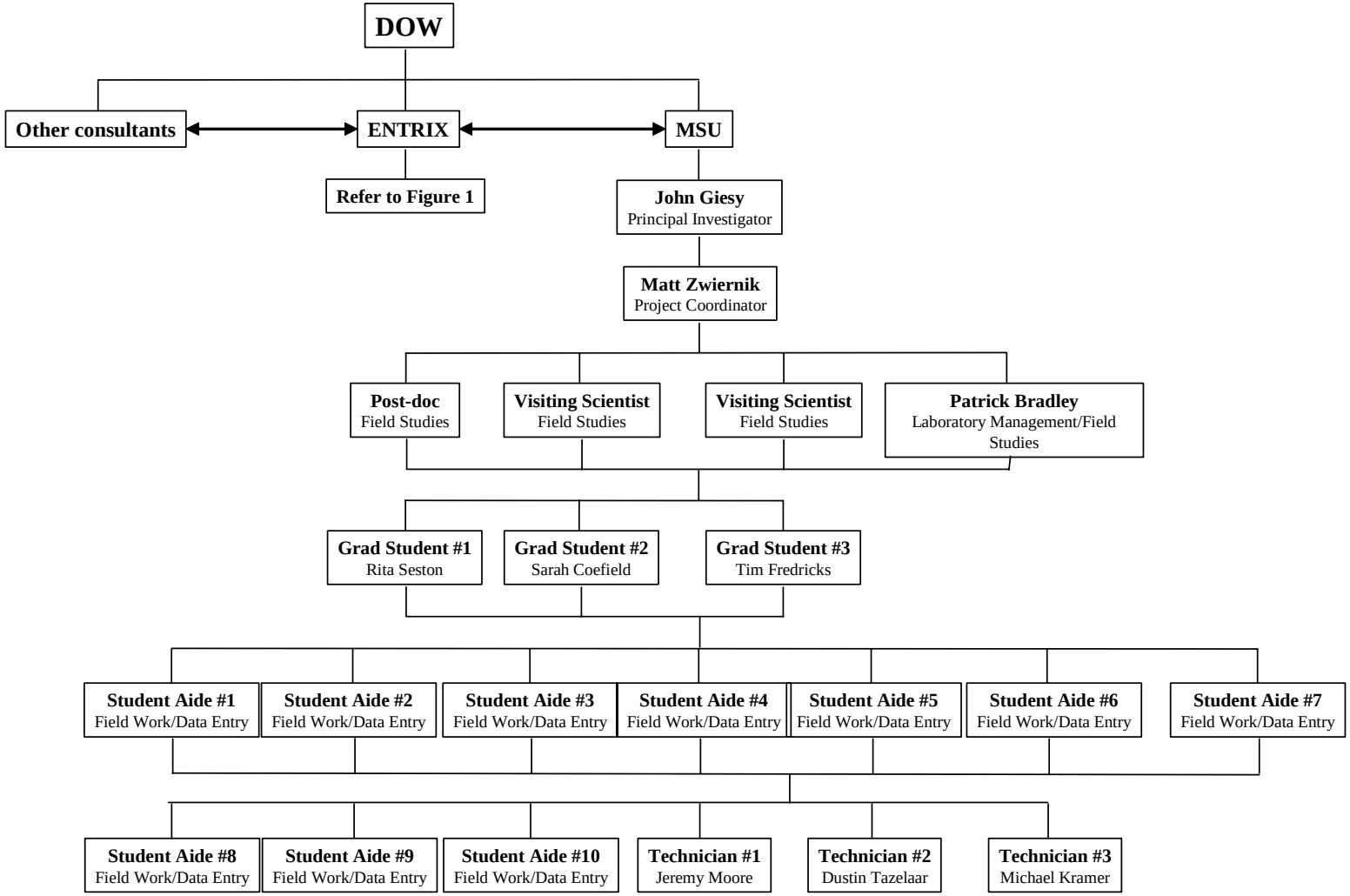

Figure 2-3. Project Organizational Chart - MSU

2.2 Problem Definition

The Ecological Risk Assessment (ERA) is designed to quantify the degree of risk posed to organisms exposed to PCDD/Fs in the Tittabawassee River floodplain. The study will determine the nature and extent of exposure and the potential for adverse ecological effects in wildlife. The results of the assessment will be used to determine appropriate site specific clean-up criteria.

The Tittabawassee River study area, hereafter referred to as the "Site", includes sediments and floodplain soils for approximately 23 miles of the Tittabawassee River downstream of Midland, Michigan. Specifically, the Site includes the upstream boundary of The Dow Chemical Company to the confluence of the Tittabawassee and Shiawassee Rivers downstream of Greenpoint Island, as defined in the Hazardous Waste Management Facility Operating License, which was issued on June 12, 2003 by Michigan Department of Environmental Quality (MDEQ) to The Dow Chemical Company (Dow).

Previous documents have reported concentrations of polychlorinated dibenzo-*p*-dioxins (PCDDs) and dibenzofurans (PCDFs) in the sediments, floodplain soils, and fish of the Tittabawassee River that exceed some state generic criteria (Taylor et al., 2002, Hilsherova et al., 2003, MDEQ, 2003). As outlined in the Operating License, specific activities have to be undertaken. One of the requirements under the conditions of the Hazardous Waste Management Facility Operating License is that an ecological risk assessment (ERA) needs to be conducted as part of the Remedial Investigation (RI) process. As recognized by the USEPA (USEPA, 1997; USEPA 1998), site-specific field studies are almost always required for sound decision making. This is especially true for complex systems such as the Tittabawassee River.

Due to the results of previous investigations that demonstrated that some concentrations of PCDDs and PCDFs in the Tittabawassee River floodplain soils downstream of Midland are greater than those from reference locations (MDEQ, 2002, 2003; Hilsherova et al., 2003), questions have been raised regarding the risk of PCDD/Fs to wildlife that reside and/or forage within the Tittabawassee River and associated floodplains. Currently, there is minimal information on the presence or concentration of PCDDs and PCDFs in the tissues or diets of avian and mammalian wildlife species that reside within the Tittabawassee River and floodplain downstream of Midland, Michigan or from other locations that could be used as reference areas.

As a result, a more refined investigation is needed to reduce some of the uncertainties relative to species-specific dietary exposure concentrations and tissue residue concentrations in wildlife that are potentially exposed to PCDDs and PCDFs in the Tittabawassee River and floodplain soils. The Work Plan associated with this QAPP describes in detail a series of site-specific studies and sample collections to be performed by the Michigan State University Aquatic Toxicology Laboratory (MSU-ATL) of the Department of Zoology and National Food Safety and Toxicology Center (NFSTC). Supplemental investigations will be conducted by ENTRIX, Inc. as specified in this Work Plan. The ERA Work Plan will include detailed plans for evaluating the aquatic and terrestrial resources and food webs of the Tittabawassee River and floodplain. In addition, the RI will include a detailed description of the ecosystem including the identification of key plant and animal species.

2.2 Project Description

The studies presented in the Work Plan are designed to elucidate site-specific and congener-specific stressor exposure and population health for those ecological receptors previously identified as being of greatest priority. The studies are of two types: exposure studies and effects studies. Exposure studies will gather site-specific data on the concentrations of individual PCDD/F congeners. This will better define PCDD/F exposures, thereby minimizing the need for conservative exposure and effects assumptions.

Studies on effects will examine receptor populations present at the "Site". Site-specific population health studies were developed to provide the appropriate data where such data were lacking in the previous evaluations.

Effects of PCDD/Fs can be better predicted by integrating congener-specific exposures to congener-specific toxicities. There are 75 PCDD congeners and 135 PCDF congeners that vary in the degree and position of chlorine substitution. Of the 210 PCDD and PCDF congeners, 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (2,3,7,8-TCDD, also referred to as TCDD) is considered to be the most potent and is the one most studied. For example, the potency of TCDD and related compounds in avian and mammalian wildlife has been well-established in laboratory and field studies (Murray et al., 1979; Gilbertson et al., 1991; Giesy et al., 1994; Ludwig et al.,1996; Tillitt et al., 1996; Powell et al., 1997). Observed effects of TCDD and related chemicals in wildlife and laboratory animals include biochemical adaptive changes such as enzyme induction, developmental deformities, reproductive failure, liver damage, wasting syndrome, and death. As a result, the biological effects of PCDD/Fs are highly congener-specific and are expressed primarily through the Ah-receptor pathway (Okey et al., 1994). As a result, PCDD/F toxicity can be assessed by converting congener-specific data to 'Toxic Equivalents' using appropriate Toxic Equivalency Factor values (Van den Berg et al.,1998).

Pesticide residues have also been detected in the tissues of some key receptors at the in the vicinity of the "Site". Most notably relatively great concentrations of DDT metabolite have been detected in the tissues of great horned owls found at the site. Therefore, residues of *p,p'*-DDT and its metabolites (*p,p'*-DDE, *p,p'*-DDD, *o,p'*-DDT) will also be monitored to evaluate the relative risks contributed by DDT.

2.2.1 Applicable Technical Quality Standards or Criteria

The study is being conducted to evaluate PCDD/Fs exposure in the environment. As such, there are no applicable regulatory or technical standards to which the analytical data will be compared. All analytical data will be collected under the QA/QC standards specified in the relevant analytical methods (EPA Method3 8290A 8270C and 1668A).

2.2.2 Special Personnel or Equipment Requirements

Special equipment requirements for the proposed work include, 3 Nexttel™ combination 2-way radio and digital cellular phones, a Wildco® sediment coring device and a surface sediment sampling device. Observational equipment includes 4, Bushnell spotting scopes, 12 portable blinds, 12 folding chairs and 4 propane heaters. Organism collection equipment may include an aquatic insect emergence trap, Ponar grab sampler, sweep nets, minnow traps, Smith Root 1.5 KVA stream electrofisher, AbP-3 backpack electrofisher, pitfall traps, bird boxes and platforms, and Sherman live traps to collect a variety of aquatic and terrestrial species. Personnel will be used that are trained to work and/or take measurements with this equipment and identify the variety of aquatic and terrestrial species encountered. Additional information on special training, requirements and certifications are presented in Section 2.6. Procedures for collection of organisms are specified in the applicable SOPs attached to the SAP. Field personnel will be equipped with suitable PDAs to facilitate the electronic collection of field data and permit the backup and transfer of that data to central storage.

2.2.3 Assessment Techniques

A summary of assessment activities that are required for the work are as follows:

- Assessment of field operations. To evaluate field operations performance, frequent review of sample collection documentation, COCs, field notebooks and field measurements, and the performance of unannounced field operation audits will be conducted.

- Assessment of laboratory operations. An audit of the MSU-ATL facility will be performed quarterly by the QA manager. All inspections of the study facilities will be unannounced. Laboratory audits will include assessments of all sample tracking and other documentation, instrument log books, personnel working on the project and their training records and a random audit trail check of selected samples. Any nonconformities will be reported to Mr. Patrick Bradley and the Project Director within five working days and official notification of corrective actions will be reported to the QA manager and Project Director within an additional five working days. If the QA manager determines that nonconformities are of a nature that would compromise sample integrity he will have authority to order immediate cessation of laboratory operations until corrective measures are in place and notified to the QA manager and project director.

Specific details of assessment procedures can be found in Section 4.0.

2.2.4 Work Schedule

Sampling and analysis are to begin in April 2004 and will continue through 2007. Data analysis and interpretation will continue through 2008.

2.2.5 Project and Quality Records and Reports

Critical records for this project include:

- field operations records;
- project reports outlined above; and
- laboratory records.

More details on project records and reports can be found in Section 2.6.

2.3 Data Quality Objectives and Criteria for Measurement Data

In this section the data quality objectives for the work tasks and the performance criteria and measurement system that will be employed are discussed.

2.3.1 DQO Development

Data quality objectives (DQOs) are both qualitative and quantitative statements that define the type, quality, and quantity of environmental data appropriate for the intended application. The DQO process used for this project follows the EPA QA/R-5 regulations (USEPA 1998) and EPA QA/G-4 guidance (USEPA 1994b). Quality assurance activities associated with all sampling and analysis are addressed in the SOPs for those activities. DQOs associated with field studies are addressed in the Sampling and Analysis Plan portion of the ERA Work Plan.

2.3.2 Method Performance Objectives

The sampling approach and rationale are presented in the Sampling and Analysis Plan and are discussed in terms of DQOs. Method performance requirements for analytical laboratory methods to be performed for the study are expressed in terms of precision, accuracy, representativeness, comparability, completeness, and sensitivity (PARCCS). Summarized below are brief definitions for each PARCCS parameter, with calculation equations as appropriate.

2.3.2.1 Precision

Precision is an estimate of the variability between individual measurements of the same physical or chemical property, under prescribed similar conditions.

Field Precision

Field precision is usually assessed through the collection and measurement of duplicate field samples at the same location. The duplicate sample is submitted "blind" to the laboratory, and sample results are compared to check for the overall variability introduced by sampling and analytical procedures. The field duplicate approach is generally not applicable to systems where the experimental unit is the single organism since each individual is represents a sampling replicate. Homogenizing of such an individual organism and preparation of replicate samples represents an analytical duplicate rather than a field duplicate. Similarly when a single soil sample is collected and divided into additional blind samples these replicate samples represent analytical replicates. However, if a composite soil sample is prepared by the compositing of numerous individual cores then a field duplicate can be prepared by collecting a second series of cores adjacent to the first. However, it should be noted that PCDD/F concentrations in soils are known to be highly variable spatially and so variability in field duplicated can be considerable. Another example of a field duplicate would be the collection of two samples of insects at the same location at the same time. However, these two samples cannot be generated by collection of a single composite and then splitting it into two samples. Therefore we will not determine field precision in these studies.

Laboratory Precision

Precision in the laboratory is assessed through the calculation of the relative percent difference (RPD) for two replicate samples. The precision of the analysis can be inferred through the use of one of the following: 1) laboratory control spike and laboratory control spike duplicate (LCS and LCSD) samples, which are laboratory blank samples spiked with known analyte concentrations, 2) matrix spike and matrix spike duplicate (MS/MSD) samples which are project samples spiked with known analyte concentrations, or 3) duplicate analyses of unspiked project samples. The laboratory analyzes one or more of the aforementioned types of duplicate samples at a rate of one per batch of twenty (20) or fewer investigative samples per matrix.

The MS/MSD samples provide information about the effect of the sample matrix on extraction and measurement methodology. An MS/MSD pair will be analyzed at a rate of one per twenty (20) per analytical batch or fewer investigative samples per matrix.

Calculating the RPD for each pair of duplicate analyses (e.g., MS/MSD, laboratory control sample spike duplicates, unspiked duplicate samples) and the RPD for field duplicate sets, using the following formula will assess the precision of laboratory analyses:

Equation 2-1

$$RPD = \frac{S - D}{(S + D)/2} x100$$

where:

RPD	=	Relative Percent Difference, %.
S	=	First sample value (original or MS value or larger of the duplicate),
D	=	Second sample value (duplicate or MSD value or smaller of the duplicate),

2.3.2.2 Accuracy

Accuracy is the degree of agreement between a measurement or observation and an accepted value.

Field Accuracy

Accuracy in the field is assessed through the collection and analysis of appropriate field equipment blanks and trip blanks, and achieved through adherence to all sample handling, preservation, and holding time requirements. Field blank samples are analyzed to check for procedural contamination that may cause sample contamination. Equipment rinse blanks are used to assess the adequacy of decontamination of sampling equipment between collection of individual samples. Trip blanks are used to assess the potential for contamination of samples due to contaminant (i.e., volatile organic compounds) migration during sample shipment, handling, and storage. Accuracy of the field instruments will be assessed by using daily instrument calibration and calibration checks. Field blank, equipment rinsate blank, and trip blank analysis frequencies are given in Table 2-1.

Laboratory Accuracy

Laboratory accuracy is assessed by the analysis of method blanks, surrogate spikes, matrix spikes (MS), laboratory control samples (LCS), and/or Standard/Certified Reference Materials (SRM). The results are expressed as percent recovery. Method blank samples are generated within the laboratory and used to assess contamination resulting from laboratory procedures. Surrogate compounds are used in analyses for organic contaminants and specified in the analytical method. Prior to sample extraction, surrogate compounds are added to each organic environmental, blank, spike, and duplicate sample. Method blanks, MS, LCS, and/or SRM samples will be analyzed at a rate of one per analytical batch of twenty (20) or fewer investigative samples/matrix.

The percent recovery (percent R) of spike samples will be calculated using the formula:

Equation 2-2

$$R = \frac{A - B}{C} x100$$

where:

R = Recovery, %

A = The analyte concentration determined experimentally from the spiked sample, units.

B = The background level determined by a separate analysis of the unspiked sample, units.

C = The amount of the spike added, units.

Table 2-1. Field QC Samples for Precision and Accuracy.

Type of QC Sample	Frequency	Acceptance Criteria
Equipment rinsate blank	2 per day per equipment type	No analyte should be detected at >3 times the laboratory blank
Matrix spike/matrix spike duplicate (MS/MSD)	1 per 20 tissue samples	RPD should be ≤30 % for each analyte.
Field blank	1 per day	No analyte should be detected at >3 times the laboratory blank.

Note: MS/MSD samples are included as field QC samples for planning purposes, to ensure sufficient sample volume is collected for the analyses.

2.3.2.3 Representativeness

Representativeness is a qualitative measure of the degree to which sample data accurately and precisely represent a characteristic environmental condition. Representativeness is a subjective parameter and is used to evaluate the efficacy of the sampling plan design. Representativeness is demonstrated by providing full descriptions of the sampling techniques and the rationale used for selecting certain tissue samples and sampling locations in the project planning documents.

There cannot be a target numerical goal for a qualitative parameter such as representativeness or comparability. Therefore, this criterion is completed and evaluated subjectively rather than quantitatively. The measure for representativeness is answered during the preparation of the sampling and analysis approach and rationale, and then reassessed during the data usability process. For example, an integral part of developing the sampling and analysis approach and rationale is to answer the question "How many samples are needed to fully evaluate x?" Then, during the data usability process, the question "Were enough data collected to answer the original question?" must be answered. Thus, it is not possible to construct a table with numerical goals that can be used to evaluate these subjective measures. The criteria to make these decisions can be based on power analysis conducted after initial information has been collected or during data interpretation to determine if additional samples are necessary to fully describe the nature and extent.

Since the analytical samples will generally be obtained as homogenized tissue composites from individual specimens an assessment of the representativeness of the homogenized samples is required. Sample homogenates will be prepared as composite samples containing standardized amounts of collected tissues. To ensure complete homogenization of the samples, duplicate aliquots of 10% of samples will be submitted to the analytical laboratories as blind replicates.

2.3.2.4 Comparability

Comparability expresses the confidence with which one data set can be compared with another data set obtained during parallel or previous investigations. Comparability can be related to precision and accuracy, since these parameters are measures of data reliability.

Results of chemical analyses in the same medium are generally considered comparable if the same procedures for collecting and analyzing the samples are employed, if the samples comply with the same QA/QC procedures, and if the units of measurements are the same.

Only some of the tissue types to be collected for analysis for this study have not been collected from the Tittabawassee River previously. Where appropriate results for samples from the current study will be compared to results from previously collected samples to determine comparability.

The analytical protocols for PCDD/F determination for this study will be comparable with previous data collected for fish in the river (Hilscherova et al. 2003; ENTRIX 2004). The method used, based on US-EPA method 8290, determines each PCDD/F congener individually so data will be amenable to comparison with other PCDD/F determinations. The acceptability criteria for the method are performance based and compliance with QA/QC requirements will be ensured.

The quality objectives for data from each field sampling and analysis task within this study is to achieve a level of comparability that allows for the comparison of data collected among all field tasks for this study. To accomplish this goal, all data generated during the tasks included in this investigation will be subject to strict QA/QC procedures as specified in this QAPP.

2.3.2.5 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was planned to be obtained under normal conditions. Data completeness will be calculated by using Equation 2-3.

Equation 2-3

$$\%\ \text{Completeness} = \frac{\text{Valid Data Obtained}}{\text{Total Data Planned}} \text{x}100$$

Experience on similar projects has shown a reasonable goal considering combined historical field and laboratory performance is 90 percent completeness. All valid data will be used. During the data validation process, an assessment will be made of whether the valid data are sufficient to meet project objectives. If sufficient valid data are not obtained, the Project Manager will initiate corrective action. Where invalid data is generated all documentation and the reasons for the invalidation of the data will be provided.

2.3.2.6 Sensitivity

Sensitivity is the measure of the concentration at which an analytical method can positively identify and report analytical results. The sensitivity of a given method is commonly referred to as the detection limit. Although there is no single definition of this term, the following terms and definitions of detection limits will be used for this program.

- **Instrument detection limit** (IDL) is the minimum mass of analyte that can be measured above instrument background noise under ideal conditions.
- **Detection limit** (MDL) For GC/MS analysis detection limits are generally first determined as a sample-specific estimated detection limit (EDL). The EDL is the concentration of a given analyte required to produce a signal with a peak height of at least 2.5 times the background signal level. An EDL is calculated for each 2,3,7,8-substituted congener that is not identified, regardless of whether or not other non-2,3,7,8-substituted isomers are present. The EDL is then used in conjunction with information about the amount of sample used and amount of surrogates added to calculate a sample specific MDL.

The sum TEQ for all MDLs in a single sample may not exceed 0.9 pg TEQ/g. Table 2-2 gives target ranges for congener specific MDLs. These limits are of sufficient sensitivity to allow for comparison to toxicological benchmarks. The MDL for each congener is a function of signal to noise ratio for each sample, which affects the amount of compound detectably different from baseline, and the sample mass used. An MDL is also provided based on the calculation of "total dioxin equivalents" based on the WHO promulgated TEF values for various animal classes (van den Berg et al. 1998).

Sample MDLs will vary from sample to sample and will depend on the amount of samples processed. Failure of the analytical laboratory to achieve the required MDLs will impair the ability to statistically compare sampling locations.

Table 2-2. PCDD/F Congeners to be analyzed and target MDLs

Compound	CAS No	Target MDL (pg/g)*
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1746-01-6	0.1-1
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	40321-76-4	0.1-1
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	57653-85-7	0.1-1
1,2,3,4,7,8- Hexachlorodibenzo-p-dioxin (HxCDD)	39227-28-6	0.1-1
1,2,3,7,8,9- Hexachlorodibenzo-p-dioxin (HxCDD)	19408-74-3	0.1-1
1,2,3,4,6,7,8- Heptachlorodibenzo-p-dioxin (HpCDD)	35822-39-4	0.1-1
Octachlorodibenzo-p-dioxin (OCDD)	3268-87-9	1-5
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	51207-31-9	0.1-1
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	57117-41-6	0.1-1
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	57117-31-4	0.1-1
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	57117-44-9	0.1-1
1,2,3,7,8,9- Hexachlorodibenzofuran (HxCDF)	72918-21-9	0.1-1
1,2,3,4,7,8- Hexachlorodibenzofuran (HxCDF)	70648-26-9	0.1-1
2,3,4,6,7,8- Hexachlorodibenzofuran (HxCDF)	60851-34-5	0.1-1
1,2,3,4,6,7,8- Heptachlorodibenzofuran (HpCDF)	67562-39-4	0.1-1
1,2,3,4,7,8,9- Heptachlorodibenzofuran (HpCDF)	55673-89-7	0.1-1
Octachlorodibenzofuran (OCDF)	39001-02-0	0.1-1
SUM WHO-TEQ MUST NOT EXCEED 0.9 pg/g (ww)		

* Units represent wet wt for tissues.

2.4 Laboratory Comparison

To ensure timely, accurate and independently verifiable results for this study, two primary analytical facilities have been selected (see Section 3.1.2). To ensure the validity and comparability of results from the two laboratories, a program of blind sample replicates will be used to provide data for intra- and inter-laboratory comparison.

Quality assurance criteria for acceptability and usability of data are provided in Table 3-3 of this QAPP.

2.5 Special Training, Requirements, and Certifications

The Project Manager is responsible for assembling a project team with the necessary experience and technical skills. Part of the process is to identify special training requirements or certifications necessary to execute the project successfully. Project-specific requirements include training specific to the analytical methods to be conducted, specific collection and handling methods for tissue samples, and health and safety training for field and laboratory activities.

All field personnel will receive training before commencing fieldwork to ensure they are familiar with the required SOPs and are adequately skilled at sample and field data collection. Personnel training records are maintained by the laboratory manager.

Additionally, all contractors working at the site should have the appropriate health and safety training as outlined in the Health and Safety Plan.

The analytical laboratories chosen for the study both have extensive experience and certification for the determination of PCDD/Fs in a wide variety of matrices. Both laboratories are recognized as world leaders in this field of analysis.

2.6 Documentation and Records

This section identifies critical field and laboratory records required for this project, information to be included in project reports, the data reporting format for analytical data report packages, and the document control procedures to be used.

2.6.1 Required Records

The critical records required for this project are identified below with descriptive or supporting information as appropriate. Records information is presented below for field operations. Critical laboratory records are described in Section 2.7.3 of this QAPP.

Critical records generated during field operations are listed below.

- Sample collection records including field notebooks, photographs, and any other records used to record raw data. General field procedures will be referenced in the field notes, while any necessary deviations or modifications required to collect samples will be described in detail.
- Chain-of-custody records (COC).
- Field QC sample records.
- Corrective action reports.

The information contained in these records documents the overall field operations. Procedures for field operations records control, archiving, and storage are described in Section 2.7.4 of this QAPP.

2.6.2 Project Reports

Several types of reports will be produced during the course of this project. The Project Manager will prepare summary reports for investigations described herein. Tasks described herein will be submitted in the following technical report publications and manuscripts to be submitted to the peer-reviewed scientific literature, including summary report of data and QA determinations.

2.6.3 Laboratory Records

All analytical results for tissue data will be reported in an approved format, described below. In addition to the reported data, the laboratory data report will, at a minimum, include a narrative that will discuss any problems or discrepancies, and sufficient calibration and QC information to determine that the method was in control at the time that the samples were analyzed. The laboratory records will include:

- Case narrative;
- COC documentation (external);

- Laboratory sample ID, field sample ID, location, matrix, and dilution factors;
- Sample receipt, extraction, and analysis dates for holding time verification;
- Percent recovery of each surrogate;
- Final analyte concentration including reporting limit, laboratory qualifiers, and re-analyses;
- Surrogate recovery control limits;
- Percent recovery of each compound in the MS sample;
- MS recovery control limits;
- RPD for all MS/MSD and/or LCS/LCSD results;
- RPD control limits for MS/MSD and/or LCS/LCSD reports;
- Laboratory control sample results when analyzed;
- Recovery control limits for LCS or SRM recoveries and RSD;
- Blank results for method blanks, field blanks, equipment blanks, and trip blanks; and
- Method blank summary indicating associated samples.

For data validation, the following additional data will be required:

- Sample receipt/sample log-in forms;
- Calibration information, including initial calibration, concentration response data of the calibration check standards, continuing calibration check data, instrument tunes, and associated samples;
- Internal standard areas and retention times; and
- All raw data and logs will include the following information:
    - analyst's initials and date
    - initial and final sample and extract volumes or weights and/or dilutions
    - condition of instrument (e.g., retention times for GC)
    - documentation linking sample analysis to instrument calibration (where appropriate)
    - time of start of analysis of all field and QC samples
    - instrument run log showing analytical sequence
    - dilutions performed and amount of sample analyzed or injected
    - field samples, QC samples, and blanks clearly labeled
    - chromatograms and quantitation reports
    - sample preservation (where applicable)

In addition to the hard-copy report requirements, the laboratory will provide (1) electronic deliverables conforming to an ASCII comma-delimited format for all data reported and (2) an electronic back up for all laboratory data generated.

Procedures for project control, archiving, and storage of laboratory records are described in Section 2.6.4 of this QAPP. The laboratory's internal records management protocols are described in SOP #802 (Appendix H) entitled, "Data Package Review". MSU-ATL and ENTRIX, Inc. will adhere to a record retention time (RRT) of 7 years for all laboratory records for the project.

2.6.4 Record Maintenance and Storage

All documents relating to the project will be controlled to assure proper distribution, filing, and retrieval, and to assure that revisions are properly recorded, distributed, and filed.

Project records will be stored and maintained by ENTRIX, Inc. The Project Manager and office staff are responsible for organizing, storing, and cataloging all project information and for collecting records and supporting data from project team members. Once cataloged, ENTRIX will assure that project records are appropriately filed by category in the correct project file. Filed documents are available to MSU-ATL and ENTRIX staff through check-out procedures developed to assure the integrity of the project file. Individual project team members may maintain separate files or notebooks for individual tasks. These files or notebooks are transferred to the project manager as part of project close-out. The archived files will be stored and maintained by ENTRIX, Inc. Additional information on record management can be found in Section 3.9.7 and 3.9.8 of this QAPP.

3.0 MEASUREMENT AND DATA ACQUISITION

This section describes all aspects of measurement design and implementation, and discusses the methods that will be used for sampling, analysis, data handling, and QC in support of the tasks discussed herein. The following specific aspects of measurement and data acquisition will be covered in this section:

- Sampling process design;
- Sampling methods requirements;
- Sample handling and custody requirements;
- Analytical method requirements;
- Quality control requirements;
- Instrument/equipment testing, inspection, and maintenance requirements;
- Instrument calibration and frequency;
- Inspection and acceptance requirements for supplies and consumables;
- Data acquisition requirements; and
- Data management.

3.1 Sampling Process Design

The measurements to be taken and the media to be sampled include concentrations of PCDD/F congeners in various tissues of biota and environmental matrices.

The planned sampling locations and rationale for selection are detailed in the Sampling and Analysis Plan (SAP). Any modifications to the work tasks described therein will be presented as an addendum or update to the SAP.

3.1.1 Field Sampling Documentation

Field team members will maintain bound field logbooks to provide a daily record of significant events, observations, and measurements during sampling. Each data book will have a unique identifier and each page and carbon copy will include this data book identifier. All information pertinent to sampling will be recorded in the logbooks. Each day's logbook entries will be signed and dated and will include:

- Name and title of author, date and time of entry, and weather and environmental conditions during the field activity;
- Location of sampling activity;
- Sampled species or environmental matrix;
- Sample collection method; and
- Number of samples taken.

When activity-specific data forms are used, they will also include:

- Project name and number;
- Investigation location;
- Sampler's initials;
- Sampled species; and
- Sample collection method.

The following information will be recorded either in the logbook or on the activity-specific data forms:

- Date and time of collection;
- Sample identification number(s);
- Sample destination (e.g., laboratory);
- Field observations;
- Field measurements; and
- Sample handling (preservation).

All original data recorded in field logbooks, field data forms, sample labels, and COC forms must be written with waterproof, indelible ink. None of these accountable, serialized documents are to be destroyed or discarded, even if one is illegible or contains inaccuracies requiring document replacement. If an error is made on an accountable document assigned to one individual, that individual will make all corrections simply by crossing a line through the error, initialing and dating the correction, and entering the correct information. The erroneous information will not be obliterated. The person who made the entry will correct any subsequent error discovered on an accountable document. All personnel will be trained in the proper use of notebooks during training for field work.

During the course of this study ATL will undertake to enter data into a Personal Digital Assistant (PDA) system to aid in automation of data collation and upload. Procedures and systems for the entry, verification, backup and compilation are currently underway. Until these systems and procedures are in place and ATL can verify the integrity and security of such data the hardcopy paper records discussed above will be kept. All PDA entered data records will contain the same information as the paper records. When PDA data entry is implemented it will be the responsibility of Dr Denise Kay (ENTRIX) to ensure that suitable electronic and/or paper copies of all PDA data are prepared and transferred to the security of the project archive.

3.1.2 Sample Identification

The field analysis and sample identity information are recorded in bound field logbooks or recorded on data sheets while in the custody of the sampling team.

A sample label will be completed and attached to each animal and sample container for every species collected. Labels consist of a waterproof material backed with a water-resistant adhesive. Labels are to be filled out using waterproof ink, and are to contain at least the following information:

- Sampling date and time;
- Sample identification number;
- Investigation location;

- Sampler's initials;
- Sample matrix or matrix identifier.

Each sample to be analyzed for residues will be assigned a unique number consisting of an alphanumeric code that identifies the investigative area, medium (tissue), and the specific sampling location. These numbers will be tracked electronically, from collection through laboratory analysis and into the final reports.

The sample number will be cross-referenced with the site name and sample location on the COC. Additional sample volume will be collected for samples identified for laboratory QC purposes (i.e., MS, MSD, DUP) and identified as "For Lab QC Use." Information to be included on COCs is specified in SOP TR401 entitled, "Sample Management - Receiving, Preservation, Storage, Documentation, Decontamination, and Disposal".

3.1.2.1 Tissue Sample Handling Procedures

Appropriate sample containers will be sealed, labeled, and placed on wet or blue ice in an insulated container. Appropriate COC documentation will accompany the samples as required by the QAPP. Specific sample volumes, sample containers, preservatives, and replication of samples are detailed in the following sections. Any sampling equipment that will be reused will be decontaminated by rinsing with deionized water followed by reagent grade acetone and hexane between sampling.

3.1.2.2 Decontamination Procedures and Materials

All equipment used during investigation activities that could come into contact with chemically affected materials will be thoroughly cleaned, before and after each use, by washing with Liquinox (a laboratory-grade detergent) and rinsing with deionized water followed by reagent grade acetone and hexane. Decontamination procedures may be modified and/or revised based upon the data obtained or the field equipment used.

Decontamination waste is expected to consist of acetone and hexane. Decontamination solutions will first be discharged to drums in a designated staging area and then later transferred to laboratory facilities for proper disposal and management.

3.1.3 Support Facilities for Sampling Methods

The primary laboratories for analysis of samples collected for this study will be:

- MSU-ATL Analytical Chemistry Laboratory, Michigan State University, East Lansing, MI 48824.
- AgriQuality Limited, 1B Bell Road, PO Box 31-242, Lower Hutt, New Zealand.

3.1.4 Sampling/Measurement Failure Response

If QC surveillance and/or field audits result in detection of unacceptable conditions, procedures or data, the Project Manager, in conjunction with the QA Manager, will be responsible for developing and directing implementation of corrective actions. Corrective actions will include one or more of the following:

- Identifying the root cause of the problem and implementing systems to prevent future occurrences;

- Identifying the source of the violation;
- Evaluating and amending sampling and/or analytical procedures; and
- Accepting data and flagging the data to indicate the level of uncertainty associated with failure to meet the specified QC performance criteria.

Any finding requiring corrective action must be documented to the Project Manager. The Project QA Manager will check to ensure that corrective actions have been implemented and that the problem has been resolved. Problems will be addressed and the corrective action noted in the appropriate lab or field notebook.

If an error is made on an accountable document assigned to one individual, that individual will make all corrections simply by crossing a line through the error, initialing and dating the correction, and entering the correct information. The erroneous information will not be obliterated. The person who made the entry will correct any subsequent error discovered on an accountable document.

3.1.5 Sample Preservation and Holding Time Requirements

The sample containers, preservative requirements, and maximum holding times for analytical methods used in this project are provided in Table 3-1.

Table 3-1. Required Sample Containers, Preservation, and Holding Times.

Analyses	Sample matrix[a]	Container[b]	Preservative[c]	Holding time[d]
PCDD/F congeners (EPA Method 8290, Sec. 6.4)	S, P, T	125ml Glass	Freeze -20°C	365 days
PCB congeners (EPA Method 1668, Sec. 8.5)	S, P, T	125ml Glass	Freeze -20°C	365 days
DDT compounds (EPA Method 8270C)	S, P, T	125ml Glass	Freeze -20°C	Not specified
Percent Lipids (gravimetric)	S, P, T	N/A	Freeze -20°C	NA

Note:
Sample container and volume requirements will be specified by the analytical laboratory performing the tests. Three times the required volume should be collected for samples designated as MS/MSD samples.

[a] Sample matrix: T = Tissue

[b] Glass containers will be pre-cleaned and sealed with Teflon®-lined screw caps and solvent rinsed foil.

[c] Tissue samples will be shipped at 4°C to the laboratory and stored at -20°C after dissection/processing.

[d] Holding times are from the time of sample collection. Holding times are based on method 8290. All extracts will be analyzed within 45 days of extraction. Numbers represent days to analysis of extract.

3.2 Sample Handling and Chain of Custody Requirements

Proper sample handling, shipment, and maintenance of chain of custody (COC) are key components of building the documentation and support for data that can be used to make program decisions. It is essential that all sample handling and sample COC requirements be performed in a complete, accurate, and consistent manner. Sample handling and custody requirements must be followed for all samples collected as part of this project.

3.2.1 Sample Custody

Sample custody and documentation procedures described herein must be followed throughout all sample collection activities. Components of sample custody procedures include the use of field logbooks, sample labels, custody seals, and COC forms. The COC form must accompany the samples during shipment from the field to the laboratory.

A sample is under custody under the following conditions:

- It is in one's actual possession;
- It is in one's view, after being in his or her physical possession;
- It was in one's physical possession and that person then locked it up to prevent tampering; and/or
- It is in a designated and identified secure area.

The following procedures must be used to document, establish, and maintain custody of field samples:

- A sample label will be completed and attached to each sample container for every sample collected. Labels consist of a waterproof material backed with a water-resistant adhesive. Labels are to be filled out using waterproof ink, making sure that the labels are legible and affixed firmly on the sample container. Sample labels are to contain at least the following information: sampling date and time; sample identification number; investigation location; and sampler's initials.
- All sample-related information must be recorded in the project logbook or on activity-specific data forms.
- The field sampler must retain custody of samples until they are transferred or properly dispatched.
- To simplify the COC record and minimize potential problems, as few people as possible should handle the samples or physical evidence. For this reason, one individual from the field sampling team should be designated as the responsible individual for all sample transfer activities. This field investigator will be responsible for the care and custody of the samples until they are properly transferred to another person or facility.
- A COC record will accompany all samples. This record documents the transfer of custody of samples from the field investigator to another person, to the laboratory, or other organizational entities, as a signature for relinquishment and receipt of the samples must accompany each change of possession. Chain-of-custody will be prepared for groups of samples collected at a given location on a given day.
- The COC form makes provision for documenting sample integrity and the identity of any persons involved in sample transfer. Information entered on the COC will consist of the following:
    - project name and number;
    - field logbook number;
    - chain-of-custody serial number;
    - project location;
    - sample numbers;
    - sampler/recorder's signature;
    - date and time of collection of each sample;
    - collection location;
    - sample type;
    - analyses requested;

    - inclusive dates of possession;
    - name of person receiving the sample;
    - laboratory sample number;
    - date of receipt of sample;
    - name, address, and telephone number of laboratory;
    - name, address, and telephone number of person to whom laboratory report will be sent; and
    - method of delivery and courier.
- Completed COC forms will be inserted into a Ziploc™ bag, sealed, and taped to the inside cover of the shipping container used for sample transport from the field to the laboratory when a courier or shipping company is used. The shipping company will not sign for custody of the samples.
- When samples are relinquished to a courier for transport, the tracking number from the shipping bill or receipt will be recorded on the COC form or in the site logbook.
- The recipient for the samples must be notified of the date of shipment and anticipated time of arrival. The shipping bill number must also be provided to the recipient to enable tracking of samples.
- It must be clearly established prior to shipment who will be responsible for ensuring that timely sample delivery occurs and who will track the samples in case of shipping delays.
- The recipient of the samples must inform the sender when the samples are delivered.
- Custody seals must be affixed on shipping containers when samples are shipped to the laboratory to prevent sample tampering during transportation.
- In cases of delivery delay or packing damage all details of damage and sample condition must be recorded and if necessary photographed for documentation.

3.2.1.1 Laboratory Sample Handling and Custody

The Project Liaison or Field Team Leader (FTL) will notify the Laboratory Project Manager of upcoming field sampling activities and the subsequent transfer of samples to the laboratory. This notification will include information concerning the number and type of samples to be shipped, analyses requested, and the expected date of arrival. The Laboratory Project Manager will notify appropriate laboratory personnel about the expected shipment including the sample custodian.

Upon arrival at the laboratory, the samples will be received and logged in by a trained sample custodian in accordance with the laboratory's sample handling program. A description of the laboratory's general program is provided in SOP TR401 and is summarized below.

Upon sample receipt, the sample custodian is responsible for performing the following activities during sample receipt where appropriate:

- Examining the shipping containers to verify custody seals, if used, are intact;
- Examining all sample containers for damage;

- Take digital photographs of any custody seals used, before opening, and of any damage to the shipping container or individual sample containers
- Comparing samples received against those listed on the COC;
- Verifying sample holding times have not been exceeded;
- Determining sample temperature (from the temperature blank vial) and documenting variations from the acceptable range on the COC;
- Verifying that all samples listed on the COC are present or accounted for;
- Immediately signing and dating COC after shipment is accepted;
- Noting any sample receipt problems on the COC, initiating a Condition Upon Receipt report (CUR), and notifying the Laboratory Project Manager;
- Attaching laboratory sample container labels with laboratory identification number and test; and
- Placing the samples in proper laboratory storage.

The Laboratory Project Manager is responsible for contacting the Project Liaison as soon as possible if any problems are identified during sample receipt. All identified sample receiving problems will be resolved before sample preparation and analysis.

Following sample receipt, the sample custodian is responsible for logging the samples in the laboratory sample log-in book, and/or the Laboratory Information Management System (LIMS) with the following information:

- Laboratory project number;
- Sample numbers (laboratory and client);
- Type of samples;
- Required tests;
- Date collected; and
- Date received.

The sample custodian is also responsible for notifying the Laboratory Project Manager and appropriate Group/Team Leader(s) of sample arrival and placing completed COCs, waybills, and any additional documentation in the project file.

Samples will be stored appropriately within the laboratory to maintain any prescribed temperature, to protect against contamination, and to maintain the security of the samples.

If any samples are transferred to a different laboratory, the transfer will be done under COC procedures and ENTRIX will maintain the appropriate documentation to preserve the traceability of the samples through final analysis and disposal.

3.2.2 Sample Packing and Shipping

Samples will be delivered to the designated laboratories by field personnel, laboratory courier, or by commercial shipping services (such as UPS or Federal Express). The method of sample shipment will be noted on the COC. During the field effort, the FTL or a designee will inform the laboratory daily of

planned shipments. Hard plastic ice chests or coolers with similar durability will be used for shipping samples. The coolers must be able to withstand a 4-foot drop onto solid concrete in the position most likely to cause damage. The samples will be packed to prevent the least amount of damage if such a fall would occur.

After packing is complete, the cooler will be taped shut with custody seals affixed across the top and bottom joints. Each container will be clearly marked with a sticker containing the originator's address.

The following procedures must be used when transferring samples for shipment.

- A COC form must accompany samples. When transferring possession of samples, the individuals relinquishing and receiving must sign, date, and note the time on the record. This record documents transfer of custody of samples from the field sampler to another person or to the laboratory. Overnight shipping companies will not be required to sign the COC. A copy of the receipt of shipment will accompany the COC.
- Samples must be properly packaged for shipment and dispatched to the appropriate laboratory for analysis with a separate signed COC form enclosed in each sample box or cooler. The COC should reflect <u>only</u> the contents of the cooler in which it is enclosed.
- A COC form identifying the contents must accompany all packages. The original record must accompany the shipment, and the FTL must retain a copy.

3.3 Analytical Methods Requirements

This subsection presents the analytical methods requirements for analyses that may be performed during the study including preparation/extraction procedures where appropriate and method performance requirements.

MSU-ATL and Agriquality will conduct laboratory analyses. The laboratory's QA protocols will be available in the project files and will contain summary information from the analytical methods including the following:

- Sample containers, preservatives, and holding times;
- Calibration requirements including frequency and acceptance criteria;
- Laboratory quality control samples including frequency, acceptance criteria, and corrective action; and
- MDLs.

More detailed information on the laboratory's analytical methods is presented in laboratory-specific SOPs that can be obtained directly from MSU-ATL and AgriQuality.

3.3.1 Analytical Methods

Analyses on this project will utilize EPA-approved methods, method 8290 will be used for the analysis of PCDDF congeners by HRGC/HRMS. As indicated in the SAP a portion of the samples will also be analyzed for PCB congeners using EPA method 1668A and for DDT compounds using EPA method 8270C. Method references for these analytical methods are provided in Table 3-2 including preparation/extraction methods where appropriate.

Table 3-2. Analytical Requirements for PCDD/F Methods.

Analyses	Preparatory Method[a]	Analytical Method	Reference
PCDD/F congeners	TR213	EPA method 8290A	http://www.epa.gov/epaoswer/hazwaste/test/main.html
PCB congeners	TR215	EPA method 1668A	http://www.epa.gov/Region3/1668a.pdf
DDT	TR205	EPA method 8270C	http://www.epa.gov/epaoswer/hazwaste/test/pdfs/8270c.pdf

[a] Due to ongoing revision process for SOPs specific SOP version numbers are not provided here.

3.3.2 Reporting Limits

Target MDLs for the analysis of PCDD/F congeners are identified in Table 3-3 and are presented in Table 2-1. These MDLs are target values based on data quality requirements for the risk assessment of complex PCDD/F mixtures. These MDL may be modified based upon laboratory performance, sample matrix effects and/or changes to the methods. Any such modifications will be discussed with all stakeholders and any effects on the quality of subsequent risk assessment procedures will be determined.

3.3.3 Laboratory Method Performance Requirements

Summary tables of method-specific quality control samples that the laboratory uses to monitor method performance are specified in Method 8290. Acceptance criteria may be modified based upon the laboratory's current performance and/or changes to the methods. For each analysis, these tables present the types of QC samples to be run including the frequency, acceptance criteria and purpose of QC analysis. The laboratory analyst will review results of the quality control samples against the acceptance criteria. Any identified discrepancies will trigger the laboratory's internal corrective action system as described below.

Table 3-3. QC Samples and Acceptance Criteria for PCDD/F Congener Analysis

QA/QC Test	Acceptance Criteria	Frequency	Reason for Test
Retention time for Calibration Mix	value ±0.5min of mean	Daily	GC Performance
GC Linearity	PRRF CV ±3%	Weekly	Data Integrity
CRM/IRL	value ±20% of expected	1 per analytical set (20 samples)	Method Validation Representativeness and Comparability
Surrogate Recovery	value ±30% spiked concentration	for each sample extracted	Method Efficiency Data correction
Matrix Spike	value ±30% spiked concentration	1 per analytical set (20 samples)	Method Accuracy Representativeness and Comparability
Field Blank	concentration <IDL for first blank	1 per analytical set	Background Check; Complete Sampling System
Laboratory Blank	Should be < MDL, if present then MDL = concentration	1 per analytical set	Quality assurance (monitor laboratory contamination)
Field / Matrix spike Duplicate	RPD < 30%	1 per analytical set	Sampling Precision
Blind Check Sample	value ±30% expected value	Minimum of 1 during course of program	Method Validation; Representativeness and Comparability
Completeness	90% of Field Samples meet QA/QC	Evaluated at end of program	Project Integrity

3.3.4 Laboratory Corrective Action

Both laboratories have formal corrective action systems in place to assure that prompt action is taken when an unplanned deviation from a procedure or plan occurs and that whenever possible, corrective actions include measures to prevent the reoccurrence of deviations. Specific corrective actions will be taken and documented when a QC sample does not meet acceptance criteria. Following is a description of how information from the laboratory's corrective action system is communicated to the project team.

Corrective action procedures include prompt notification of the project contact (QA Manager) for any significant problems or discrepancies. The Laboratory Project Manager is responsible for reporting any significant problems or discrepancies that occur as analyses are conducted to the Project Liaison or other identified project contact. The Laboratory Project Manager is also responsible for assuring that corrective action is taken where appropriate to prevent the reoccurrence of similar problems or discrepancies. In addition, each analytical data report will include a case narrative that discusses any problems or discrepancies, and sufficient calibration and QC information to verify that the method was in control at the time that the samples were analyzed. The case narrative will also include a discussion of any corrective action taken by the laboratory to prevent the reoccurrence of similar problems or discrepancies.

3.4 Quality Control Requirements

This section presents the field QC checks that will be performed during field investigations including a discussion of field QC samples with frequency and acceptance criteria and field corrective action procedures. A discussion of laboratory QC samples is presented in Section 3.4.3 and laboratory corrective action is presented in Section 3.4.4.

3.4.1 Field QC Samples

The type and frequency of field QC samples to be collected during field investigations are summarized in Table 2-1 and are described below:

3.4.1.1 Equipment Rinsate Blank Samples

Equipment rinsate blanks (ERB) are samples of hexane passed through and over the surface of decontaminated sampling equipment. The rinsate is collected in sample bottles, preserved, and handled in the same manner as the samples. ERBs are used to monitor effectiveness of the decontamination process. The planned frequency for ERBs is one per day per equipment type. If more than one type of equipment is used to collect samples for a particular matrix, then an ERB is collected and submitted for each representative group of equipment. Typically, ERBs are analyzed for the same analytes as the corresponding samples collected that day.

3.4.1.2 Field (Trip) Blanks

Field blanks are unopened sample containers which are transported to and returned from the field collection location. Typically, at least one field blank per lot number of collected samples will be analyzed.

3.4.1.3 Duplicate (Blind) Field Samples

“Blind” duplicate field samples are collected to monitor the precision of the field sampling process. The use of field replicates to assess precision is discussed in section 2.4.2.1. Where appropriate field duplicates will be collected and submitted to the laboratories for analysis. Due to the constraints imparted by the selection of the experimental unit (e.g. individual animals) for some matrices, field duplicates cannot be analyzed for some matrix types.

3.4.1.4 Independent Confirmation of Results

To permit validation of data determined by MSU and AgriQuality, sample splits will be provided to Dow Chemical. A section of the final report will provide a comparison of data derived at the three laboratories.

3.4.2 Field Corrective Action

Problems that require corrective action may be encountered in the field. Any finding requiring corrective action must be documented to the Project Manager. The Project QA Manager will check to ensure that corrective actions have been implemented and that the problem has been resolved. More easily addressed problems may also be encountered in the field. Such problems will be addressed and the corrective action noted in the appropriate field notebook. If an error is made on an accountable document assigned to one individual, that individual will make all corrections simply by crossing a line through the error, initialing and dating the correction, and entering the correct information. The erroneous information will not be obliterated.

3.5 Equipment Inspection, and Maintenance Requirements

Maintenance and inspection of both field and laboratory equipment are described in the following sections.

3.5.1 Field Instrument/Equipment

Preventative maintenance of field instrumentation and equipment will be performed according to manufacturer's instructions. The field staff is responsible for ensuring that all instrumentation is operating properly prior to use. If problems are encountered, they will be documented in a bound field notebook. The faulty instrumentation/equipment will be scheduled for repair and sequestered and tagged until repaired and qualified for re-use.

3.5.2 Laboratory Instrument/Equipment

Laboratory instrument/equipment testing, inspection, and maintenance will be conducted in accordance with the procedures specified in the analytical laboratory QA manuals. The QA manual discusses the schedule, procedures, criteria, and documentation in place at the laboratory to prevent instrument and equipment failure and to minimize downtime. For each instrument or piece of equipment the laboratory maintains the following:

- Instrument/equipment inventory list;
- Instrument/equipment major spare parts list or inventory;
- External vendor service agreements (if applicable); and
- Instrument-specific preventive maintenance logbook or file.

The laboratory documents all preventive maintenance and repair for each instrument or piece of equipment in dedicated logbooks or files.

3.6 Instrument Calibration and Frequency

Calibration and frequency of calibration of both field and laboratory equipment are described in the following sections.

3.6.1 Field Instruments

The field equipment that will need calibration are listed below:

- GPS receiver
- Balance

Proper maintenance, calibration, and operation of each instrument will be the responsibility of field personnel assigned to a particular field activity. All instruments and equipment used during the field investigations will be maintained, calibrated, and operated according to the manufacturer's guidelines and recommendations.

3.6.2 Laboratory Equipment and Instrumentation

All laboratory equipment and instruments used for quantitative measurements are calibrated in accordance with the laboratory's formal calibration program as described in the QA manual. A summary

of the laboratory instrument/equipment calibration program is presented. Detailed calibration procedures specific to each analysis are included in method-specific SOPs which can be obtained from the laboratory.

Whenever possible, the laboratory uses recognized procedures for calibration such as those published by USEPA or ASTM. If established procedures are not available, the laboratory develops a calibration procedure based on the type of equipment, stability, characteristics of the equipment, required accuracy, and the effect of operation error on the quantities measured. Equipment requiring only periodic calibration such as balances, thermometers, and micropipettors are listed along with their respective calibration requirements in the QA manual. Whenever possible, physical reference standards associated with periodic calibrations such as weights or certified thermometers with known relationships to nationally recognized standards are used. Where national reference standards are not available, the basis for the reference standard is documented.

Other instruments that require initial and/or continuing calibration as a part of instrument usage are listed along with their respective calibration requirements in the QA manual. Initial calibrations are verified and documented for each constituent by analysis of laboratory-prepared certified independent standard solutions. Chemical reference standards used in operational calibration are obtained from recognized standards suppliers and whenever possible are traceable to NIST, A2LA, or other recognized standards.

Equipment or instruments that fail calibration or become inoperable during use are tagged to indicate they are out of calibration. Such instruments or equipment are repaired and successfully recalibrated prior to re-use.

All high resolution mass spectrometer instruments undergo extensive tuning and calibration prior to running each sample set. The calibrations and ongoing instrument performance parameters are recorded and reported as part of the analytical data package.

3.7 Acceptance Requirements for Supplies and Consumables

Supplies and consumables that may be used during field investigations include sample bottles, hoses, materials for decontamination activities, potable water, deionized water, and ASTM Type II water. Project team members obtaining supplies and consumables are responsible for assuring that the materials obtained meet the required specifications, are intact and in good condition, are available in adequate supply, and are stored appropriately until use. Project team members will direct any questions or identification of any problems regarding supplies and consumables to the Field Team Leader for resolution.

3.8 Data Acquisition Requirements (Non-direct Measurements)

This section of the QAPP describes the various sources and purpose of non-directly measured data that will be required for this investigation. The evaluation of the current site conditions requires a review of historical investigation reports that were prepared specifically for the Site.

3.9 Data Management

The objective of Data Management is to establish procedures to be used during the field investigations for documenting, tracking, and presenting investigative data. Data generated during the field investigations, as well as historical data, will be used to form the basis for conclusions and recommendations. Efficient utilization and comprehensive consideration of available data requires that the data be properly organized for review. Organization of the data shall be planned prior to actual collection to assure the generation of identifiable and usable data. This section contains procedures necessary to assure the collection of

sufficient data for accurate validation of raw data and transfer of validated data to a data management system with which it can be evaluated with minimal effort. This section also describes the operating practices to be followed by personnel during the collecting and reporting of data.

3.9.1 Purpose and Background

Data collected during the field investigations will include analytical chemistry data from biota and environmental matrices, and data on physical conditions present at the site during sample collection. These data will be integrated into an analysis of the nature and extent of COPC in environmental media and biota.

To complete this analysis, various computer programs will be utilized. The programs that are anticipated to be used are Microsoft Excel, Microsoft Access, SYSTAT, SAS, and Geographic Information Systems (GIS).

3.9.2 Data Recording

Observations made and measurements taken in the field will be recorded on appropriate project data sheets or in field logbooks. Upon completion of the field investigation, the data will be entered into a Database Management System (DBMS) and tabulated for evaluation and presentation in the field investigation report. Copies of the original data records will be attached to the report as appendices. Tissue matrix sample data will be summarized in tabular form in reports and will include sample location and other pertinent data.

All data used for meeting project objectives will be stored in an electronic database. This database will facilitate the following processes:

- Tracking COC and sample identification data;
- Reviewing and evaluating analytical data against project-specific QAPP criteria;
- Production of data tables.

An electronic data deliverable (EDD) will be submitted with the hard copy data reports. It is expected that the laboratories will perform a comparison of electronic data with the hard copy report prior to submittal to ensure that the EDD and hard copy data are identical. EDDs will be checked against the hard copy with 100% QA/QC for all detect analytes. The EDD should be submitted on a CD-ROM, with the disk label including the Laboratory Delivery Group, submittal date, laboratory name, and site description. If the EDD is resubmitted, the EDD will be labeled as “Revised”.

3.9.3 Data Validation

Data validation is an integral part of the QA program and consists of reviewing and assessing the quality of data. Data validation provides assurance that the data are of acceptable quality as reported. For validity, the characteristics of importance are precision, accuracy, representativeness, comparability, and completeness. Data usability is the determination of whether or not a data set is sufficiently complete and of sufficient quality to support a decision or action, in terms of the specific DQOs. An outside firm or company specializing in data validation will independently validate analytical data generated during the project.

Analytical data will be generated by ENTRIX in EDD form, and will be submitted directly to the data validation firm for verification and validation. If necessary, exception reports will be produced. Qualified results will be loaded into the database and sent directly to ENTRIX.

The data validation process includes:

- Evaluating against laboratory and field blank criteria;
- Evaluating against accuracy criteria such as holding times, surrogates, laboratory control samples, and matrix spikes;
- Evaluating against precision criteria such as matrix spikes/matrix spike duplicates, and field and laboratory duplicates;
- Confirming that data qualifiers are assigned appropriately; and
- Uploading field sample analytical data only to the central database.

3.9.4 Data Transformation

If data transformation is performed for this study, then conversion procedures will be described in detail in the associated technical report.

3.9.5 Data Transmittal

Entering the data from field forms into the DBMS completes the integration of field data by data entry personnel. A staff scientist will review the data for completeness and accuracy by comparing the values to the original field data.

Analytical laboratory data are provided in both a hard copy and in EDD format. The electronic data are provided in a specified format that will be uploaded to intermediate files, reviewed for completeness and accuracy by the Project Liaison before uploading to the project DBMS.

3.9.6 Data Analysis

Data analysis (e.g. computation of summary statistics, standard errors, confidence intervals, etc.) will be conducted for this project.

3.9.7 Data Tracking

The Project Manager is ultimately responsible for all activities conducted during site activities, including data management. The Project Manager has the authority to enforce proper procedures as outlined in this plan and to implement corrective procedures to assure the accurate and timely flow and transfer of data. The Project Manager will review the final data reports.

Data will be generated from the field surveys and environmental sampling and analysis. The generators of data will be responsible for accurate and complete documentation of data required under the task, and for assuring that these data are presented to their supervisor in a timely manner.

The FTL will be responsible for the day-to-day monitoring of data collected in the field. He/she assures that data are collected in the format specified in this QAPP and route data to ENTRIX to be placed in the project files at the end of field collection activities. Original documents will be maintained in the ENTRIX central project file.

The FTL shall also be responsible for evaluating biological and field collected data. He/she reviews biological data for accuracy and completeness. The project manager for each component of the study will assure that representations of current site conditions are accurate and complete.

The Project Liaison will be responsible for the day-to-day monitoring of activities related to the generation and reporting of chemical data. He/she ensures that samples are analyzed according to the

specified procedures; that data are validated; and that the data are properly coded, checked for accuracy (QA), and entered into the data management system. He/she assures the data are then routed to ENTRIX to be placed in the project files.

3.9.8 Data Storage and Retrieval

A project file will be established for the storage of original data, historical data, written documents, and data collected or generated during the field investigation. The format for the file will follow the central filing system procedure list, which consists of the following categories:

- Correspondence;
- Budgets;
- Contracts;
- Field Data
    - general field data
    - field notes
    - raw data
- Figures and Maps;
- Permits;
- Paper and electronic copies of field collected data – both paper and PDA data
- Laboratory Data and QA/QC Documents;
- Chains of Custody;
- Photographs;
- Reports;
- Schedules;
- Background.

All materials will be dated, carry the initials of the person responsible for the preparation of the document, and bear the project number. The file copies will include peer review sign-off on the calculation sheets and editing review sheets where applicable.

Access to the project files will be limited to those personnel assigned to this project. The Project Manager maintains overall responsibility for the project files and assures that appropriate documents are filed. All documents relating to the project shall be controlled to assure proper distribution, filing, and retrieval. The document control shall also assure that revisions are properly recorded, distributed, and filed. ENTRIX staff maintain the project files.

ENTRIX staff will handle all documents submitted to the project file and will assure that the documents are appropriately filed by category and placed in the correct project file. Once filed, documents are available to ENTRIX staff and may be removed from file for use by signing out the material.

concentrations. The laboratories also have ongoing internal audit programs implemented to monitor the degree of adherence to their policies, procedures, and standards. The internal audit program is described in the QA manual and includes systems audits, performance evaluations, data audits, and spot assessments. Laboratory personnel who are independent of the area(s) being evaluated will conduct internal audits. The laboratory also participates in external audits conducted by regulatory agencies and other clients. Project-specific assessments of laboratory operations are described below.

The Project Liaison will be in contact with the Project Manager on a weekly basis while samples collected during this investigation are being analyzed. This will allow assessment of progress in meeting DQO and the identification of any problems requiring corrective actions early in the investigative process. The Project Liaison will promptly report problems identified, corrective actions taken, and recommendations as appropriate for additional corrective action to the Project Manager. The Project Manager will review the problem and provide for the swift implementation of any outstanding corrective actions. In addition, contact between the Project QA Manager and the Independent Data Auditor (see Sections 5.1 and 5.3) could result in the need for a laboratory audit. The Project QA Manager will report the audit findings and any recommendations for corrective action to the Project Manager, the Project Liaison, and the laboratory. The Project Liaison will be responsible for working directly with the laboratory to assure the prompt resolution of any problems identified.

4.2 Reports to Management

This subsection discusses reports internal to the project team. External reports are discussed in Section 2.7.2.

Reports to management include project status reports, the results of surveillance evaluations, field and/or laboratory audits, and data quality assessments. These reports will be directed to the Project Manager who has ultimate responsibility for assuring that any corrective action response is completed, verified, and documented.

Final reports produced during this investigation will include a quality assurance section with the following information:

- Identification of problems that required corrective action and resolution of the problems;
- Data quality assessment in terms of precision and accuracy and how they affect the usability of the analytical results;
- Limitations of any qualified results and a discussion of any rejected results; and
- Discussion of the field and laboratory QA/QC sample results.

All written communications between project team members including reports to project management will be maintained in the project files.

4.0 ASSESSMENT AND OVERSIGHT

This section presents the internal and external checks (assessments) that have been built into this project to assure that:

- Elements of this QAPP have been correctly implemented as prescribed for all investigations conducted;
- The quality of the data generated is adequate and satisfies the DQOs that have been identified in this QAPP; and
- Corrective actions, when needed, are implemented in a timely manner and their effectiveness is confirmed.

Assessment activities may include surveillance, inspection, peer review, management systems review, readiness review, technical systems audit, performance evaluation, and data quality assessment.

4.1 Assessment Activities

The following subsections identify the planned assessment and oversight activities to assure the objectives identified above are attained for field and laboratory operations. The QA Manager and/or the Project Manager may also identify additional assessment activities to be performed during the course of the project based upon findings of the planned assessment activities described below.

4.1.1 Assessment of Field Operations

The QA Manager and/or other designated members of the project team will conduct internal assessments of field operations, where appropriate. The assessment activities will evaluate field operations performance issues such as:

- Are sampling operations being conducted in accordance with the QAPP?;
- Are the sample labels being filled out completely and accurately?;
- Are the COC records complete and accurate?;
- Are the field notebooks being filled out completely and accurately?; and
- Are the sampling activities being conducted in accordance with SOPs?

Planned assessment activities to evaluate these and other field operations performance issues include surveillance (frequent review) of sample collection documentation, sample handling records (COC forms), field notebooks, and field measurements, and the performance of unannounced field operations audits.

The team member conducting the assessment activity will report the results of any assessment activities to the Project Manager. Assessment activity reports will include the findings and identification of any corrective actions taken or planned.

4.1.2 Assessment of Laboratory Operations

MSU-ATL and AgriQuality have performed congener-specific PCDD/F and PCB analysis for various clients and agencies in a variety of environmental matrices. The data generated for those projects have been approved. CRMs are analyzed routinely and the measured values are within ±20% of the actual

5.0 DATA VALIDATION AND USABILITY

This section of the QAPP provides a description of the QA activities that will occur after the data collection phase of the project is completed. Implementation of this section will determine whether or not the data conform to the specified criteria, thus satisfying the project objectives.

5.1 Data Review, Validation, and Verification

Data validation is the process of reviewing data and accepting, qualifying, or rejecting data on the basis of sound criteria using established EPA guidelines. The laboratory will report laboratory data generated during field investigations as Level IV data packages. All of these data will be subjected to full data validation conducted by an independent data validator as discussed below in Section 5.1.1.

5.1.1 Independent Data Validation Protocols

While the actual procedures used will be determined by the validator the validation approach will consist of a systematic review of the analytical results, associated QC methods and results, and all of the supporting data. Specific data package review procedures can be found in SOP #802 "Data Package Review" included in this Work Plan. Best professional judgment in any area not specifically addressed by EPA guidelines will be utilized as necessary and described in the Usability Assessment portion of the data validation report.

Data will be validated according to applicable guidelines set forth in the following sources and guidelines to ensure compliance with the Federal Information Quality Act:

- "Data Package Review" SOP #802 Aquatic Toxicology Laboratory, National Food Safety and Toxicology Center, Michigan State University, E. Lansing, MI 48824-1222 USA
- "Guidance for Data Usability in Risk Assessment (Part A)," U.S. EPA Publication 9285.7-09A, U.S. EPA, April, 1992.
- "Guidelines for ensuring and maximizing the quality, objectivity, utility, and integrity of information disseminated by the Environmental Protection Agency" U.S. EPA Publication EPA/260R-02-008, October, 2002.
- "Guidelines for ensuring and maximizing the quality, objectivity, utility, and integrity of information disseminated by Federal Agencies." Federal Register, 67, No. 36, pp8451-8460, February 22, 2002.

Data validations will include a data completeness check of each data package, a transcription check for sample results, and a thorough review of all laboratory reporting forms and the associated raw data for QA/QC issues. Specifically, this review will include:

- Review of data package completeness;
- Review of the required reporting summary forms and all associated raw data to determine if the QC requirements were met and to determine the effect of exceeded QC requirements on the precision, accuracy, and sensitivity of the data;
- Review of the overall data package to determine if contractual requirements were met (based upon National Functional Guidelines);

- Review of raw data and all calculations associated between one and a minimum of 10% of all samples to determine if the sample results and quantitation limits were correctly calculated and reported;
- Review of additional QA/QC parameters, such as field blank contamination, to determine technical usability of the data; and
- Application of standard data quality qualifiers to the data.

In addition, each data validation will include a comprehensive review of the following QA/QC parameters as indicated in the National Functional Guidelines:

- Holding times (to assess potential for degradation that will affect accuracy)
- GC/MS instrument check (to assess accuracy and sensitivity of method)
- Initial calibration (to assess method sensitivity)
- Continuing calibration (to assess method sensitivity)
- Blanks (to assess contamination for all compounds)
- System monitoring compounds (to assess method accuracy)
- MS/MSD or laboratory fortified blanks (to assess accuracy of the methods and precision of the method relative to the specific sample matrix)
- Internal standards (to assess method accuracy and sensitivity)
- Target compound identification
- Compound RL and MDL (to assess sensitivity as compared to project-specific requirements)
- System performance (to assess accuracy and precision)

5.1.2 ENTRIX Internal Data Quality Control Procedures

ENTRIX has established an internal QA Program to assure that all project analytical data are tracked within a COC database system and are of reliable and comparable data quality. The Project QA Manager will be responsible for assuring that ENTRIX internal QC procedures are followed for all project analytical data.

The COC database system allows ENTRIX to track samples and their analytical results to ensure that the project data quality objective for completeness is met. Samples and analytical data are tracked in a COC database system by their COC number. The COC number along with the date the laboratory received the samples for analyses are entered into the COC database system from the information on the field copy of the COC. When the final laboratory reports are completed, the laboratory report number along with the date and initials of the ENTRIX personnel who have reviewed the report is entered into the COC database system according to the COC number.

A limited internal data validation is performed on all project analytical data when the final report is reviewed by ENTRIX. The limited data validation will include a data completeness review of each data package, and a limited review of QA/QC parameters as indicated in the National Functional Guidelines to assure that all project analytical data are of reliable and comparable data quality. Specifically, the following QA/QC parameters will be reviewed:

- Holding times (to assess potential for degradation that will affect accuracy);
- Blanks (to assess contamination for all compounds);
- MS/MSD or Laboratory Control Spike/Spike Duplicates (to assess accuracy of the methods and precision of the method relative to the specific sample matrix);
- Internal Standards (to assess method accuracy and sensitivity);
- Compound RL and MDL (to assess sensitivity as compared to project-specific requirements); and
- Field Duplicate RPDs (to assess precision of the method relative to field sampling techniques, the specific sample matrix, and representativeness of the sample aliquot to the area sampled).

The results of this limited data validation and any corrective actions implemented are recorded on a QA/QC worksheet. The data reviewer will initial and date the QA/QC worksheet. The Project Manager will provide secondary review of the QA/QC worksheet and will also initial and date the QA/QC worksheet. The initialed and dated QA/QC worksheet will be attached to the final analytical laboratory report that is retained in the project files.

5.2 Validation and Verification Methods

The data validation process is conducted to assess the effect of the overall sampling and analysis process on the usability of the data. There are two areas of review: laboratory performance evaluation and the effect of matrix interferences. Evaluation of laboratory performance is a check for compliance with the method requirements and is a straightforward examination. The laboratory either did or did not analyze the samples within the QC limits of the analytical method and according to protocol requirements. The assessment of potential matrix effects consists of a QC evaluation of the analytical results and also the results of testing blank, duplicate, and matrix spike samples, and then assessing how, if at all, the matrix effect will impact the usability of the data.

All analytical data will be supported by a data package. The data package contains the supporting QC data for the associated field samples. The data validation report deliverables will include the following information:

- A comprehensive narrative detailing all QC exceedances, explaining qualifications of data results. In cases where data are qualified due to quantifiable QC exceedances, the bias (high or low) will be identified;
- Data summary tables in Microsoft Access format reporting all data results with the qualifiers that were added during the data validation review. These tables will include sample ID, laboratory ID, date sampled, sample type (e.g., field duplicate, field blank), units, concentration of analytes, and validation qualifiers. These tables may be modified to report other information as needed (such as depth of soil samples, date analyzed, dilution factor);
- Re-submittal requests sent to the laboratory indicating missing information, verification of analytical information, etc.; and
- EDDs will be compatible with the project database. These electronic deliverables will contain the validated results and qualifications as presented in the data summary tables of the validation reports. Additionally, the validation reports can be submitted in electronic format for inclusion in interim RI data deliverables.

Before the laboratory releases each data package, the laboratory must carefully review the sample and laboratory performance QC data to verify sample identity and also the completeness and accuracy of the sample and QC data. This is performed through three levels of laboratory data review starting with 100% verification performed by the laboratory analyst, followed by a second-level review performed by a peer, supervisor, or designee. The laboratory Project Manager performs the third and final laboratory review to assure that project requirements are met for the analyses performed.

Data validation is at times based on best professional judgment. In order to achieve consistent data validation, data worksheets will be completed for each data validation effort. A data review worksheet is a summary form on which the data validator records data validation notes and conclusions specific to each analytical method. The worksheets will help the validator to track and summarize the overall quality of the data. Sample results will then be qualified as appropriate, following EPA protocols. Samples that do not meet the acceptance limit criteria will be indicated with a qualifying flag, which is a one or two-letter abbreviation that indicates a problem with the data (Table 5-1).

The data verification process begins once the data packages for each project have been validated. During verification, the entire data set will be verified for overall trends in data quality and usability. Information summarized as part of the data quality verification will include frequencies of detection, dilution factors that might affect data usability, and patterns of target compound distribution. The data set also will be evaluated to identify potential data limitations or uncertainties in the laboratory. The trend analysis results will be included in the validation summary report, which will be submitted to the Project Manager at the end of the field effort. The validation report and notes will be archived with the analytical data.

5.3 Reconciliation with User Requirements

The Independent Data Auditor will provide an assessment of the usability of the validated data compared to the data validation criteria and DQOs. The usability assessment will be performed based on Guidance for Data Usability in Risk Assessment (EPA 1992) and best professional judgment. The Independent Data Auditor will delineate major and minor deficiencies in the data, their effects on the reported results, and determination of usability for each compound reported in each sample included in the data package. The usability assessment will provide an overall summary of data quality. It defines acceptability or problems with accuracy, precision, sensitivity, and representativeness of the results with clear guidance to the data users of the uncertainties in the data that have been qualified as estimated (J) and a quantification of these uncertainties (e.g., bias high by a maximum of 80%), wherever possible. The Independent Data Auditor may determine specific results to be unusable because of cumulative effects of QC exceedances. Alternatively, based upon the EPA guidelines and best professional judgment, the Independent Data Auditor may determine specific results to be usable for DQOs when they are not significantly outside the QC criteria.

The final activity of the data validation process is to assess whether the data meets the DQOs. The final results, as adjusted for the findings of any data validation/data evaluation, will be checked against the DQOs and an assessment will be made as to whether the data are of sufficient quality to support the DQOs. The decision as to data sufficiency may be affected by the overall precision, accuracy, and completeness of the data as demonstrated by the data validation process. If the data are sufficient to achieve project objectives, the project manager will release the data and work can proceed. If the data are insufficient, corrective action will be required.

Table 5-1. Data Validation Qualifiers.

Qualifier	Explanation of Qualifier
Organic Analyses	
U	The compound was analyzed for, but was not detected above the reported method detection limit.
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.
UJ	The analyte was not detected above the reported method detection limit. However, the reported limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
Inorganic Analyses	
U	The compound was analyzed for, but was not detected above the reported method detection limit.
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.
UJ	The analyte was not detected above the reported method detection limit. However, the reported limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
B	The analyte was positively identified; the reported concentration is greater than the instrument detection limit, but less than the QAPP specified Reporting Limit.

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6.1 Associated Standard Operating Procedures

SOP #	Title
TR203	Homogenization of Tissue Samples
TR210	Extraction and Analysis of PCBs and Non-ortho Coplanar PCBs in Biological and Environmental Matrices
TR211	Mono-and Non-*ortho PCB* Analysis by GC-MSD using Chrompack CP SIL 5/C18
TR212	Glassware Cleaning: General and Trace Organic Analysis
TR213	Extraction and Analysis of 2,3,7,8 Substituted Polychlorinated dibenzo-p-dioxin (PCDD) and dibenzofurans (PCDF) in Sediment & Biota Samples Using the High Resolution Gas Chromatography High Resolution Mass Spectrometry
TR214	Documentation, Preservation, handling, and Tracking of Samples for Analysis
TR401	Sample Management: Receiving, Preservation, Storage, Documentation, Decontamination, and Disposal
TR402	Maintenance of Sample Integrity, and Proper Usage of Refrigerators, Freezers, and Liquid Nitrogen Dewars
TR802	Data Package Review

SITE-SPECIFIC HEALTH AND SAFETY PLAN FOR FIELD SAMPLING ACTIVITIES IN SUPPORT OF THE ECOLOGICAL RISK ASSESSMENT WORK PLAN FOR THE TITTABAWASSEE RIVER AND FLOODPLAIN

Prepared by:
ENTRIX, Inc.
E. Lansing, Michigan

Prepared for:
The Dow Chemical Company
Midland, Michigan

July 2005

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Definitions and Acronyms

AhR	Aryl Hydrocarbon Receptor
ATL	Aquatic Toxicology Laboratory
BBP	Bloodborne pathogen
COC	Contaminants of concern
COPECs	Chemicals of potential ecological concern
CPR	Cardiopulmonary Recesitation
DQOs	Data Quality Objectives
ECT	Equivalent Chill Temperature
ERA	Ecological Risk Assessment
FSP	Field Sampling Plan
FTL	Field Team Leader
HAZWOPER	Hazardous Waste Operation and Emergency Response
HSO	Health and Safety Officer
MDCH	Michigan Department of Community Health
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
MSDS	Material Safety Data Sheet
MSU	Michigan State University
NFSTC	National Food Safety and Toxicology Center
OSHA	Occupational Safety and Health Administration
PCBs	Polychlorinated Biphenyls
PCDDs	Polychlorinated Dibenzo-*p*-Dioxins
PCDFs	Polychlorinated Dibenzofurans
PPE	Personal Protective Equipment
QAPP	Quality Assurance Project Plan
QA	Quality Assurance
QC	Quality Control
RI	Remedial Investigation
S-HASP	Site Specific Health and Safety Plan
SOP	Standard Operating Procedure

TEFs	Toxic Equivalency Factors
TEQs	TCDD equivalents
TCDD	2,3,7,8-Tetrachlorodibenzo-*p*-dioxin
TRB	Tittabawassee River Basin
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Services
WGS	Wild Game Sampling
WHO	World Health Organization

1.0 INTRODUCTION

This Site-Specific Health and Safety Plan (S-HASP) delineates the basic safety requirements for field sampling activities to be performed on the Tittabawassee River site (referred to hereafter as the Site) in support of the Ecological Risk Assessment (ERA) Work Plan for the Tittabawassee River and Floodplain. The Tittabawassee River site as defined in the Hazardous Waste Management Facility Operating License (issued on June 12, 2003 by Michigan Department of Environmental Quality to The Dow Chemical Company) includes approximately 23 miles of the Tittabawassee River from the upstream boundary of The Dow Chemical Company to the confluence of the Tittabawassee and Shiawassee Rivers downstream of Greenpoint Island. Planned activities include soil, sediment, and biota sampling. Fieldwork for Ecological Risk Assessment Work Plan for the Tittabawassee River and Floodplain is expected to occur through 2007.

This S-HASP is prepared in compliance with the requirements of the Federal OSHA Hazardous Waste Operation and Emergency Response Standard (HAZWOPER; 29 CFR 1910.120).

The provisions set forth in this S-HASP apply to the personnel of Michigan State University (MSU) and ENTRIX, Inc. and related subcontractors engaged in field activities in support of the Ecological Risk Assessment Work Plan for the Tittabawassee River and Floodplain. Subcontractors may elect to modify these provisions, but only to upgrade or increase safety activities. It is noted that this S-HASP may not thoroughly address all hazards associated with any specialized subcontractor operations. In this situation, subcontractors shall be responsible for developing their own health and safety procedures to adequately address their scope of operations at this site.

This S-HASP addresses the expected potential hazards that may be encountered for this project. If unanticipated changes in site or working conditions occur which are not addressed by this plan, addenda will be provided by ENTRIX, Inc.

1.1 Site Location and Background

The Tittabawassee River is located in central Michigan, and begins at the confluence of the Tobacco and Molasses Rivers. As part of the Saginaw River watershed, the Tittabawassee flows from the north through Midland in a southeastern direction to the confluence with the Saginaw River and eventually to Saginaw Bay. The distance between Midland and the confluence with the Saginaw River is approximately 23 river miles.

1.2 Scope of Work

The overall objective of the proposed study is to collect site-specific data necessary to evaluate ecological risk for key exposure pathways and receptors of concern.

- Mink
- Raptors (bald eagles and great horned owls)
- Piscivorous birds (kingfishers and great blue herons)
- Passerine birds (tree swallows, house wrens, American robins)

To do this, information will be collected to determine

- the presence or absence of key receptor species in the Tittabawassee floodplain;
- the current exposure of key receptor organisms to PCDDs and PCDFs;
- the status of the habitat suitability for the key receptor species; and
- the status of key receptor populations.

The following is a general summary of the site-specific information to be collected.

- Identify, describe, and quantify site-specific occurrence of key receptors, their population densities and suitability of habitats for key species of concern or appropriate surrogates.
- Determine site use and exposure pathways for key receptors.
- Determine the dietary exposure for key receptors.
- Conduct polychlorinated dibenzo-*p*-dioxin (PCDD) and polychlorinated dibenzofuran (PCDF) analysis on soils, sediments, and biota tissue

Additional information regarding the ERA can be found in Section 3.0 of the Ecological Risk Assessment Work Plan for the Tittabawassee River and Floodplain

2.0 PROJECT SAFETY AUTHORITY

MSU and ENTRIX, Inc. personnel responsible for project safety are the Project Manager and the Site Health and Safety Officer (HSO) or his/her designee. In addition, Field Team Leaders will be responsible for project safety for their specific tasks. The Project Manager is responsible for the provisions and submittal of this plan, and for advising the HSO on health and safety matters. The Project Manager has the authority to provide for the auditing of compliance with the provisions of this plan, suspension or modification of work practices, and administration of disciplinary actions for individuals whose conduct does not meet the requirements set forth herein. The Project Manager may elect to give the HSO authority to administer disciplinary actions for individuals whose conduct does not meet the requirements set forth herein.

The HSO is responsible for the dissemination of the information contained in this plan to all personnel assigned to the project, and to the responsible representative of each subcontractor firm working under MSU or ENTRIX, Inc. on the project. The Field Team Leaders (FTL) will be responsible for task-specific health & safety. As such, he or she is responsible for performing or providing the following as necessary:

- Adequate on-site safety supplies & equipment inventory (see list of protective equipment, Sec. 7.0).
- Verification of 40-hour HAZWOPER and applicable HAZWOPER updates, supervisor training, and/or medical monitoring for all potentially exposed on-site personnel.
- Tailgate discussion of site safety plan. Documentation of tailgate safety meetings in field notebook.
- Documentation of all accidents or safety plan violations per the incident reporting and investigation procedures provided in Appendix G of this S-HASP.
- Emergency contacts as needed.

The HSO or FTL has the authority to suspend work any time he or she determines that the health and safety practices at the site are inadequate and shall also inform the Project Manager of individuals whose conduct is not consistent with the requirements of the plan. The HSO or FTL has the responsibility to check in with any identified safety contact each day before commencing field operations. The HSO or FTL will disseminate any new information provided to the field team during tailgate safety meetings.

3.0 SAFETY/ORIENTATION TRAINING

This section presents the general and site-specific training requirements for this project in accordance with regulatory, client, and/or MSU or ENTRIX, Inc. requirements. Personnel will provide proof of required training to the HSO for inspection prior to performance of any subject field activities. The HSO will be responsible for reviewing the proof of required training in accordance with the requirements described below and documenting this review in the field notes before job start up.

3.1 General Training Requirements

General training requirements that apply to personnel on this project are described below.

3.1.1 HAZWOPER

All MSU and ENTRIX personnel engaged in project operations that expose them to hazardous wastes, hazardous substances, or any combination of hazardous wastes or hazardous substances shall have satisfied the following training requirements for Hazardous Waste Operations and Emergency Response (HAZWOPER; 29 CFR 1910.120):

- Initial 40 hour HAZWOPER training, and
- Annual 8 hour HAZWOPER refresher training current within one year.

In addition, the Site Safety Officer and any other personnel supervising hazardous waste workers must have completed the following training:

- One time only 8 hour HAZWOPER Supervisor training.

3.1.2 First Aid

At least one team member on every field team shall have current first aid training including adult CPR training. Current training for the purposes of this S-HASP is as follows: 1) First Aid training current within 3 years and 2) Adult CPR current within 1 year.

3.1.3 Medical Monitoring

It is not anticipated that medical monitoring will be necessary for activities performed on this project.

3.2 Site-specific Training

Field personnel including volunteers and subcontractors will review this S-HASP before beginning work as part of the site-specific safety training for this project. The HSO or FTL will conduct a tailgate safety meeting to review the S-HASP before the start of field operations that may substantiate prior review of the S-HASP or serve as the primary review. Field personnel will certify their review by signing a S-HASP training record form (Appendix B) or signing the field notebook after the tailgate safety meeting. The Project Manager or HSO is responsible for distributing this S-HASP to appropriate personnel and verifying review by obtaining signed review forms or copies of field notes. Signed review forms or copies of field notes with signatures will be placed in project files.

Whenever a change of conditions on-site occurs that may affect safety, the HSO or FTL will conduct a tailgate safety meeting if appropriate. Changing site conditions that may affect safety include the following:

- Change of field personnel (volunteer or subcontractor);
- Change in work activity;
- Change in weather conditions; and
- Visitors on site.

All training sessions, safety meetings, and safety briefings will be documented by the HSO or FTL in the field notebook or on Tailgate Safety Meeting Record forms (Appendix C). Documentation will include a brief description of topics addressed and the signatures of all training attendees.

4.0 HAZARD ASSESSMENT

This section presents the identification of general, task or activity-specific and site-specific hazards and control measures associated with planned field activities for this project. The general hazards and protective measures expected during the Site field activities and methods used to promote worker safety are presented in Table 5-1. Physical, chemical, and biological hazards and control measures are addressed separately and more completely in the following sections.

4.1 Physical Hazards

General physical hazards that may be present during field sampling activities include the following:

- Falls from elevations such as trees perches;
- Falling objects such as tools and equipment;
- Tripping over tools, equipment or uneven terrain;
- Slipping on wet or oily surfaces;
- Manual lifting;
- Working over or near water;
- Insufficient or faulty protective equipment;
- Insufficient or faulty operations, equipment, or tools; and
- Storm events accompanied by high winds and/or lightning.

4.1.1 Site-Specific Hazards

The sampling sites on this project may require climbing over relatively steep, uneven, or heavily vegetated terrain. In addition, the presence of mud along the banks presents additional slip hazards. Other site-specific hazards include:

- Trip, slip, and fall hazards from walking and/or kneeling on potentially uneven, steep, and/or slippery terrain.
- Falls from trees during climbing and nest studies.
- Cold stress from low environmental air temperatures or from accidental immersion in low temperature water;
- Sunburn, windburn;
- Damage to eyes from sun exposure (UV radiation); and
- Manual lifting of sediment core samplers to collect sediments and benthic biota.

Safety precautions for general and site-specific hazards are addressed in Section 7.0.

4.2 Chemical Hazards

During the conduct of ecolgical sampling and processing, various chemicals may be used for decontamination purposes. Two solvents that will be used in the decontamination process are acetone and hexane. Material Safety Data Sheets (MSDS) for acetone and hexane are provided in Appendix D. While concentrations of PCDDs and PCDFs in environmental and biota samples are the subject of this investigation, these chemicals do not pose an immediate hazard to field personnel since they are tightly bound to lipids, soils and sediments.

4.3 Biological Hazards

Multiple biological hazards may be present in the Site and are identified and discussed below. Protective measures for each biological hazard identified are also included in the following discussion. Field personnel shall carefully review this section.

4.3.1 Snakes

Snakes are common in the Site. Personnel should be extremely careful when walking through tall grass, rocks, or debris. If a snake is encountered, slowly and quietly back away from the snake. Inform all personnel at the site of its location. Do not attempt to move or kill a snake because certain species are protected under state and federal laws. In the event of snakebite, do not try to move the affected limb; wait for transportation. The venom should be wiped off the skin because it will attack intact skin.

4.3.2 Insects

Bees, wasps, yellow jackets, black widow, and brown recluse spiders present a potential hazard at the site, especially for those individuals sensitive to those bites or stings. Before initial assignment on the project, personnel with known allergic responses to insect stings shall make their field supervisor aware of this condition. In all cases, a person suspected of being bitten by a black widow or brown recluse spider shall receive medical attention. The venom from the brown recluse spider is capable of causing coma and kidney failure in its victim. Protection against insects, such as protective clothing, repellents, extermination, and training in recognition and identification of harmful insects, may be employed.

4.3.3 Ticks

Ticks transmit many diverse etiologic agents. Diseases transmitted by the tick include Lyme disease, Rocky Mountain Spotted Fever, and other viral and rickettsial diseases. Ticks are normally found in wooded and bushy areas. When walking through tall brush areas, periodically check yourself and your coworkers for ticks. Ticks burrow into the skin. It is essential to remove the entire tick as soon as it is found.

4.3.4 Poisonous Plants

Poisonous plants may be present at the site, including poison ivy, poison oak, and poison sumac. The plants contain a resin that causes a delayed allergic hypersensitivity reaction on contact. The resin is active in live, dead, dry, and burned plant parts, and it may be carried through the air. Signs and symptoms are usually evident within 24 to 48 hours after exposure, including burning, stinging, and blisters. Notify the health and safety officer (or designee) if these plants are observed. If exposure or contact occurs, wash the affected area first with rubbing alcochol followed by soap and water, but do not spread the resin to uncontacted areas.

4.3.5 Vermin

Rats, mice, squirrels, and rabbits are carriers of disease. The most serious are rabies, plague, and Hantavirus. Fully 50 percent of Hantavirus victims die from the disease. Vermin bites should be reported immediately to the health and safety officer (or designee) and proper medical care shall be obtained.

4.3.6 Aquatic Life

Work in shallow waters may exposure personnel to a variety of aquatic hazards. Project personnel shall not wade barefoot while performing project work. Appropriate footgear includes rubber boots or waders. Free swimming is prohibited.

4.4 Task-Specific Hazards

The following tasks have task-specific hazards and control measures as described below.

4.4.1 Nest Box Studies

Birds and their waste products may transmit disease. Passerine and piscivorous nestlings will be handled as well as the eggs and eggshells of these birds during nest studies. Gloves will be worn to prevent direct contact with birds or their waste products.

4.4.2 Tree Climbing

Falls from trees while conducting nest studies are a physical hazard during some collection activities. All personnel participating in nest studies and data collection that involve tree climbing will have appropriate training before these activities commence. In addition, all climbers will be outfitted with helmets, a safety harness and safety ropes. Climbing will always be undertaken in at least two-person teams.

4.4.3 Boat Operation

A site-specific boat operation plan has been prepared for sampling activities on this project. Activity hazard analyses have also been performed for boating activities as follows:

- Boat operation and water safety (Appendix E).

4.4.4 Work Over or Near Water

When working over or near water, there is a potential for employees to fall in and the danger of drowning exists. Work within 15 feet of unobstructed access to water shall be performed in accordance with the requirements given below. The following requirements shall be met by all personnel:

- Personnel will use the buddy system at all times.
- Swimming shall be prohibited for personnel, unless necessary to prevent injury or loss of life.
- Each boat shall be supplied and equipped with the following:
  - Oars and properly attached oarlocks (except on inboard powered boats)
  - Anchor

- One life preserver per person

Persons shall refer to Appendix E for safety requirements when chartering or operating small craft.

In addition to drowning, immersion in cold water, particularly in combination with cool ambient temperatures can present a risk of hypothermia if provisions are not made for personnel to promptly change into dry clothes. Accordingly, all personnel working on or around water will have a change of clothes available and nearby at all times.

4.4.5 Handling Owl Pellets

Small mammals such as rats, mice, squirrels, and rabbits eaten by owls and subsequently regurgitated as pellets are carriers of disease. The most serious are rabies, plague, Hantavirus, and Salmonella. Fully 50 percent of Hantavirus victims die from the disease. Care must be taken to avoid direct contact with regurgitated pellets during collection. Biohazard protective gloves should be worn at all times while collecting pellets.

4.4.6 Handling Mink Scat

Mink scat may be a carrier of disease. The most serious health concerns are Salmonella, *E. coli*, viruses, and internal parasites. Care must be taken to avoid direct contact with scat during collection. Biohazard protective gloves, such as nitrile gloves, should be worn at all times while collecting scat.

4.5 Subcontractor-Furnished Equipment

Each subcontractor is responsible for the proper and safe operation of all equipment he brings to the site.

Table 4-1. Hazards and protective measures.

Potential Hazards	Methods to Ensure Worker Safety
Injuries caused by tripping or falling	Job site reconnaissance will be conducted to identify hazards.
Falling from trees while climbing or conducting nest studies	A two-person team equipped with climbing harness, helmet and appropriate safety ropes are necessary for climbing trees. All climbers will have completed training prior to any climbing activities.
Lifting, manual labor	The site HSO or designee will identify ergonomic factors and will develop measures to prevent injury. Proper lifting techniques and warm-up will be used before strenuous tasks. Special hand protection will be required where indicated.
Work near or over water	Establishment of communications, and implementation of water safety requirements/measures will be used to ensure worker safety. Change of dry clothes for all personnel.
Poison plants	Site screening, protective clothing, removal of plants, or skin creams will be used.
Snakes	Site screening, protective clothing, training, and on-site first-aid kits will be used for remote work locations.
Solar radiation	Protective clothing or sunblock will be worn.
Weather	If lightning or thunder is seen or heard, then all personnel will cease sampling and retreat to a safe location until the threat of lightning passes.
Stinging insects such as wasps and bees	The HSO will identify areas where workers could contact stinging insects and will determine actions needed to rectify the problem. Workers will not be allowed to work near insects where an unreasonable risk is present.
Other Insects	Inspection for ticks and other biting insects should be performed when leaving the site, particularly wooded areas.
Wild animals	Site screening will be used. Hantavirus precautions may be required.

Note:

HSO	Site Health and Safety Officer
PPE	Personal Protective Equipment
MSDS	Material Safety Data Sheet

5.0 AIR MONITORING AND CONTROL MEASURES

Airborne exposure is generally not a concern with dioxin in soils. PCDDs and PCDFs are generally not volatile at ambient temperatures. In addition, PCDDs and PCDFs absorb to soils tightly so the volatization rate of PCDDs and PCDFs affixed to soils is quite low. Given the low volatility of PCDDs and PCDFs, in all probability, airborne concentrations of dioxins would not be detectable at any level. Therefore, air monitoring is not required for any activities on this project.

6.0 GENERAL PROJECT SAFETY REQUIREMENTS

6.1 General Safety Precautions

The project operations shall be conducted with the following minimum safety requirements employed:

- No person shall ever be at a field site alone
- Responsible parties will be notified when any person goes into the field. Notification will include dates and locations.
- A cellular phone or communication radio will be carried on all field outings. Always test to see if this equipment is operational before departing for site and immediately upon arrival to site.
- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of material shall be prohibited during sample collection.
- Eating and drinking will be restricted to areas outside the operations area.
- Closed toe and heel shoes or boots with good traction appropriate for walking on uneven surfaces will be worn.
- Hats, long-sleeve shirts, long pants and sunscreen will be worn as appropriate to prevent sunburn/windburn.
- Layers of clothing are recommended to prevent hypothermia or heat stress.
- All personnel shall be required to wash or wipe hands and face before eating or drinking.
- Legible and understandable precautionary labels shall be prominently affixed to containers of scrap, waste, debris, and contaminated clothing.
- All wastes generated from project activities (soiled PPE, etc.) shall be contained and disposed of in accordance with procedures for investigation-derived waste (see Section 8.0).
- The HSO and all field employees will be responsible to identify and alert other field team members to physical hazards present at the site.
- All employees will be provided access and be responsible to read the appropriate safety manuals.

Additional safety precautions for specific operations are described in Section 8.0.

6.2 Forbidden Practices

The following practices shall be strictly forbidden during any work on site:

- Horseplay
- Fighting

- Use of facial cosmetics other than prescription medication, sunscreen, or as prescribed on the advice of a physician.
- Climbing on or over obstacles
- Starting or maintaining an open flame of any type unless authorized by the HSO
- Entering the work site with safety equipment that has not been determined to be in working condition immediately before entry
- Entering the work site, under any circumstances, by an employee or visitor without prior approval

In addition to the forbidden practices, the HSO may impose other prohibitions that may be required for safe operations.

6.3 Cold Stress

During cold weather, about 60 percent of a person's body fuel is used to heat the body. When exposed to cold temperatures for extended periods of time, a person tires easily and exposed skin cools rapidly. Individuals working in these conditions are at risk for developing hypothermia and frostbite. When immersion in water is a possibility, workers in cold weather situations are also at risk for trench foot. This section provides information on cold-related injuries, risk factors, harmful effects of cold and first aid measures for injuries, and prevention of cold-related disorders.

6.3.1 Cold and the Body

A person gains heat from food and muscular activity and loses it though convection, conduction, radiation, sweating. These processes work together to maintain a constant body temperature. When body temperature drops even a few degrees below normal (98.6°F or 37°C), the blood vessels constrict, decreasing peripheral blood flow to reduce heat loss from the surface of the skin. Shivering generates heat by increasing the body's metabolic rate.

There are four environmental conditions that cause cold-related stress:

- Low temperatures;
- High/cool winds;
- Dampness; and
- Cold water.

Wind chill or equivalent chill temperature (ECT), a combination of air temperature and wind speed, is a crucial factor to evaluate when working outside because it directly effects the rate of heat loss on the human body. A table to determine the ECT based on ambient temperature and wind speed is provided in Appendix F.

6.3.2 Cold-Related Risk Factors

Sucsceptibility to hypothermia is increased by the following factors:

- Wearing inadequate or wet clothing.

- Taking certain drugs or medications such as alcohol, nicotine, caffeine, and medication that inhibits the body's response to cold or impairs judgement.
- Exhaustion, dehydration, injury or immobilization.
- Recent or current illness such as cold or flu, chronic health conditions such as diabetes, heart, vascular, and thyroid problems.

6.3.3 Harmful Effects of Cold

The harmful effects of over-exposure to cold are discussed below including symptoms and first aid measures.

6.3.3.1 General Hypothermia

Hypothermia occurs when body temperature falls to a level where normal muscular and cerebral functions are impaired. While associated with freezing temperatures, hypothermia may occur at temperatures well above freezing. Hypothermia is a potentially life-threatening condition. Pain in the extremities may be the first early warning sign of danger from cold stress. Violent shivering is also an early sign of hypothermia. During cold exposure, maximum severe shivering occurs when the body temperature has fallen to 95°F (36°C). Other symptoms of hypothermia include strange or irritable behavior, slurred speech and/or clumsiness. As hypothermia progresses, vision becomes impaired, and the victim may stagger and fall, followed by numbness or sleepiness. Unconsciousness and full heart failure can occur with severe hypothermia. The onset of pain in the extremities, heavy shivering, feeling of excessive fatigue, drowsiness, irritability or euphoria are indications to immediately return to a heated warm shelter.

Treatment of hypothermia involves conserving the victim's remaining body heat and providing additional heat sources. Reduction of heat loss can be accomplished by the following: obtaining shelter, removing wet clothing, adding layers of dry clothing, blankets and/or using a pre-warmed sleeping bag. External rewarming techniques include body-to-body contact (e.g., placing the person in a prewarmed sleeping bag with a person of normal temperature), chemical heat packs, or insulated hot water bottles. Good areas to place warming packs are the armpits, neck, chest and groin.

Handle hypothermic people gently because of the increased irritability of the cold heart. Seek medical assistance for persons suspected of being moderately or severely hypothermic. If a person is not responding and not shivering, assume he or she is severely hypothermic.

6.3.3.2 Frostbite

Frostbite occurs when skin tissue actually freezes, causing ice crystals to form between cells and draw water from them, which lead to cellular dehydration. Although, this usually occurs at temperatures below 30°F (-1°C), wind chill effects can cause frostbite at above-freezing temperatures.

Initial symptoms of frostbite include uncomfortable cold and tingling sensations, stinging or aching feeling of the exposed area followed by numbness. Ears, fingers, toes, cheeks, and noses are primarily affected. Frostbitten areas appear white and cold to the touch. The appearance of frostbite varies depending on whether rewarming has occurred. Deeper frostbite involves freezing of deeper tissues such as muscles and tendons, causing exposed areas to become numb, painless and hard to the touch.

If frostbite is suspected, seek immediate medical assistance. Frostbitten parts should be covered with dry sterile gauze or soft, clean cloth bandages. Do not massage frostbitten tissues because this may cause greater injury. Take measures to prevent further cold injury.

6.3.3.3 Trench Foot

Trench foot is caused by long, continuous exposure to a wet, cold environment, or actual immersion in water. Symptoms include a tingling and/or itching sensation, burning, pain, and swelling, sometimes forming blisters in more extreme cases. Move individuals to a warm, dry area where the affected tissue can be treated with careful washing and drying, rewarming and slight elevation. Seek medical assistance as soon as possible.

6.3.4 Preventing Cold-related Disorders

Workers should be protected from exposure to cold so that deep core temperature does not fall below 96.8°F (36°C); lower body temperatures will likely result in reduced mental alertness, reduction in rational decision making, or lack of consciousness. The following measures shall be implemented to prevent general hypothermia, frostbite and trench foot from occurring during outdoor field activities.

6.3.4.1 Personal Protective Clothing

Adequate insulated dry clothing must be worn if work is performed in ECT below 40°F (4°C). At least three layers of clothing are recommended including the following:

- An outer layer to break the wind and allow some ventilation.
- A middle layer of down or wool to absorb sweat and retain insulation when wet.
- Inner layers of cotton or synthetic weave to allow ventilation.

Pay special attention to protecting feet, hands, face and head. Up to 40% of body heat can be lost when the head is exposed. Footgear should be insulated to protect against cold and dampness. Keep a change of clothing available in case work garments become wet.

6.3.4.2 Safe Work Practices

The following additional guidelines shall be followed to prevent or minimize the risk of injury to cold stress:

- In cold field conditions, warm sweet drinks and soups are recommended to provide caloric intake and maintain fluid volume. Consumption of coffee and other caffeinated beverages should be limited because of the diuretic and circulatory system effects.
- Wet clothing at ECT of 35.6°F (2°C) or less shall be considered a life-threatening situation. Workers shall change into dry clothing immediately and return to a heated warm shelter for monitoring.
- To prevent injury to exposed skin (ears, head, cheeks, hands, etc.), continuous exposure shall be avoided when the ECT is –25.6°F (-32°C) or less.
- No solo fieldwork will be conducted at or below 10.4°F (-12°C) ECT.

6.4 Heat Stress

Heat stress can result in health effects ranging from transient heat fatigue to serious illness or death. Heat stress is caused by a number of interacting factors including environmental conditions, clothing, workload, and the characteristics of the worker. Heat stress is not generally expected to be a concern on this project as chemical-resistant suits are not required for planned activities. However, during warm weather months personnel may be at risk from heat stress due to ambient temperatures. In the event of heat stress, the following recommendations are made to reduce heat stress:

- Provide plenty of liquids.
- Wearing of an undergarment that acts to help ventilation of the body.
- Provide containerized water for personnel drenching to reduce body temperature and cool protective clothing.
- Scheduling of activities during the cooler times of the day.
- Providing sunshade over the work area if possible.
- Establish a work schedule incorporating regular rest periods.
- Mandate work slow-downs as needed.
- Rotation of shifts of workers wearing impervious clothing.
- Heat stress monitoring.

Any of the following techniques can be used to screen for heat stress:

- Heart rate at the radial artery should be measured as early as possible in the resting period. Should the heart rate exceed 110 beats per minute, the next work period should be shortened by 10 minutes (33%), while the length of the rest period stays the same. If the pulse rate is greater than 100 at the next rest period, the following work cycle should be shortened by an additional 33%.
- Body temperature can be used to screen for heat stress. If the oral temperature at the beginning of the rest period exceeds 99 degrees Fahrenheit, the next work period should be shortened by 10 minutes (or 33%), while the length of the rest period stays the same. This process should be continued until the body temperature does not exceed 99 degrees F.

7.0 PROTECTIVE EQUIPMENT REQUIREMENTS

7.1 Personal Protective Equipment

Personal protective equipment (PPE) consists of three components: standard safety equipment required on the site, special PPE (fall protection, water safety), and respiratory protective equipment. All personnel are expected to come to work with proper safety equipment as provided by MSU or ENTRIX, Inc. In addition, all project and subcontract personnel entering a site shall comply with any activity-specific safety requirements.

7.1.1 Equipment

The equipment level required for a given field activity will be determined by the HSO. This level of equipment may be revised as site conditions change. A detailed description of the proposed initial PPE ensemble for tasks with identified chemical exposure is presented in Table 7-1. The level of equipment required at the site will depend on the activities being performed.

7.1.1.1 Basic Protective Clothing and Equipment

The minimum required PPE for the Site consists of the following:

- Fully enclosed hard-soled shoe or boots;
- Maps
- Cell phones and/or 2-way radios

7.1.1.2 Activity-Specific Protective Clothing

The PPE listed below is designed to prevent direct contact with solvents, mink scat, owl pellets, and contaminated sediments. The following PPE are required during equipment cleaning and rinsing, sampling of benthic invertebrates and the collection of scat and pellets:

- Safety glasses;
- Rubber over-the-sock boot or waders; and
- Chemical-resistant gloves (e.g., nitrile).

Table 7-1 shows the PPE required for activities specific to areas and/or type of media sampled.

Table 7-1. Personal Protective Equipment.

Activity	Level	Body	Respirator	Skin	Other
Basic PPE					
All activities except collection of benthos	D	Standard	None required	None required	None required
PPE for Area-Specific Activities					
Work over or near water	D	Standard	None required	None required	Spare set of dry clothes, life jacket
PPE for Specific Activities					
Biological Hazard Activities (handling mink scat, frozen mink carcasses and owl pellets)	D	Standard	None required	Nitrile or other biohazard glove	None required
Tree Climbing	D	Safety Harness, Helmet	None required	Gloves	None required
Benthos collection	D	Standard	None required	Nitrile gloves, safety glasses, rubber boots or waders	None required

PPE Personal Protective Equipment
TRB Tittabawassee River Basin

8.0 DECONTAMINATION/CONTAMINATION REDUCTION PROCEDURES

8.1 Decontamination

A decontamination station will be designated, configured, and secured at the site only if appropriate. All contaminated personal protective equipment (PPE) will be transferred to designee for proper disposal. Personnel shall always wash hands and exposed skin after removing protective clothing or leaving level D controlled work areas (basic decontamination level). Selected sampling equipment as designated in the Sampling and Analysis Plan, Quality Assurance Project Plan, and standard operating procedures, will be decontaminated using hexane/acetone, followed by DI water to prevent cross-contamination between samples. Acetone and hexane rinse water will be disposed of at the appropriate laboratory facilities in accordance with local, state, and federal regulations.

8.2 Subcontractor Requirements

Each subcontractor shall decontaminate equipment as necessary to meet technical requirements. Subcontractors are responsible for decontamination of equipment to the satisfaction of the HSO or FTL.

9.0 EMERGENCY RESPONSE PROCEDURES

This section describes project-specific procedures to be followed in case of an emergency and emergency equipment to be taken into the field. Project personnel shall carefully review and adhere to the emergency response and notification procedures described in this section.

9.1 Emergency Communications

Each field team will have a reliable means of contact with offsite emergency services. Most often this means of contact will be a cellular telephone. In addition, if field team members will be working out of visual contact with each other, then a reliable means of communication with other field team members will be established. Depending on the situation this could be horns, whistles, hand-held two-way radios or cellular telephones. If horns or whistles are used as an emergency communication device, three blasts will be used as a distress signal. Field personnel working alone will be required to report into a designated contact at prescribed intervals not less than at the end of each field day so that a timely search and rescue effort can be initiated.

9.2 Emergency Equipment

A first aid kit and bloodborne pathogen (BBP) kit will be taken into the field each day throughout the project. Additional kits will be provided for each field team if field teams will be working in separate locations to assure immediate access to first aid and BBP supplies. A portable fire extinguisher (Type ABC) will be maintained on the boat.

9.3 General Emergency Procedures

In the event of a fire, explosion, physical injury or an illness due to chemical exposure, the appropriate parties should be contacted using the phone numbers listed at the end of this section. The HSO or FTL is responsible for evaluating the seriousness of the situation and making the appropriate notifications.

9.3.1 Blood-Borne Pathogen Exposure Control Plan

All personnel should be aware of the potential to transmit disease from contact with body fluids. Personnel should assume that all bodily fluids are potentially infectious and use appropriate precautions. Controls to be considered are as follows:

- Use of the victim's hand to control initial bleeding;
- Use of available protective gear (Tyvek®, gloves) to prevent contact;
- Wash promptly after contact with body fluids;
- Use rescue breather for CPR.

9.3.2 First Aid Supplies

First aid kits will be maintained during all field activities on site. The HSO or FTL shall periodically verify that first aid supplies are available. Trained personnel may use the first aid kit to administer first aid to any worker who is injured. The HSO shall verify daily those first aid-

and CPR-qualified personnel present on site. Unqualified personnel should use the first aid kits to assist in an emergency only when qualified personnel are not available.

9.4 Medical Emergency Procedures

A person certified in first aid, including adult CPR, will be present at all times to render first aid in the event of an injury or illness. For injuries or illness other than very minor cuts or scrapes, a physician's attention is required after first aid is rendered at the site. **For treatment of potentially life-threatening injury or illness, call 911 for assistance**.

For treatment of injuries or illness that can not be easily handled on site with the first aid kit, personnel shall be driven to MidMichigan Urgent Care. Directions to the hospital from the site are indicated on the map provided in Appendix A.

10.0 RESPONSIBILITIES

Project responsibilities are described below.

Project Manager (Prof. John P. Giesy, MSU)— Will oversee and approve all project activities; review QA reports; approve final project QA needs; authorize necessary actions and adjustments to accomplish program QA objectives; and act as liaison between agencies and field staff.

Quality Assurance (QA) Manager (Prof. Paul D. Jones, MSU)— Will oversee all QA activities to ensure compliance with contract specifications; initiate audits on work completed by project personnel and subcontractors, including analytical laboratories and independent data validation contractors; review program QA activities, quality problems, and quality-related requests. In response to field and analytical findings, he will approve the corrective actions. He will report quality non-conformances to the Project Manager and review all pertinent portions of the deliverables before they are transmitted to ensure conformance with QA/QC procedures and quality work product.

Data Manager (Dr. Denise Kay, ENTRIX)— Will oversee data management for this project. He is responsible for the structure, organization, format, implementation, and operation of the project database.

Field Team Leader (Dr. Matt Zwiernik, MSU)— Will oversee field activities and supervise the field crews. He will ensure that proper sample collection, preservation, storage, transport, and COC QC procedures are followed. He will inform the Project QA Manager when field problems occur, and will communicate and document corrective actions taken. The Field Team Leader will discuss field activities with the Project Manager.

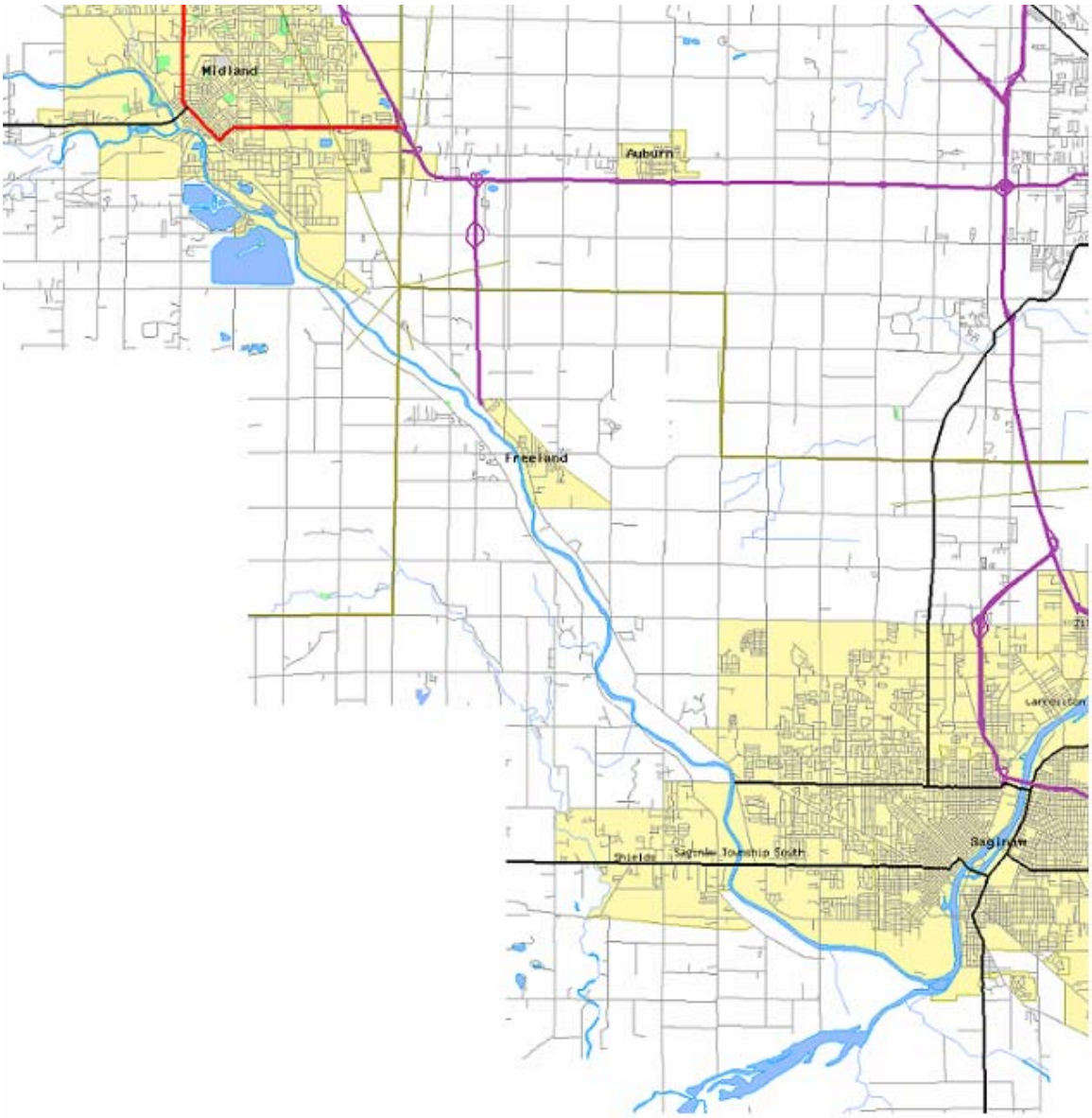
Laboratory Project Manager (Mr. Patrick Bradley, MSU)— The laboratory project manager for this project. He is responsible for assuring that the analysis of all samples is performed in accordance with the QAPP and the laboratory's quality assurance manual. In addition, the Laboratory Project Manager performs the final laboratory review of project data packages for completeness and compliance with project requirements.

Health and Safety Officer (Mr. Jeremy Moore, MSU) — Will oversee the implementation of the site-specific health and safety plan. He will ensure that proper training requirements are fulfilled before fieldwork begins. Incident report forms will be reviewed by the Health and Safety Officer who will have the authority to suspend work or alter procedures at any time to insure the safety of all team members.

APPENDIX A

SITE LOCATION MAP, EMERGENCY CONTACTS, AND HOSPITAL LOCATION MAP

The Tittabawassee River site as defined in the Hazardous Waste Management Facility Operating License (issued on June 12, 2003 by Michigan Department of Environmental Quality to The Dow Chemical Company) includes approximately 23 miles of the Tittabawassee River from the upstream boundry of The Dow Chemical Company to the confluence of the Tittabawassee and Shiawassee Rivers downstream of Greenpoint Island.



Emergency Telephone Numbers

Off site Emergency Contacts

- Fire, Police, Ambulance 911
- MidMichigan Urgent Care (Midland) 989-839-1750
- CHEMTREC 1-800-424-9300
- Poison Control Center 1-800-662-9886

Additional Contingency Telephone Numbers

- Client Contact: The Dow Chemical Company 989-636-0787
  Contact: Ben Baker (or Dow Reprenstative)

- ENTRIX, Inc. 517-381-1434 (work)
  Contact: Alan Blankenship 517-256-2669 (cell)

- Michigan State University 517-749-5243
  Contact: Matt Zwiernik

MidMichigan Urgent Care - Midland
3009 North Saginaw Road
Midland, Michigan 48640
Telephone
989-839-1750

APPENDIX B

SITE-SPECIFIC HEALTH AND SAFETY TRAINING RECORD FORMS

SITE-SPECIFIC HEALTH AND SAFETY PLAN (S-HASP) TRAINING RECORD

HASP Title/Revision No. Site-Specific Health and Safety Plan for Field Sampling Activities in Support of the Ecological Risk Assessment Work Plan for the Tittabawassee River and Floodplain

_____
Site Safety Officer

I have read the S-HASP listed above and fully understand the material covered. I understand that I am responsible for compliance with the requirements of this S-HASP and I agree to abide by the same. I also had the opportunity to discuss the information presented in the S-HASP, and to ask any questions about the information that I want clarified. I understand that this record will become a permanent part of my employee health and safety training file.

Date	Print Name	Signature

APPENDIX C

TAILGATE SAFETY MEETING FORMS

DAILY TAILGATE SAFETY MEETING FORM

Date:_____ Time:_____ Project Number:_____

Project Name:_____

Specific Location:_____

Type of Work:_____

_____

Chemicals Present:_____

SAFETY TOPICS DISCUSSED

Protective Clothing/Equipment: _____

_____

Hazards of Chemicals Present: _____

_____

Physical Hazards: _____

_____

Special Hazards: _____

_____

Other Topics: _____

_____

ATTENDEES

Name (printed)	Signature

APPENDIX D

MATERIAL SAFETY DATA SHEETS

ACETONE

1. Product Identification

Synonyms: Dimethylketone; 2-propanone; dimethylketal
CAS No.: 67-64-1
Molecular Weight: 58.08
Chemical Formula: (CH3)2CO
Product Codes:
J.T. Baker: 5008, 5018, 5356, 5580, 9001, 9002, 9003, 9004, 9005, 9006, 9007, 9008, 9009, 9010, 9015, 9036, 9125, 9254, 9271, A134, V655
Mallinckrodt: 0018, 2432, 2435, 2437, 2438, 2440, 2443, 2445, 2850, H451, H580, H981

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Acetone	67-64-1	99 - 100%	Yes

3. Hazards Identification

Emergency Overview

DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 1 - Slight
Flammability Rating: 4 - Extreme (Flammable)
Reactivity Rating: 2 - Moderate
Contact Rating: 1 - Slight
Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER
Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:
Inhalation of vapors irritates the respiratory tract. May cause coughing, dizziness, dullness, and headache. Higher concentrations can produce central nervous system depression, narcosis, and unconsciousness.
Ingestion:
Swallowing small amounts is not likely to produce harmful effects. Ingestion of larger amounts may produce abdominal pain, nausea and vomiting. Aspiration into lungs can produce severe lung damage and is a medical emergency. Other symptoms are expected to parallel inhalation.
Skin Contact:
Irritating due to defatting action on skin. Causes redness, pain, drying and cracking of the skin.
Eye Contact:
Vapors are irritating to the eyes. Splashes may cause severe irritation, with stinging, tearing, redness and pain.
Chronic Exposure:
Prolonged or repeated skin contact may produce severe irritation or dermatitis.
Aggravation of Pre-existing Conditions:
Use of alcoholic beverages enhances toxic effects. Exposure may increase the toxic potential of chlorinated hydrocarbons, such as chloroform, trichloroethane.

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4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
Ingestion:
Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT INDUCE. If vomiting occurs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an unconscious person. Call a physician immediately.
Skin Contact:
Immediately flush skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get medical attention.

---

5. Fire Fighting Measures

Fire:
Flash point: -20C (-4F) CC
Autoignition temperature: 465C (869F)
Flammable limits in air % by volume:
lel: 2.5; uel: 12.8
Extremely Flammable Liquid and Vapor! Vapor may cause flash fire.
Explosion:
Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Vapors can flow along surfaces to distant ignition source and flash back. Contact with strong oxidizers may cause fire. Sealed containers may rupture when heated. This material may produce a floating fire hazard. Sensitive to static discharge.
Fire Extinguishing Media:
Dry chemical, alcohol foam or carbon dioxide. Water may be ineffective. Water spray may be used to keep fire exposed containers cool, dilute spills to nonflammable mixtures, protect personnel attempting to stop leak and disperse vapors.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

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6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as sawdust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker SOLUSORB® solvent adsorbent is recommended for spills of this product.

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7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. Containers of this

material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

---

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
Acetone:
-OSHA Permissible Exposure Limit (PEL):
1000 ppm (TWA)

-ACGIH Threshold Limit Value (TLV):
500 ppm (TWA), 750 ppm (STEL) A4 - not classifiable as a human carcinogen
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, a half-face organic vapor respirator may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece organic vapor respirator may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.
Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

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9. Physical and Chemical Properties

Appearance:
Clear, colorless, volatile liquid.
Odor:
Fragrant, mint-like
Solubility:
Miscible in all proportions in water.
Specific Gravity:

0.79 @ 20C/4C
pH:
No information found.
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
56.5C (133F) @ 760 mm Hg
Melting Point:
-95C (-139F)
Vapor Density (Air=1):
2.0
Vapor Pressure (mm Hg):
400 @ 39.5C (104F)
Evaporation Rate (BuAc=1):
ca. 7.7

---

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
Carbon dioxide and carbon monoxide may form when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Concentrated nitric and sulfuric acid mixtures, oxidizing materials, chloroform, alkalis, chlorine compounds, acids, potassium t-butoxide.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

---

11. Toxicological Information

Oral rat LD50: 5800 mg/kg; Inhalation rat LC50: 50,100mg/m3; Irritation eye rabbit, Standard Draize, 20 mg severe; investigated as a tumorigen, mutagen, reproductive effector.

--------\Cancer Lists\----------

---NTP Carcinogen---

Ingredient	Known	Anticipated	IARC Category
Acetone (67-64-1)	No	No	None

12. Ecological Information

Environmental Fate:
When released into the soil, this material is expected to readily biodegrade. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released into water, this material is expected to readily biodegrade. When released to water, this material is expected to quickly evaporate. This material has a log octanol-water partition coefficient of less than 3.0. This material is not expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material may be moderately degraded by photolysis. When released into the air, this material is expected to be readily removed from the atmosphere by wet deposition.
Environmental Toxicity:
This material is not expected to be toxic to aquatic life. The LC50/96-hour values for fish are over 100 mg/l.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: ACETONE
Hazard Class: 3
UN/NA: UN1090
Packing Group: II
Information reported for product/size: 215L

International (Water, I.M.O.)

Proper Shipping Name: ACETONE
Hazard Class: 3
UN/NA: UN1090
Packing Group: II

Information reported for product/size: 215L

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15. Regulatory Information

--------\Chemical Inventory Status - Part 1\----------

Ingredient	TSCA	EC	Japan	Australia
Acetone (67-64-1)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\----------

Ingredient	--Canada-- Korea	DSL	NDSL	Phil.
Acetone (67-64-1)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Acetone (67-64-1)	No	No	Yes	No

--------\Federal, State & International Regulations - Part 2\----------

Ingredient	-RCRA- CERCLA	261.33	-TSCA- 8(d)
Acetone (67-64-1)	5000	U002	No

Chemical Weapons Convention: No TSCA 12(b): Yes CDTA: Yes

SARA 311/312: Acute: Yes Chronic: No Fire: Yes Pressure: No

Reactivity: No (Pure / Liquid)

Australian Hazchem Code: 2[Y]E
Poison Schedule: None allocated.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

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16. Other Information

NFPA Ratings: Health: 1 Flammability: 3 Reactivity: 0
Label Hazard Warning:
DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM.
Label Precautions:
Keep away from heat, sparks and flame.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Avoid breathing vapor.
Avoid contact with eyes, skin and clothing.
Label First Aid:
Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT INDUCE. If vomiting occurs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an unconscious person. Call a physician immediately. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.
Product Use:
Laboratory Reagent.

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

HEXANES

1. Product Identification

Synonyms: n-Hexane; hexyl hydride; 3-methyl pentane
CAS No.: 110-54-3
Molecular Weight: 86.18
Chemical Formula: CH3(CH2)4CH3 n-hexane
Product Codes: Product Codes: 4153, 4159, 5167, 5175, 5188, 5189, 6969, H079, H487

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Hexane	110-54-3	99.4%	Yes

3. Hazards Identification

Emergency Overview

DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL OR FATAL IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS THE CENTRAL AND PERIPHERAL NERVOUS SYSTEMS.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Life)
Flammability Rating: 3 - Severe (Flammable)
Reactivity Rating: 1 - Slight
Contact Rating: 3 - Severe (Life)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER
Storage Color Code: Red (Flammable)

Potential Health Effects

The health hazards addressed are for the major component: n-hexane.

Inhalation:
Inhalation of vapors irritates the respiratory tract. Overexposure may cause lightheadedness, nausea, headache, and blurred vision. Greater exposure may cause muscle weakness, numbness of the extremities, unconsciousness and death.
Ingestion:
May produce abdominal pain, nausea. Aspiration into lungs can produce severe lung damage and is a medical emergency. Other symptoms expected to parallel inhalation.
Skin Contact:
May cause redness, irritation, with dryness, cracking. May be absorbed through the skin with possible systemic effects.
Eye Contact:
Vapors may cause irritation. Splashes may cause redness and pain.
Chronic Exposure:
Repeated or prolonged skin contact may defat the skin and produce irritation and dermatitis. Chronic inhalation may cause peripheral nerve disorders and central nervous system effects.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems or impaired respiratory function may be more susceptible to the effects of the substance. May affect the developing fetus.

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4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
Ingestion:
Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT INDUCE. If vomiting occurs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an unconscious person. Call a physician immediately.
Skin Contact:
Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:
BEI=2,5-hexadione in urine, sample at end of shift at workweeks end, 5 mg/g creatine. Also, measure n-hexane in expired air. Analgesics may be necessary for pain

management, there is no specific antidote. Monitor arterial blood gases in cases of severe aspiration.

---

5. Fire Fighting Measures

Fire:
Flash point: -22C (-8F) CC
Autoignition temperature: 225C (437F)
Flammable limits in air % by volume:
lel: 1.1; uel: 7.5
Listed fire data is for n-Hexane. Extremely Flammable Liquid and Vapor! Vapor may cause flash fire. Dangerous fire hazard when exposed to heat or flame.
Explosion:
Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Contact with oxidizing materials may cause extremely violent combustion.Explodes when mixed @ 28C with dinitrogen tetraoxide. Sensitive to static discharge.
Fire Extinguishing Media:
Dry chemical, foam or carbon dioxide. Water may be ineffective.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Water spray may be used to keep fire exposed containers cool. Vapors can flow along surfaces to distant ignition source and flash back. Vapor explosion hazard exists indoors, outdoors, or in sewers.

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6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

---

7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from direct sunlight and any area where the fire hazard may be acute. Store in tightly closed containers (preferably under nitrogen atmosphere). Outside or detached storage is

preferred. Inside storage should be in a standard flammable liquids storage room or cabinet. Separate from oxidizing materials. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product. Do Not attempt to clean empty containers since residue is difficult to remove. Do not pressurize, cut, weld, braze, solder, drill, grind or expose such containers to heat, sparks, flame, static electricity or other sources of ignition: they may explode and cause injury or death.

---

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
N-Hexane [110-54-3]:
-OSHA Permissible Exposure Limit (PEL): 500 ppm (TWA)
-ACGIH Threshold Limit Value (TLV): 50 ppm (TWA), Skin
other isomers of hexane
-ACGIH Threshold Limit Value (TLV): 500 ppm (TWA),1000ppm (STEL)
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Breathing air quality must meet the requirements of the OSHA respiratory protection standard (29CFR1910.134). This substance has poor warning properties.
Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

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9. Physical and Chemical Properties

Appearance:
Clear, colorless liquid.
Odor:
Gasoline-like odor.

Solubility:
Insoluble in water.
Specific Gravity:
0.664 @ 15.6C/15.6C
pH:
No information found.
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
67 - 69C (153 - 156F)
Melting Point:
No information found.
Vapor Density (Air=1):
ca. 3.0
Vapor Pressure (mm Hg):
No information found.
Evaporation Rate (BuAc=1):
ca. 0.3

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10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Heat will contribute to instability.
Hazardous Decomposition Products:
May produce acrid smoke and irritating fumes when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Strong oxidizers.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

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11. Toxicological Information

For n-Hexane: LD50 Oral rat 28710 mg/kg; LC50 Inhalation rat 48000 ppm/4H, Irritation eye rabbit (std Draize),10 mg, mild. Investigated as a tumorigen, mutagen and reproductive effector.

--------\Cancer Lists\----------

---NTP Carcinogen---

Ingredient	Known	Anticipated	IARC Category

Hexane (110-54-3)	No	No	None

12. Ecological Information

Environmental Fate:
When released into the soil, this material may biodegrade to a moderate extent. When released into the soil, this material is not expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released into water, this material may biodegrade to a moderate extent. When released to water, this material is expected to quickly evaporate. When released into the water, this material is expected to have a half-life between 1 and 10 days. This material has an estimated bioconcentration factor (BCF) of less than 100. This material has a log octanol-water partition coefficient of greater than 3.0. This material is not expected to significantly bioaccumulate. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life between 1 and 10 days.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: HEXANES
Hazard Class: 3
UN/NA: UN1208
Packing Group: II
Information reported for product/size: 200L

International (Water, I.M.O.)

Proper Shipping Name: HEXANES
Hazard Class: 3
UN/NA: UN1208
Packing Group: II

Information reported for product/size: 200L

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15. Regulatory Information

--------\Chemical Inventory Status - Part 1\----------

Ingredient	TSCA	EC	Japan	Australia
Hexane (110-54-3)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\----------

	--Canada--			
Ingredient	Korea	DSL	NDSL	Phil.
Hexane (110-54-3)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------

	-SARA 302-		------SARA 313------	
Ingredient	RQ	TPQ	List	Chemical Catg.
Hexane (110-54-3)	No	No	Yes	No

--------\Federal, State & International Regulations - Part 2\----------

	-RCRA-	-TSCA-	
Ingredient	CERCLA	261.33	8(d)
Hexane (110-54-3)	5000	No	No

Chemical Weapons Convention: No TSCA 12(b): Yes CDTA: No

SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No

Reactivity: No (Mixture / Liquid)

Australian Hazchem Code: 3[Y]E
Poison Schedule: None allocated.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

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16. Other Information
NFPA Ratings: Health: 1 Flammability: 3 Reactivity: 0
Label Hazard Warning:
DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL OR FATAL IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS THE CENTRAL AND PERIPHERAL NERVOUS SYSTEMS.
Label Precautions:
Keep away from heat, sparks and flame.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Avoid breathing vapor or mist.
Avoid contact with eyes, skin and clothing.
Label First Aid:
Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT INDUCE. If vomiting occurs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an unconscious person. Call a physician immediately. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.
Product Use: Laboratory Reagent.

APPENDIX E

SITE-SPECIFIC BOAT OPERATION SAFETY PLAN

SITE-SPECIFIC BOAT OPERATION SAFETY PLAN

Table E-1. Activity Hazard Analysis for Boat Operation and Water Safety.

PRINCIPAL STEPS	POTENTIAL SAFETY/ HEALTH HAZARDS	RECOMMENDED CONTROLS
Identify the principal steps involved and the sequence of work activities	*Analyze each principal step for potential hazards*	*Develop specific controls for each potential hazard*
1. Engine start-up.	1. & 2. Possible fire hazard.	1. & 2. Cut engine while fueling.
2. Engine operation.	2. Running out of fuel during operation.	2. Check oil and fuel prior to leaving dock.
3. Boat handling.	3. a) Slip and fall hazards including falling overboard. b) Collisions with other vehicles or physical hazards c) Stranding on mudflat.	3. a) Use hand-holds, wear shoes with good traction, and approved life jacket. b) Be aware of surroundings. c) Pay attention to tides where applicable.
EQUIPMENT TO BE USED	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**
List equipment to be used in the work activity	*List inspection requirements for the work activity*	*List training requirements, including hazard communication*
1. USCG-approved Type V work vest for special conditions. 2. GPS/depth finder. 3. Anchor and tie-lines. 4. Fire extinguisher (Type ABC). 5. Extra fuel. 6. Radio/cell phone/horn. 7. Tools.	1. Check for wear and operation of buckles. 2 - 7. Check prior to leaving dock to assure operational and in good working condition.	1. Boat operator shall have experience operating similar vessels under similar conditions.

APPENDIX F

EQUIVALENT CHILL TEMPERATURE

Table F-1. This table shows the cooling power of wind on exposed flesh expressed as equivalent temperature in degrees Fahrenheit under calm conditions.

Wind Speed		Temperature (degrees Fahrenheit)															
mph	kmh	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40
4	6	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40
5	8	32	27	22	16	11	6	0	-5	-10	-15	-21	-26	-31	-36	-42	-47
10	16	22	16	10	3	-3	-9	-15	-22	-27	-34	-40	-46	-52	-58	-64	-71
15	24	16	9	2	-5	-11	-18	-25	-31	-38	-45	-51	-58	-65	-72	-78	-85
20	32	12	4	-3	-10	-17	-24	-31	-39	-46	-53	-60	-67	-74	-81	-88	-95
25	40	8	1	-7	-15	-22	-29	-36	-44	-51	-59	-66	-74	-81	-88	-96	-103
30	48	6	-2	-10	-18	-25	-33	-41	-49	-56	-64	-71	-79	-86	-93	-101	-109
35	56	4	-4	-12	-20	-27	-35	-43	-52	-58	-67	-74	-82	-89	-97	-105	-113
40	64	3	-5	-13	-21	-29	-37	-45	-53	-60	-69	-76	-84	-92	-100	-107	-115
45	72	2	-6	-14	-22	-30	-38	-45	-54	-62	-70	-78	-85	-93	-102	-109	-117
		Unpleasant		Frostbite possible		Frostbite likely. Outdoor activity increasingly dangerous.					Exposed flesh will freeze within one-half minute.						

Table F-2. This table shows the cooling power of wind on exposed flesh expressed as equivalent temperature in degrees Celcius under calm conditions.

Wind Speed		Temperature (degrees Celsius)						
km/h	mph	0	-5	-10	-15	-20	-25	-30
10	6	-2	-7	-12	-17	-22	-27	-32
20	12	-7	-13	-19	-25	-31	-37	-43
30	18	-11	-17	-24	-31	-37	-44	-50
40	24	-13	-20	-27	-34	-41	-48	-55
50	30	-15	-22	-29	-36	-44	-51	-58
60	36	-16	-23	-31	-38	-45	-53	-60

APPENDIX G

INCIDENT REPORTING DOCUMENTATION

INCCIDENT/INJURY REPORT
ENTRIX, Inc.

4295 Okemos Rd; Suite 101
Okemos, MI 48864
Ph (517) 381-1434

Type or Print — Police/Fire Emergency Dial 911

TIME & PLACE	Inccident Date:	Time:	
	Location:	Weather:	
DESCRIBE WHAT HAPPENED	Describe What Happened		
INJURED PERSON	Name	Employee # (if applicable)	
	Age:	Gender: Female ☐	Male ☐
	Address		
			PHONE #
DESCRIPTION OF INJURY	INJURED Yes ☐ No ☐ If Yes - Describe the type, severity, and body part(s) involved: Medical Care Received Yes ☐ No ☐ If Yes - Describe:		
DESCRIPTION OF EQUIPMENT DAMAGE	Describe Equpment Damaged		Cost
WITNESSES	Name	Address	Phone #
	Name	Address	Phone #

REOCCURRENCE PREVENTION:

Report Completed by: (Print Name & Title) Date:

Report Reviewed by: (Print Name & Title) Date:

Appendix C. Study Plan I - Exposure Pathway Analysis

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1.0 STUDY PLAN I - EXPOSURE PATHWAY ANALYSIS

1.1 Introduction

At present, there is limited site-specific information available to examine ecological exposure pathways in the Tittabawassee system. To estimate exposures of wildlife to COPECs while minimizing the use of conservative assumptions, site-specific data must be collected on the behavior, home range, dietary composition, and concentrations of COPECs in select dietary items (e.g., plants, invertebrates, small mammals, birds, and select fish). Actual data reduces uncertainty in exposure estimates generated by the use of extensive modeling procedures.

1.2 Purpose and Objectives

Currently, there are data gaps and uncertainty for estimating the transfer of COPECs into the terrestrial and aquatic food webs. Much of this uncertainty can be reduced through the identification and quantification of site-specific home ranges, dietary composition, and COPEC concentrations in key environmental matrices (e.g., plants, invertebrates, small mammals, birds, and select fish). The results of this study will provide comprehensive data in order to refine modeling and to reduce uncertainty associated with risk assessments and/or risk characterizations.

Thus, the overall purpose of this study is to reduce uncertainties in the ERA through collection of site-specific information to characterize ecological receptors and their potential exposure pathways. Specifically, the goals and objectives of this study are to:

- Characterize exposure pathways for key receptors
- Develop a site-specific conceptual model for exposure of key receptors to COPECs
- Characterize the migratory and foraging behaviors of key ecological receptors
- Analyze concentrations of COPECs in biotic and abiotic media to which key wildlife would be exposed
- Develop bioaccumulation factors and biomagnification factors in the lower aquatic and terrestrial food webs
- Finalize the selection of receptors of concern based on known sensitivity to COPECs, presence of suitable habitat, presence of a complete exposure pathway, species of special concern, and preliminary data.

1.3 Data Quality Objectives (DQOs)

1.3.1 Problem Statements

There is a concern that PCDDs and PCDFs and other COPECs present in sediments or floodplain soils are entering into the aquatic and terrestrial food webs of the Tittabawassee floodplain at levels associated with risk. To assess whether these contaminants are at levels of concern, it is first necessary to determine if PCDDs and PCDFs and other COPECs are entering the food web and consequently passing to higher trophic level receptors. At present, there is limited site-specific information available to study the ecological exposure pathways of PCDDs and PCDFs and other COPECs to wildlife inhabiting the Tittabawassee River and associated floodplain downstream of Midland, MI. In one study, concentrations

of PCDDs and PCDFs were measured in sediments and floodplain soils collected along the Tittabawassee River (Hilsherova et al., 2003). Additionally, concentrations of PCDDs and PCDFs have been measured in several fish species inhabiting the Tittabawassee River, and risk toward piscivorous avian and mammalian species have been predicted based on these measurements (Galbraith, 2003). However, due to the limited nature of the existing site-specific data set, additional sample matrices in the exposure pathway need to be collected to reduce uncertainty in the risk characterization process.

1.3.2 Decision Identification

Exposure pathways analyses will:

- Determine the concentrations of PCDDs and PCDFs (expressed as total TEQs) or other COPECs in sediments, soils and prey items, evaluate the magnitude of risk posed to wildlife receptors, characterize sediment and soil exposure pathways, and aid in decisions regarding remediation activities.

1.3.3 Inputs to Decisions

The decision process regarding exposure pathway analyses will be supported by the following measurements:

- Concentrations of PCDDs and PCDFs and other COPECs in sediments, aquatic macrophytes, benthic invertebrates, aquatic emergent insects, crayfish, fish, soils, terrestrial macrophytes (consumable leaves and fruiting bodies), terrestrial invertebrates, and small mammals collected from the Tittabawassee River and assoicated floodplain downstream of Midland, MI and from upstream reference areas.

- Dietary compositions of wildlife receptors inhabiting the Tittabawassee River and associated floodplain downstream of Midland, MI and upstream reference areas.

1.3.4 Spatial and Temporal Boundaries

The floodplains along the Tittabawassee River provide habitat for a variety of flora and fauna. Sampling areas were selected based on a number of criteria including available data based on previous sampling events, contiguous habitat, and covering a range of breadth and extent of exposure potentials. Proposed downstream or target areas include Smith's Crossing area, an area upstream from the Tittabawassee Township Park, the Freeland Festival Park area and the Imerman Park area (Figure C-1). Upstream or reference sites will include the Sanford sampling area and the Chippewa Nature Center. Similar matrices of samples will be collected from all locations.

Data obtained for COPECs in the target areas will be used to develop relationships between the COPEC concentrations in various matrices so that site-specific relationships can be determined. The conclusions of this analysis can then be applied to other locations. Physicochemical properties, rather than geographical features, predominantly influence transfer of COPECs, such as PCDDs and PCDFs, among different trophic levels. Therefore, the trophic transfer coefficients determined for individual PCDD and PCDF congeners at the downstream exposure site should be applicable to the remaining area of the Tittabawassee River system based on the data generated for a single well-defined matrix.

All soil collection sites will be located within the 100-year floodplain of the river. The boundary of the terrestrial sampling area will be defined by the 30 m by 30-m small mammal sampling grid. Soil, terrestrial vegetation, and worms will be collected synoptically from locations within the small mammal sampling grid. Ideally, surface terrestrial invertebrates will be collected from within that same grid but it may be necessary to expand sampling beyond the boundaries of the small mammal trapping grid to obtain the required biomass and representative samples.

The aquatic samples, including aquatic vegetation, sediments, and benthic invertebrates, will be synoptically collected from the river proximal to the terrestrial sampling grid. The sediment sample will be a composite of samples taken during the collection of aquatic vegetation and sediment-associated benthic invertebrates. Crayfish and aquatic emergent invertebrates will be collected in the same area. Fish will be collected from the Tittabawassee River at Caldwell Boat Launch, Center Road, Freeland Festival Park, and Imerman Park. In addition, fish will be collected from two reference sites upstream of the Dow Dam, the Sanford site and the Chippewa Nature Center site.

Collection activities of the exposure pathway samples commenced in the spring of 2004.

1.3.4.1 Reference Areas

Both reference sites are located upstream of Midland, including the Sanford site along the Tittabawassee River and the Chippewa Nature Center site along the Chippewa River. Concentrations of PCDDs and PCDFs in the sediments and floodplain soils near the reference area are consistent with statewide background concentrations of TEQs (MDEQ, 2003). Thus, both of these areas are considered to be relatively uncontaminated and can thus serve as reference locations for sediment, soil, and lower food web samples.

Near Sanford, land use can generally be described as primarily mixed agriculture and emergent forest. This reference location is approximately 6 miles upstream of the Dow dam and approximately 9 miles upstream of the furthest upstream study area near Smith's Crossing.

At the Chippewa Nature Center, land use can generally be described as primarily mixed field and emergent forest. The property of the Nature Center lies along the Chippewa River near the confluence with the Pine River. Collectively, the Pine and Chippewa Rivers drain an area of 806 square miles. This reference location is approximately 4 miles upstream of the Dow dam and approximately 7 miles upstream of the furthest upstream study area near Smith's Crossing.

Thus, taken together with substantial residential, urban, and industrial barriers that are present in this area, both of these reference areas are reasonably far enough removed from the primary study areas to not expect any significant transfer of lower food web biota among these locations.

In general, habitats are similar for upstream reference areas relative to most of the study areas along the Tittabawassee River downstream of Midland.

1.3.4.2 Primary Study Areas

There are four study areas located along the Tittabawassee downstream of Midland. These include areas adjacent or near Smith's Crossing, Tittabawassee Township Park, Freeland Festival Park, and Imerman Park.

Land use at Smith's Crossing can generally be described as emergent forest and mixed agriculture. Smith's Crossing is located approximately 3.7 miles (6 km) downstream of the Dow dam in Midland.

The Tittabawassee Township Park is located approximately 6.2 miles (10 km) downstream of the Dow dam in Midland, and land use at this site can be described as emergent forest and mixed agriculture.

Freeland Festival Park encompasses about 12 acres, including approximately 980 feet of river frontage. With the exception of this southernmost area, the banks of the river are relatively steep and heavily vegetated. The westernmost section of the park contains a large undeveloped forested area. Land use at Freeland Festival Park can be described as a mixture of emergent forest, maintained grassland, and mixed agriculture. The Freeland Festival Park is located approximately 6.8 miles (11 km) downstream of the Dow dam in Midland.

Imerman Memorial Park encompasses approximately 96 acres. Land use at Imerman can be described as emergent forest, maintained grassland, and mixed agriculture. Imerman Park is located approximately 11.2 miles (18 km) downstream of the Dow dam in Midland.

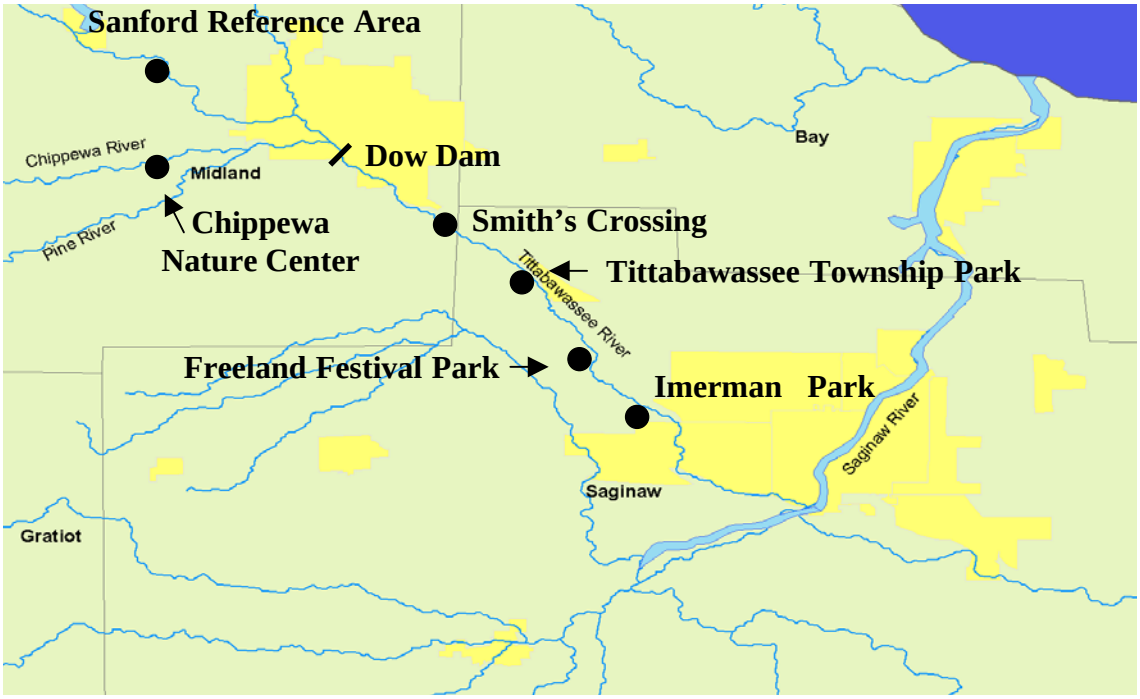

Figure C-1: Sampling Locations along the Tittabawassee River

1.3.5 Decision Rules

The occurrence of PCDD/Fs in biota, and other measures of population health are intended to be descriptive and, therefore, do not involve conventional rules for decision making. However, statistical procedures that are appropriate based on the distribution of any given data set will be used for comparing significant differences between data collected from the downstream study sites and the upstream reference area.

1.3.6 Limits of Decision Errors

Specifying limits on decision errors involves defining the possible decision errors and the consequences of making these errors. Typically, this is done by describing the decisions in terms of hypothesis tests or other objective decision criteria and by specifying the hypotheses to be tested using an appropriate statistical model. Limits can also be specified by identifying the decision errors as false-positive and false negative errors. In this study, the type I error (the false positive decision error; α) will be set at 0.05. The type II error (the false negative decision error; β) will be set at 0.2.

1.3.7 Optimized Sampling Design

The details concerning data collection for use in assessing exposure pathways are provided in the attached SOPs (Appendix H). These methods have been tailored to the physical and logistical constraints associated with obtaining dietary composition information and other endpoint measurements on the receptors of interest in the Tittabawassee River and associated floodplain. If analysis shows that the

sample size is too small while the variability is too great to reduce the probability of a type II error, then target sample size may be adjusted to obtain the additional necessary data to address the objectives of these studies.

1.4 Measurement Endpoints

The measurement endpoints for the exposure pathway analysis are made up of the measured contaminant concentrations in the sediments, soils, and lower food web organisms that are collected as part of this investigation.

1.4.1 Number and Type of Samples to be Collected

A variety of biotic and abiotic samples from the aquatic and terrestrial food webs will be collected at multiple locations and at different time points (Table C-1). The primary objective is to collect representative dietary items that a variety of ecological receptors may consume. Thus, sample sizes will be determined based on a balance between the need to broadly sample as many food web items as is practical and the need to characterize variability in certain food web items. The samples will be collected synoptically (e.g., same time and location) to the extent practical. For key food web items (e.g., small mammals, terrestrial invertebrates as a class, aquatic emergent invertebrates as a class, benthic invertebrates as a class, and fish), a power analysis has indicated that the sample sizes presented below should allow for discrimination of a 20% difference in total PCDD and PCDFs with a type I error of 0.05 and type II error of 0.2. These estimates are based on the standard deviations of concentrations of PCDD and PCDFs measured in sediments and bird eggs to date. These samples will be analyzed for residue concentrations of individual PCDD and PCDF congeners as well as other potential COPECs.

1.4.2 Sampling Frequency and Duration

Some fish (including bullhead, bowfin, northern pike, and some forage fish species) were collected in the fall of 2003 and will be used in this exposure pathway investigation. Other samples for the exposure pathway analysis will be collected primarily in the spring and summer of 2004. The first sampling event will begin in mid to late May and continue for 15 days. The second sampling event will begin 45 days later in either late June or early July and continue for 15 days.

Table C-1. Number and type of samples collected for the exposure pathway analysis.

Matrix	# of Locations	# of Samples Per Sampling Event	# Sampling Event(s)	Total # of Samples
Sediments	6	1 composite	2	12
Aquatic Macrophytes	6	1 composite	2	12
Benthic Invertebrates	6	3 composites separated by orders	2	36
Crayfish	6	1 composite	2	12
Aquatic Emergent Insects	6	3 composites separated by orders	2	36
Fish	3	6	1	18
Forage Fish	6	1 composite (500 g)	2[A]	12
Floodplain Soils	6	1 composite	2	12
Depurated Earthworms	6	1 composite	2	12
Non-depurated Earthworms	6	1 composite	2	12
Frogs	6	1 composite by species	2	12
Terrestrial Macrophytes (consumable leaves)	6	1 composite by species	2	12
Terrestrial Macrophytes (fruiting bodies)	6	1 composite by species	2	12
Terrestrial Invertebrates	6	3 composites separated by orders	2	36
Small Mammals	6	12	2	144

[A] Number of sampling events may vary based on availability of equipment and dietary analyses of great blue herons

1.5 Sampling and Analysis Plans

The sampling design has separate terrestrial and aquatic portions. The terrestrial sampling areas are defined by the 30 m by 30 m small mammal sampling grids. Co-located samples of soil, small mammals, terrestrial vegetation, subterranean terrestrial invertebrates (earthworms), and surface terrestrial invertebrates will be collected synoptically from locations within the small mammal sampling grid. Ideally, surface terrestrial invertebrates will be collected from within that same grid but it may be necessary to expand sampling beyond the boundaries of the small mammal trapping grid to obtain the required biomass and representative samples.

Aquatic samples, including aquatic vegetation, sediments, and benthic invertebrates, will be synoptically collected from the river proximal to the terrestrial sampling grid. The sediment sample will be a composite of samples taken during the collection of aquatic vegetation and sediment-associated benthic invertebrates. Crayfish and aquatic emergent invertebrates will be collected in the same area. Fish will be collected from the Tittabawassee River at Caldwell Boat Launch, Center Road, Freeland Festival Park, and Imerman Park. In addition, fish will be collected upstream of the Dow Dam at two reference areas, the Sanford reference area and the Chippewa Nature Center reference area.

Additional details on the sampling methodology and design are provided below for each sample type.

1.5.1 Sediment

Sediment sample locations will be recorded and samples will be collected using a core or grab sampler (SOP #TR221). As described above, the sediment sample will be a composite of samples taken during the collection of aquatic vegetation and sediment-associated benthic invertebrates. Samples will be placed into clean, labeled buckets, sealed, and stored in coolers during transportation to the laboratory. The actual sample locations may need to be adjusted on-site as deemed necessary by the location of sedimentation zones, physical and navigational obstructions, or other factors. Coring devices and grab samplers will be used to collect sediment depending on conditions at each sampling station. SOP #TR221 - Standard Method for Field Collection of Sediments for Chemical Analyses, provided in Appendix H, contains further detail on how sediments will be sampled.

1.5.2 Soil Sampling

Soil sample locations will be recorded and samples will be collected using a core sampler and/or bucket auger. Samples will be placed into clean, hexane-rinsed glass containers, sealed, and stored in coolers during transportation to the laboratory. SOP #TR220 - Standard Method for Field Collection of Soils for Chemical Analyses, provided in Appendix H, contains further detail on how soils will be sampled.

1.5.3 Terrestrial Vegetation

The sampling procedure and plan is designed to obtain representative samples of edible terrestrial vegetation that typically comprise the diet of birds and mammals. Subsequently, these samples will be sorted into three classes (fruiting bodies, seeds, and edible leaves).

The types of vegetation (fruiting bodies, seeds, and leaves) and genera to be sampled will be representative of the types of plant species consumed by wildlife. Types of fruiting bodies that are typically consumed by wildlife (e.g., robins) include those in the genera Prunus (cherry and plum), Cornus (dogwood), Rhus (sumac), Morus (mulberry), Celtis (elm), Juniperus (juniper), and berries such as hackberries, blackberries, and raspberries. Types of seeds that are typically consumed by wildlife include grasses, shrubs such as buttonbush (*Cephalanthus occidentalis*), acorns (*Quercus spp*.), and pine seeds (*Pinus spp*.). Types of leafy vegetation that are typically consumed by wildlife include numerous genera of grasses, shrubs, and trees. It is likely that not all of the plants listed above will be found and thus will not be sampled and there may be other plants not listed here that are found at the sampling locations that would be consumed by wildlife. It is expected that the field team will collect the most representative sample of each vegetation type that is present at each location and at each time point.

Samples will be carefully collected, cleaned, and appropriately apportioned into fruits, seeds, and consumable leaves. Samples will be collected by the most appropriate method for each sample type. In most cases, fruits, seeds, and leaves will be cut from the main body of the plant with stainless steel scissors while minimizing the amount of non-consumable material as much as possible. In some cases, it may be possible to pull the fruit or seed head from the plant. Large woody stems will be discarded. The samples collected will be located on a sampling map and identified to the lowest practical taxonomic

classification. Sampling tools will be rinsed with hexane followed by isopropyl alcohol followed by DI water between sampling sites. Samples will be rinsed with DI water to remove soil and then stored in clean, hexane-rinsed glass jars and frozen.

Sample size in both weight and number of independent observations is dependent on detection limits and sample variation respectively. For the terrestrial vegetation samples, a biomass of 20 g (dry weight) is recommended for each composite sample to achieve the required analytical detection limits. Percent moisture should be assumed to be 90% for fruiting bodies, 60 % for leaves, and 30% for seeds. Therefore, the approximate biomass that needs to be collected for each sample type is 200 g for fruiting bodies, 50 g for leaves, and 30 g for seeds. SOP #TR227 - Protocol for Sampling the Edible Portions of Terrestrial Vegetation (Fruiting Bodies, Seeds and Consumable Leaves), provided in Appendix H, contains further detail on how terrestrial vegetation will be sampled.

1.5.4 Aquatic Vegetation

The types of vegetation and genera to be sampled will be representative of the types of plant species consumed by wildlife. It is expected that the field team will collect the most representative sample of each vegetation type that is present at each location. Vegetation will be collected simultaneously with the benthic invertebrates and co-located sediment samples by using a ponar grab sampler. Samples of the top ~16 cm will be collected and transferred to a sieve bucket (500 µm) in the field and rinsed of excess sediment and debris. On shore, the plants collected from the grab sampler will be spread out on a plastic sheet, rinsed with distilled water to remove sediment, and separated by species. Consumable portions of plants will be cut from the main body of the plant with stainless steel scissors while minimizing the amount of non-consumable material (e.g., large woody stems) as much as possible. The samples collected will be located on a sampling map and identified to the lowest practical taxonomic classification. Sampling tools will be rinsed with hexane followed by isopropyl alcohol followed by DI water between sampling sites. Each species will be weighed and then all species will be combined into a pooled composite for each sampling location and then stored in chemically clean glass jars.

Sample size in both weight and number of independent observations is dependent on detection limits and sample variation respectively. A representative single composite sample of the aquatic vegetation samples will be collected from each of the sampling locations. For the aquatic vegetation samples, a biomass of 20 g (dry weight) is recommended for each composite sample to achieve the required analytical detection limits. Percent moisture should be assumed to be 75% for general vegetation. Therefore, the approximate biomass that needs to be collected for each location is 80 g wet weight. Refer to SOP #TR222 - Protocol for Sampling the Edible Portions of Aquatic Vegetation, provided in Appendix H, for further details on how vegetation will be sampled.

1.5.5 Subterranean Terrestrial Invertebrates (Earthworms)

At each location, two composite samples of earthworms (approximately 10-20 g for each composite) and one composite sample of approximately 20 g of co-located soil will be collected at the same time. The two different samples of earthworms include: 1) fresh earthworms that have been rinsed in distilled water; and 2) earthworms that have been allowed to depurate soil from their intestinal tract for 24 hours. The depurated earthworms are necessary to calculate site-specific bioaccumulation factors into worm tissue and address the issue of bioavailability. The fresh earthworms are necessary inputs to the food web model since predators consume whole earthworms. The difference between the two types of samples will provide a measure of the amount of incidental soil ingestion that is another necessary input into the food web model.

Earthworms and co-located surface soil samples will be collected by hand digging in each sampling area. Depending on the soil conditions of the actual sampling locations, a combination of shovels and hand spades will be used. The soil will be dug to a depth of approximately 15 cm and may be transferred to a

stainless steel tray outside the plot. If necessary, a series of sieves will be used to break up the soil and distinguish the worms. The soil sieve kit consists of a set of four-stacked stainless steel screens of graduated mesh sizes, a solid pan at the bottom, and a lid. The four sieves are made of high-impact plastic, 6.75 in by 3 in. in size, with wire mesh Nos. 6, 20, 40, 100. According to Nelson and Satchell (1962), this method results in satisfactory recovery of worms weighing over 0.2 grams wet weight.

The approximate volume of excavated soil will be recorded. It is recommended that earthworm samples be identified and separated to the lowest practicable taxonomic unit. Additional specifications for field processing of earthworms include rinsing both earthworm composite samples (target of 10-20 g per composite) from each location with distilled water. One rinsed composite of earthworms will be patted dry, photographed, the weight taken and recorded, transferred into pre-cleaned and labeled pre-cleaned glass sample containers, and frozen as soon as possible with dry ice. The second rinsed composite of earthworms will be placed in petri dishes containing moistened filter paper and stored in a cool, dark location for approximately 24 hours to allow for evacuation of gut contents. After this period, each sample will be rinsed in distilled water, photographed and the weight taken and recorded, and frozen as soon as possible with dry ice. The samples will be stored in a secure facility prior to shipment to MSU. Details of terrestrial invertebrate sampling are provided in the attached SOP #TR226 - Protocol for Terrestrial Invertebrate Sampling and Analysis, provided in Appendix H.

1.5.6 Surface Terrestrial Invertebrates

Ideally, surface terrestrial invertebrates will be collected from within that same grid but it may be necessary to expand sampling beyond the boundaries of the small mammal trapping grid to obtain the required biomass and representative samples.

Sampling surface terrestrial invertebrates will employ a two-tiered approach:

(a) use forceps to collect surface-dwelling terrestrial invertebrates (e.g., beetles, ants, spiders, sowbugs, and millipedes) from the soil surface and leaf litter; and

(b) collecting grasshoppers and other leaf-hoppers from plants using a sweep net and/or an aerial insect net. Sampling plots will not be restricted to a specific area (e.g., one square meter) because the purpose of sampling is to collect as much biomass as necessary for tissue PCDD and PCDF and lipid analysis, rather than to quantify the number of terrestrial invertebrates per unit area of habitat.

Details of terrestrial invertebrate sampling are provided in the attached SOP #TR226 - Protocol for Terrestrial Invertebrate Sampling and Analysis, provided in Appendix H.

1.5.7 Fish

Fish sampling events will be completed in a two-week period to minimize temporal variability. Various fish species, including northern pike, bullhead, and bowfin, will be collected from the Tittabawassee River. In addition, a forage fish total composite weighing 500 grams (made up of fish < 23 cm) will be collected. MSU-ATL personnel will select the appropriate fish sampling techniques based on knowledge of the Tittabawassee River fishery. Based on previous sampling events the primary sampling technique to be employed is electrofishing. It may be necessary to supplement sampling with gill and/or trap netting targeted toward specimens difficult to obtain via electrofishing. In all cases sampling will be accomplished by removal trapping, in which individual organisms are collected from the habitat with each sampling effort. The electrofishing procedure and apparatus utilized depends on numerous variables including but not limited to; access to the sampling location, water depth, rate of flow, sample size requirements and sample species (see attached SOP #TR225 - Protocol for Fish Sampling, provided in Appendix H, for more details).

1.5.8 Amphibians

Amphibian species will be collected from areas adjacent to aquatic emergent insects sampling locations or from areas within or adjacent to the small mammal sampling grid (refer to section 7.3.7.9). Amphibians are targeted for collection since they are expected to make up a significant portion of the great blue heron and belted kingfisher diet. Endangered or species of special concern will not be collected, including Blanchard's cricket frog (*Acris crepitans* blanchardi), the marbled salamander (*Ambystoma opacum*), and the small-mouthed salamander (*Ambystoma texanum*). Amphibian sampling will be accomplished by hand or with the use of a dip net. Amphibians will be euthanized by immersion into a concentrated solution of MS-222. For each captured amphibian, the following observations and measurements will be recorded:

- Species
- Sex (male or female)
- Weight in grams
- Date and time of day of capture
- Collector's initials

Sampling will occur during two different sampling events during the Summer of 2004. Preceding chemical analysis, amphibian samples will be composited by species and location and will be stored at 20°C. A specific SOP for amphibian collections will be developed before sampling commences.

1.5.9 Mammals

The overall small mammal sample will likely be composed of herbivorous, insectivorous, and omnivorous small mammals (e.g., white-footed mice, short-tailed shrews, etc.). The methods described below are designed to simulate the collection of prey available to Great Horned owls, foxes, mink, and other receptors that consume small mammals. The small mammal sampling grid will establish the sample area for all of the terrestrial sampling.

Sampling will occur during two different sampling events during the Summer of 2004. Sampling at each site will employ both baited Sherman live traps and pitfall traps. Trap locations will be selected based on experience and knowledge of preferred foraging and movement behaviors of small mammals. The actual area sampled will be reported and plotted on a sampling map. At each location, both baited Sherman live traps and pitfall traps will be used to collect small mammals. Small mammals will be identified and separated to the lowest practicable taxonomic unit.

The sampling design will consist of a permanent sampling grid at each location. Each grid will contain trap stations at approximately 5 m intervals (allowing for optimization of placement of exact trap locations based on experience and knowledge of preferred foraging and movement behaviors of small mammals). The grids will be designed to allow collection of small mammals from different habitat types. At every other station, either a baited Sherman live trap or a baited pitfall trap will be deployed. During each sampling period, each of the sampling grids will be checked three times per day for a minimum of 5 consecutive days until the target sample size of 10-12 individual mammals is reached. Within each grid, the traps will be put in place one day and left closed overnight, then they will be left open for five days and nights. The purpose of two different types of traps is to minimize potential sampling bias and maximize representativeness of species collected.

Sherman XLF15 aluminum traps will be used. This is an extra long folding live trap that is essentially a tunnel with a door at one end and a sensitive platform at the other. As the mammal walks on the platform

a spring is released which triggers the door to close. Each trap folds down flat for ease of transport. When folded, trap dimensions are 37.5 cm x 11.25 cm and only 1.5 cm thick and weigh 0.5 kg. Bait will consist of rolled oats and peanut butter. Sherman live traps have been used to successfully capture a variety of small rodents, including voles, short-tailed shrews, deer mice, white footed mice, harvest mice, and jumping mice.

Custom designed pitfall traps have been determined to be more efficient than other types of traps for some species of small mammals, including shrews (Blackburn and Andrews, 1992). Pitfall traps will be custom designed from #10 canning tins, and will be buried flush with the ground. Bait will consist of rolled oats and peanut butter (Perkins et. al., 1998).

Traps will be checked three times daily. Optimal hours for checking traps are between 0700 and 0900 hours, again between 1500 and 1700, and finally between 2300 and 0100 hours, but these times may vary. During this time any captures will be collected and processed as described below. Checked traps will be cleaned of any old food or feces, new bait added, and reset. Care will be taken to check the trap mechanisms and maintain a relatively constant degree of tripping sensitivity for all traps. Traps used at more than one site will be washed, as previous studies have reported that the smell of certain species on a trap may deter other individuals or other species from entering (Barnet and Dutton 1995). Fresh bait will be added daily. Bait consists of rolled oats and peanut butter, which is sticky enough to stick to the trip plate of the traps.

Captured mammals will be shaken gently out of the trap into a transparent plastic quart-sized Ziploc bag and sacrificed by cervical dislocation. For each captured mammal, the following observations and measurements will be recorded:

- Species
- Sex (male or female)
- Weight in grams
- Length in millimeters of the head and body, tail, and hind foot
- Trap number
- Date and time of day of capture (to determine if nocturnally or diurnally active)
- Collector's initials

After recording observations and measurements, the sample will be processed as described in the small mammal sampling SOP. Details of small mammal sampling are provided in the attached SOP #TR228 - Protocol for Terrestrial Small Mammal Sampling and Analysis, provided in Appendix H.

1.5.10 Other Biota (Prey Items)

As other items are identified through receptor-specific studies, additional food web items may need to be sampled. In this event, SOPs will be developed and the Work Plan amended to include these additional items.

1.6 Schedule of Reporting

1.6.1 Exposure analysis

By December of 2005, PCDD, PCDF and other COPEC concentrations in soils, sediments, plants, invertebrates, fish, and small mammals from the reference and downstream study areas will be available.

This data will be used to construct a "bottom up" exposure pathway, where COPEC concentrations in lower food web organisms are quantified and extrapolated to predict residue concentrations in higher trophic level receptor species, such as mink and great horned owls. Based on residue concentration data, it will be possible to solidify exposure pathways to receptor species.

1.6.2 Effects analysis

By December of 2005, a preliminary bottom-up risk evaluation will be possible for receptor species. This analysis will contribute a line of evidence to the overall ERA process. The MSU study plans are scheduled to be completed by December of 2008. These include a "top-down" risk evaluation and assessments of receptor species productivity. In the "top-down" risk evaluation, PCDD, PCDF, and other COPECs are directly measured in receptor species of concern and risk is evaluated based on these tissue residue concentrations. Productivity measures of receptor populations will include endpoints that relate back to receptor reproductive success and population stability. For more detailed information on schedules and reports for this ERA, refer to section 7.0 of the BERA Work Plan.

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Appendix D. Study Plan II - Evaluation of Mink

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1.0 STUDY PLAN II – EVALUATION OF MINK - ABUNDANCE, HEALTH, STRESSOR EXPOSURE, AND HABITAT SUITABILITY

1.1 Introduction

To assess whether residues of PCDDs and PCDFs are adversely impacting mink populations, it is first necessary to assess what extent PCDDs and PCDFs are entering the food web and passing to higher trophic level receptors, such as mink. It is then necessary to determine whether PCDDs and PCDFs or other COPECs are having any actual adverse effects on mink populations.

1.2 Purpose and Objectives

Currently, there is no information on the presence or concentration of PCDDs and PCDFs or other possible COPECs in mink that reside within the Tittabawassee River floodplain downstream of Midland, MI or from other locations that could be used as reference areas. A search of the published scientific literature on this question failed to find any available information on concentrations of PCDDs and PCDFs in mink that would be applicable to this study area. As a result, this study plan is designed to:

- Provide information of site-specific dietary exposure data and tissue residue concentrations in mink tissue.
- Develop site specific bioaccumulation factors and biomagnification factors for mink residing at the reference and study locations.
- Assess mink abundance, health and productivity at the reference and downstream sampling locations.
- Assess mink habitat suitability for the reference and downstream sampling locations.

By measuring the exposure of mink to contaminants and by measuring the abundance of mink feeding at the study sites, the degree to which these contaminants pose actual risks to mink on the Tittabawassee River will be assessed. The use of upstream locations will provide information on 'baseline' contaminant exposure and mink abundance to allow a realistic assessment of possible effects attributable to PCDDs and PCDFs in the Tittabawassee River floodplain.

1.3 Data Quality Objectives (DQOs)

1.3.1 Problem Statements

The problem statement relevant to mink on the Tittabawassee River floodplain that is addressed in this WP is provided below.

- To assess potential the risks to mink from exposure to PCDDs and PCDFs in the Tittabawassee River floodplain. The ERA previously conducted on the Tittabawassee by MDEQ (Galbraith, 2003) identified risks to mink from exposure to PCDDs and PCDFs via consumption of contaminated fish (specifically carp, catfish, shad, and bass). These risks need to be reassessed by collection of site-specific dietary exposure data, tissue residue concentrations in mink and other prey items. In addition, data relating to mink abundance on the Tittabawassee River needs to be collected.

1.3.2 Decision Identification

The decision regarding mink will be based on answering the following questions:

- Do concentrations of PCDDs and PCDFs (expressed as total TEQs) in sediments, soils, mink prey items, or mink tissues pose unacceptable risks to mink populations within the Tittabawassee River floodplain downstream of Midland, MI?

The activities proposed in this WP are designed to provide sufficient information and data for answering this question.

1.3.3 Inputs to Decisions

The decision process regarding mink will be supported by the following measurements:

- Concentrations of PCDDs and PCDFs in sediments, soils, and mink prey items from the Tittabawassee River floodplain downstream of Midland, MI and from upstream reference areas.
- Mink abundance (as measured by snow tracks, track boards, and sign surveys) on the Tittabawassee River floodplain downstream of Midland, MI and upstream reference areas.
- Mink Habitat Suitability Index (USFWS HSI Method) determined at 500 m intervals for the Tittabawassee River floodplain downstream of Midland, MI and upstream reference areas.
- Concentrations of PCDDs and PCDFs in mink liver tissue from animals trapped and collected from the Tittabawassee River floodplain downstream of Midland, MI and from upstream reference areas.
- Body length and weight of mink trapped and collected from the Tittabawassee River floodplain downstream of Midland, MI and from upstream reference areas.
- Sex determinations of mink trapped and collected from the Tittabawassee River floodplain downstream of Midland, MI and from upstream reference areas.
- Age determinations (cementum annuli method) of mink trapped and collected from the Tittabawassee River floodplain downstream of Midland, MI and from upstream reference areas.
- Reproductive history (measured as placental scarring in females) of mink trapped and collected from the Tittabawassee River floodplain downstream of Midland, MI and from upstream reference areas.
- Dietary composition, i.e., stomach and scat content analysis of mink trapped and collected from the Tittabawassee River floodplain downstream of Midland, MI and from upstream reference areas.

1.3.4 Spatial and Temporal Boundaries

The spatial boundaries of the mink investigations include the study site, a 23-mile area from the upstream boundary of the Dow Chemical Company to the confluence of the Tittabawassee and Shiawassee Rivers, and upstream reference areas. The specific mink trapping locations will be coordinated with other studies outlined in this document as well as with local landowners. Downstream study areas will include Smith's Crossing, Tittabawassee Township Park, Freeland Festival Park, and the Imerman Park. Reference areas will include the Sanford site located upstream of Midland, MI on the Tittabawassee River and the

Chippewa Nature Center site located upstream of Midland, MI on the Chippewa River. All mink will be collected within 10 m of the river.

The mink trapping season in Michigan extends from mid November to the end of January. Thus, mink trapping began in late 2003. Mink abundance studies will be conducted year round. Mink habitat suitability investigations will be mainly conducted in the summer and fall months.

1.3.5 Decision Rules

The occurrence of PCDD/Fs in biota, and other measures of population health are intended to be descriptive and, therefore, do not involve conventional rules for decision making. However, statistical procedures that are appropriate based on the distribution of any given data set will be used for comparing significant differences between data collected from the downstream study sites and the upstream reference area.

1.3.6 Limits of Decision Errors

Specifying limits on decision errors involves defining the possible decision errors and the consequences of making these errors. Typically, this is done by describing the decisions in terms of hypothesis tests or other objective decision criteria and by specifying the hypotheses to be tested using an appropriate statistical model. Limits can also be specified by identifying the decision errors as false-positive and false negative errors. In this study, the type I error (the false positive decision error; α) will be set at 0.05. The type II error (the false negative decision error; β) will be set at 0.2.

1.3.7 Optimized Sampling Design

If analysis shows that the sample size is too small while the variability is too great to reduce the probability of a type II error, then target sample size may be adjusted to obtain the additional necessary data to address the objectives of these studies.

1.4 Measurement Endpoints

The assessment and measurement endpoints, as well as associated hypotheses for the mink study plan are presented in Table D-1.

Table D-1. Assessment and Measurement Endpoints and Associated Hypotheses for Mink.

Receptor	Assessment Endpoint	Measurement Endpoints	Hypotheses[Note 2]
Mink	Reproductive Success and Population Sustainability	• Mink Habitat Suitability Index (USFWS HSI Method) determined at 500 m intervals for Tittabawassee River floodplain study areas and reference area • Mink abundance (as measured by snow tracks, track boards, and sign surveys) in Tittabawassee River floodplain study areas and upstream reference areas • COPEC analysis of mink tissue in Tittabawassee River floodplain study areas and reference areas • Body length and weight of mink in Tittabawassee River floodplain study areas and reference areas • Sex determinations of mink in Tittabawassee River floodplain study areas and reference areas • Age determinations (cementum annuli method) of mink in Tittabawassee River floodplain study areas and reference areas • Reproductive history (placental scarring in females) of mink in Tittabawassee River floodplain study areas and reference areas • Dietary composition, i.e., stomach and scat content analysis of mink in Tittabawassee River floodplain study areas and reference areas • Parasite presence/absence in internal body organs of mink in Tittabawassee River floodplain study areas and reference area (a final decision has not been made for using this measurement)	• Ha1: The mean mink habitat suitability index (HSI) in the Tittabawassee River floodplain study areas is less than the mean HSI in the reference areas • Ha2: The mean mink abundance in the Tittabawassee River floodplain study areas is less than the mean abundance in the reference areas • Ha3: The HSI-corrected mean mink abundance in the Tittabawassee River floodplain study areas is less than the mean abundance in the reference areas (will only be tested if Ho1 is accepted) • Ha4: The mean tissue COPEC concentrations in mink in the Tittabawassee River floodplain study areas is greater than the TRV • Ha5: The mean COPEC tissue concentrations in mink from the Tittabawassee River floodplain study areas are greater than mink collected in the reference areas • Ha6: The mean body condition index of mink in the Tittabawassee River floodplain study areas is less than the mean index in the reference areas • Ha7: The mean placental scarring in female mink from Tittabawassee River floodplain study areas is less than mink scarring in the reference areas (highly dependent on the success in capturing female mink) • Ha8: The mean COPEC concentrations in mink prey items (e.g., crayfish, fish, and small mammals) in the Tittabawassee River floodplain study areas are greater than those of the reference areas • Ha9: Concentrations of COPECs in the weighted average diet of mink is greater than the dietary TRV

Note**:** For clarity, the hypotheses are presented as alternative hypotheses (Ha) because this is the question to be answered. This can be thought of as the inverse of the null hypothesis (Ho). Acceptance of Ha is equivalent to rejection of the null hypothesis.

Note $_2$: Hypotheses are not meant to be aligned with measurement endpoints.

1.4.1 Target Numbers and Types of Samples to be Collected

Mink and mink scat will be collected throughout the Tittabawassee River floodplain. Scat will be collected opportunistically to determine dietary composition and mink abundance. Mink will be trapped and collected along the Tittabawassee River or from reference locations to obtain liver tissue samples for PCDD and PCDF analysis. In addition, mink stomach contents will be examined to determine diet composition. Other endpoints, such as placental scarring, body length and weight, cementum age and bacculum size will be examined in collected mink. For more detailed methods and sample collections, refer to SOP #TR249 – Dissection of Mink Carcasses (Appendix H). The target number of mink is 10 individuals collected downstream of Midland, MI and 10 individuals collected from upstream reference areas.

1.4.2 Sampling Frequency and Duration

Mink studies began in the spring of 2004 and will continue until the spring of 2007. Trapping of mink will occur during Michigan's mink trapping season, which lasts from early November until the end of January. During the trapping season, set traps will be monitored daily.

1.5 Sampling and Analysis Plan

The following sections detail the methods that will be used when collecting mink and assessing mink abundance along the Tittabawassee River. For more detailed methodologies refer to SOP #TR240 (Mink Habitat Suitability), SOP #TR241 (Trapper's Kit), SOP #TR242 (Dietary Analysis of Scat and Stomach Contents), SOP #TR243 (Track Board Surveys for Mink Abundance Estimation), SOP #TR244 (Placental Scar Identification), SOP #TR246 (Protocol for Conducting Field Sign Surveys of Mink Scat and Tracks during Summer and Winter Months), SOP #TR247 (Field Survey of Mink Trapping Pressure), SOP #TR248 (Mink Tooth Extraction and Cleaning for Cementum Aging) and SOP #TR249 (Dissection of Mink Carcasses) (Appendix H).

1.5.1 Mink Abundance

Because mink are generally nocturnal and secretive, a variety of indirect sampling techniques will be used to estimate their relative abundance and population trends within the Tittabawassee River floodplain and reference areas (Table D-2). This Work Plan incorporates three methodologies to estimate mink abundance in the study site downstream of Midland, MI and the associated reference areas upstream. Namely, those methodologies are snow track surveys, track board surveys, and sign surveys. These three techniques will be used since no one technique can be used under all field conditions.

Two snow track and sign surveys will be conducted on the Tittabawassee floodplain study sites and in associated reference areas to determine the locations that are frequented by mink. These two seasonal surveys will not only determine how prevalent mink are in the Tittabawassee River floodplain, but may also be used long term to monitor mink populations.

Table D-2. Comparison of the utility of various population estimation techniques (modified from Reid et al., 1987).

Technique	Equipment	Field effort	Comments	Reference
Snow track survey	Minimal	Extensive labor-one or more visits	• No sex or age biases • Winter use only	Reid et al., 1987
Track board survey	Elaborate (chalk or sand boards and scent)	Extensive labor-multiple visits	• Can determine other species in study site • Some animals reluctant to step on board	Burgess and Bider, 1980; Robson and Humphrey, 1985
Sign survey (scat and track)	Minimal	Extensive labor-one or more visits	• Can be conducted year-round • Scat may be dependant on time of year and sex	Racey and Euler, 1983; Robson, 1982; Strachan et al., 1990

Detailed survey methods are provided in SOP #TR243 and SOP #TR246 (Appendix H). In winter, mink snow tracks will be recorded. These measurements can only be taken when there is sufficient snow of the right quality to record the passage of mink. Each shoreline survey segment will be 1 km in length, since this length will incorporate a large amount of the daily activity of mink (Whitman, 1981; Gerell, 1970). The study area will be separated into 1 km segments, and segments targeted for survey will be randomly chosen. Only presence/absence will be recorded to eliminate double counting of the same individual. During surveys, scats will be collected for dietary analysis. Since mink naturally occur at low densities, many sample segments can be expected to have no mink tracks present.

During the summer, mink sign surveys will also be conducted in a similar manner as the snow track survey. Since tracks will be more difficult to find, this survey will be more dependent on the marking behavior of mink and the field team's ability to detect signs. However, similar methodologies have been successfully used in the U.K. to monitor population trends in otter (Strachan et al., 1990).

Track boards have been used in Canada to determine if stream modifications altered mink activity (Burgess and Bider, 1980). Using this method will help determine if activity levels of mink are different between two areas in the Tittabawassee River floodplain. Trackboards will consist of sheets of Styrofoam anchored so that the top is flush with the ground and placed perpendicular to the river's edge. Boards will be covered with a layer of fine sand or marking chalk to record the tracks of any animals crossing the transect. Each morning, the boards will be checked to monitor footprints of animals that have crossed the previous day. Additional information can be found in the attached SOP #TR243 – Track Board Surveys for Mink Abundance Estimation, in Appendix H.

1.5.2 Mink Trapping

Members of the Michigan Trapper's Association with a valid fur harvester permit will trap mink and handle and store carcasses within reference areas and within the Tittabawassee River floodplain downstream of Midland, MI during Michigan's trapping season. Efforts will be coordinated to regulate the number of mink collected from each location to reduce any negative population level effects due to

trapping pressure. The field team will conduct trap surveys in the Tittabawassee River floodplain and reference areas during December to determine the total number of traps in the area, as there may be others who trap mink within the floodplain. This survey is designed to determine current trapping pressure and is necessary to evaluate whether additional trapping could negatively affect mink populations. Additional information can be found in SOP #TR247 – Field Survey of Mink Trapping Pressure (Appendix H). All trappers will be provided with collection kits (datasheets, plastic bags, tin foil, etc.) ensuring consistent and adequate quality of tissue labeling (date, location of collection, and sex). Trappers will also be instructed on how to properly preserve the carcass for later analyses (see attached SOP #TR241 – Trapper's Kit, in Appendix H). Random visits to participating trappers will be conducted to ensure that protocols are being followed and that mink are trapped from within the study areas. The trapping study is designed to maximize sample size with enough statistical power to determine if there are differences concentrations of PCDDs and PCDFs in tissue and also body condition between mink from the Tittabawassee River floodplain downstream of Midland, MI and associated upstream reference areas.

1.5.3 Length and Weight Determinations

Length and weight measurements have been used previously to determine the morphological condition of wild mink and similar species (*Lutra canadensis*) (Clode et al., 1995; Harding et al., 1999; Leonards et al., 1996). Wasting syndrome is described as one of the clinical symptoms commonly associated with toxicity of PCDDs and PCDFs (Heaton et al., 1995a). Length and weight measurements will be used as an index of body condition (starvation), and will be used as an indicator of stress. The index of body condition will be calculated by dividing length by weight for each mink carcass. If there are differences in body condition, other measurements will be used to determine the appropriate stressor.

To calculate an index of body condition, a graph with weight and length for all individuals will be developed and a regression line will be fit through these data. The equation generated from this regression will be used to calculate the expected weight of each individual based on the individuals actual weight. The expected weight is then used to calculate a condition index (K).

K = (actual weight)/(expected weight)

K = 1, if actual weight is equal to expected weight

K <1, if actual weight is less than the expected weight

K >1, if actual weight is greater than the expected weight

Portions of internal body organs will be analyzed for the presence of parasites, which can detrimentally affect mink populations.

1.5.4 Age and Sex Determinations

Ascertaining the sex and age of an individual animal is the first step toward defining the sex ratio and age structure of the mink population. These characteristics will provide important insight into the population's recent history, current status, and likely trends in the immediate future (Dimmick and Pelton, 1996).

Mink are sexually dimorphic; therefore, differentiating sex is relatively easy (Petrides, 1950). The examination of bacculum (males) and femur conformation (females) can provide accurate information on aging mink into juvenile or adult age classes (Dimmick and Pelton, 1996; Petrides, 1950; Birney and Fleharty, 1968; Lechleitner, 1953). Actual age of mink (within one year) will be determined by using the cementum annuli method. This procedure involves sectioning the teeth, preparing microscope slides, counting the cementum bands, and interpreting age (Dimmick and Pelton, 1996; Birney and Fleharty, 1968; Lechleitner, 1953; Driscoll and Jones, 1985). QA/QC will involve determining age of two teeth

from the same individual for measurements of precision. Additional information can be found in the attached SOP #TR248 – Mink Tooth Extraction and Cleaning for Cementum Aging (Appendix H).

Placental scars provide an accurate approximation of mink litter sizes (Larson, 1967). Placental scar data from collected female mink will provide information about their reproductive history, estimated litter size, and the potential number of kits whelped, but will not indicate how many kits survived to reproduce. However, it is one indicator of reproductive potential in a population. Placental scars are pigmented areas of uterine tissue marking sites of previous placental attachment (Harder and Kirkpatrick, 1996). Determination of placental scars will be made using the prussian blue reaction, which stains these sites for easier identification (Larson, 1967). The placental scars can be observed using this technique throughout the winter, until mink breed initiates in the spring. The prussian blue method takes more time than macroscopic inspection, but is more effective for preserved specimens. Additional information can be found in the attached SOP #TR244 – Placental Scar Information (Appendix H).

1.5.5 Sample Processing

After mink and mink samples have been collected and tagged in the field and initial documentation has been completed, samples will be stored at –20 °C until dissection and further analysis. Specific details of processing are included in the associated SOPs (SOP #TR242 – Dietary Analysis of Scat and Stomach contents, SOP #TR244-Placental Scar Identification, SOP #TR248-Mink Tooth Extraction and Cleaning for Cementum Aging and SOP #TR249-Dissection of Mink Carcasses). Mink carcasses will be processed at the University Research and Containment Facility (URCF) at Michigan State University. All processing equipment will be cleaned and solvent rinsed between samples. Carcasses will be labeled with unique sample identification numbers, collection times and dates, and initials of researcher who collected the sample. In addition, processing date and time will be recorded as well as the initials of the processor. Collected tissue samples will be kept frozen at approximately –20°C prior chemical analysis.

1.5.6 Prey Items in Diet

Most studies indicate that mink consume a variety of food items (aquatic and terrestrial animals) and that consumption varies by season (Burgess and Bider, 1980; USEPA, 1995; Sealander, 1943; Whitman, 1981). Because the Tittabawassee River floodplain consists of various habitats, there may be differences in feeding habits in different locations of the study area. In this investigation, the examination of stomach contents from carcasses of trapped mink and the analysis of scat from free ranging mink will yield information on mink food items (Litvaitis et al., 1996). Scat offers the advantage of being available year-round and is non-intrusive.

Analysis of stomachs from mink carcasses will be conducted in the winter and will be used to determine the percent occurrence of prey items during this season. Diet analysis using trapped mink may be biased due to the use of bait in traps (Litvaitis et al., 1996). Therefore, scats collected during winter track surveys will supplement dietary data. Only scat will be available for analysis year-round.

Trapped mink will be collected, handled, and stored by trappers according to SOP #TR241 – Trapper's Kit (Appendix H). The mink carcasses will be retrieved from the trappers at the end of the trapping season and transported frozen to the URCF on the MSU campus. Mink carcasses will remain frozen until analysis. Before analysis, the mink will be brought to room temperature and the stomach removed and its content analyzed according to the attached SOP #TR249 – Dissection of Mink Carcasses (Appendix H).

Scat will be located throughout the Tittabawassee River floodplain by shore-walking. Scat will also be collected at track-board stations and incidentally while conducting other field activities. During sign surveys, 500 m transects will be laid out parallel to the river to locate scat. Scat collected in this manner will be used for both abundance and dietary analyses. Scat collected incidentally will be used only for dietary analysis.

Scat will be placed in a manila envelope with an index card indicating date and location of collection. Before analysis, the envelope containing the scat will be autoclaved to ensure the health and safety of personnel because storage does not destroy tapeworm eggs or other endoparasites that may occur in the feces (Litvaitis et al., 1996). Autoclaved scat will be refrigerated until analysis. The contents found in scat and stomachs will be separated into bones, hair, feathers, scales, and miscellaneous components. These components found in the study site downstream of Midland, MI will be compared to the dietary components found in samples collected from reference areas. Dietary items (species) will be identified to family, and when possible to genus. Final results will comprise of a table of dietary items expressed as percent fish, mammal, bird, reptile and amphibian and by area and season. This methodology is routine in most carnivore dietary studies (Racey and Euler, 1983; Casson and Klimstra, 1983; Hamilton, 1936; Arnold and Fritzell, 1987; Cucci et al., 1996; Kelly, 1991; Wise, 1980). For further details on scat analysis, see SOP #TR246 – Protocol for Conducting Field Sign Surveys of Mink Scat and Tracks During Summer and Winter, and SOP #TR242 – Dietary Analysis of Scat and Stomach Contents (Appendix H).

1.5.7 Habitat Suitability

Habitat is an area that contains a combination of resources (food, cover, and water) and environmental conditions (temperature, precipitation, etc.) that promotes occupancy by individuals of a given species and allows those individuals to survive and reproduce. Quality of habitat is related to the rates of survival and reproduction of the individuals that live there, the vitality of their offspring, and the length of time the site remains suitable for occupancy (Morrison et al., 1992). Within a given area, there may be specific ecosystem types that will not meet habitat requirements of a particular species.

Habitat Suitability Indices (HSIs) provide a tool that wildlife managers can use to predict the distribution and abundance of a species, as well as to quantify and evaluate the effects of human alterations of the environment. The HSI for mink developed by the U.S. Fish and Wildlife Service (Allen, 1986) will be used to quantify mink habitat suitability on the Tittabawassee River floodplain. HSI values can range from 1.0 for optimal habitat to 0.0 for completely unsuitable habitat. The HSI model provides habitat information useful for impact assessment and habitat management (Allen, 1986), and it has been field verified in the Great Lakes basin and has accurately predicted suitable mink habitat (Loukmas, 1994).

If the HSI predicts that mink could be present in select locations on the Tittabawassee River floodplain, but the monitoring program indicates that they are not, there may be several reasons for their absence. One reason is the effects of chemicals, but other stressors such as human disturbance or trapping pressure could account for the discrepancy.

The HSI is defined as:

$$\text{HSI} = \frac{\text{Habitat conditions at the site}}{\text{Optimum habitat conditions}}$$

In order to attain an HSI score of 1.0 for mink, the following variables must be present in a riverine system (Allen, 1986):

- 75% (or more) of year with surface (river) water present;
- 75% (or more) canopy cover of trees and shrubs within 100 m of river's edge; and
- 100% shoreline cover within 1 m of river's edge.

Areas within the Tittabawassee River floodplain that do not have a sufficient canopy cover or shoreline cover would result in lesser HSI values.

On-site inspection will be necessary to measure HSI components (percent canopy cover and shoreline cover). Field crews will measure percent canopy cover and shoreline cover (overhanging or emergent vegetation, undercut banks, exposed roots, rock crevices, etc.). Field crews will also measure other variables which relate to structural diversity (e.g. # fallen trees, vegetative density).

Abundance will be corrected (if necessary) for HSI according to the method described in Escherich and Rosenberger (1987). If there is a difference in habitat suitability among areas, then mink abundance estimate differences may be due to habitat considerations. Adjustment of abundance estimates is warranted. Adjustment for habitat suitability differences will occur by using the following equation:

$$\text{Corrected abundance} = \frac{\text{Abundance}}{\text{HSI}}$$

If there are still differences in corrected abundance estimates among areas, these differences may be caused by stressors other than habitat (e.g. PCDD and PCDF exposure). Additional information can be found in SOP #TR240 – Habitat Suitability (Appendix H).

1.6 Schedule of Reporting

1.6.1 Exposure analysis

By December of 2005, PCDD, PCDF and other COPEC concentrations in soils, sediments, and mink dietary food items from the reference and downstream study areas will be available. It is also expected that the stomach contents of several mink from the reference and downstream study site will have been examined to quantify the dietary composition of mink. This data will be used to construct a “bottom up” exposure pathway for mink, where COPEC concentrations in lower food web organisms are quantified and extrapolated to predict residue concentrations in mink. Based on residue concentration data, it will be possible to estimate mink exposures to PCDDs, PCDFs, and other COPECs.

1.6.2 Effects analysis

By December of 2005, a preliminary bottom-up risk calculation will be possible for mink. It is expected that most, if not all, mink dietary items will have been collected and analyzed for COPEC concentrations. Preliminary data on PCDD and PCDF residue concentrations in mink liver may also be available by December 2005 for preliminary estimates of PCDD and PCDF risk toward mink based on the “top-down” approach. Mink productivity data, such as abundance, reproductive history, length, weight etc., is expected to be available in December of 2008. By December of 2008, it is expected that multiple lines of evidence, including risk calculations from both “bottom-up” and “top-down” approaches, as well as mink productivity data, will be integrated to evaluate risk toward mink inhabiting the downstream study areas on the Tittabawassee River and Floodplain. For more detailed information on schedules and reports for this ERA, refer to section 7.0 of the ERA Work Plan.

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Appendix E. Study Plan III - Evaluation of Passerine Birds

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1.0 STUDY PLAN III – EVALUATION OF PASSERINE BIRDS – STRESSOR EXPOSURE, REPRODUCTIVE SUCCESS, AND HABITAT SUITABILITY

1.1 Introduction

To assess whether residues of PCDDs and PCDFs are adversely impacting passerine bird populations, it is first necessary to assess what extent PCDDs and PCDFs are entering the food web and passing to higher trophic level receptors, such as passerine birds. It is then necessary to determine whether PCDDs and PCDFs or other COPECs are having any actual adverse effects on passerine bird populations.

Avian (non-raptor) reproduction may be sensitive to the adverse effects of PCDDs and PCDFs contamination. As such, regulators frequently utilized non-raptor bird reproduction as an indicator of ecological effects. This can be most conveniently measured in species such as American robins, house wrens and swallows, which are either amenable to nesting in artificial nest-boxes or nest in easily accessible natural nests. Bird nest box and natural nest studies have proven useful in determining the accumulation and effects of environmental contaminants on birds (Nichols et al. 1995; Secord and McCarty, 1997). In particular the tree swallow (*Tachycineta bicolor*), the American robin (*Turdus migratorius*), and the house wren (*Troglodytes aedon*) have been used to assess the availability of non-polar contaminants from aquatic and terrestrial environments (Nichols et al. 1995; Froese et al. 1998). The use of these species has been extensively investigated and is widely accepted by regulatory agencies such as EPA and FWS as an indicator species for contaminant availability and effects. In addition standard methods are available for sampling and reproductive assessment (Secord and McCarty, 1997).

1.2 Purpose and Objectives

Due to the results of previous investigations demonstrating that some concentrations of PCDDs and PCDFs in the Tittabawassee River floodplain soils downstream of Midland are greater than those from reference locations (MDEQ, 2002, 2003; Hilsherova et al., 2003), questions have been raised regarding the potential risk to passerine birds that reside and/or forage within the Tittabawassee River and associated floodplain. Currently, there is no information on the presence or concentration of PCDDs and PCDFs in passerine birds that reside within the Tittabawassee River and associated floodplain downstream of Midland, Michigan or from other locations that could be used as reference areas. A search of the published scientific literature on this question failed to find any available information on concentrations of PCDDs and PCDFs in passerines that would be applicable to this Site. As a result, this Study Work Plan is designed to:

- Provide information of site-specific dietary exposure data and tissue residue concentrations in eggs, nestlings, and adult passerine birds
- Develop site specific bioaccumulation factors and biomagnification factors for passerine birds residing at the reference and study locations
- Assess passerine abundance, health and reproductive success at the reference and downstream sampling locations
- Assess passerine habitat suitability for the reference and downstream sampling locations
- Assess the toxic potential of additional chemical stressors in passerine tissues (PCBs and DDT metabolites),

These studies will determine whether passerine birds are exposed to contaminants present in Tittabawassee River sediments and/or floodplain soils and if so to what extent. By measuring exposure to contaminants we will be able to accurately assess the degree to which these contaminants pose actual risks to birds at the site. By measuring the reproductive success of birds feeding at the site with known exposure to contaminants we will be able to determine whether contaminants are having any adverse effects on passerine reproductive endpoints. The use of upstream locations will provide information on 'baseline' contaminant exposure and productivity to allow a realistic assessment of possible effects attributable to PCDDs and PCDFs in the Tittabawassee River floodplain.

1.3 Data Quality Objectives (DQOs)

1.3.1 Problem Statements

The problem statement relevant to passerine birds on the Tittabawassee River and associated floodplain that is addressed in this WP is provided below.

- Risk toward insectivorous/ omnivorous birds was not specifically evaluated in the previous ERA conducted by MDEQ (Galbraith, 2003). However these birds have been shown to be sensitive to the effects of PCDDs and PCDFs (Tillitt et al., 1993; Custer et al., 2003). Therefore, potential risk to passerine birds needs to be evaluated by collection of site-specific dietary exposure data, tissue residue concentrations in eggs, nestlings, and adult birds, and productivity.

1.3.2 Decision Identification

The decision regarding passerine birds will be based on answering the following question:

- Do concentrations of PCDDs and PCDFs in sediments, soils, prey items, and bird tissues pose unacceptable risks to insectivorous/omnivorous passerine birds on the Tittabawassee floodplain downstream of Midland, MI?

The activities proposed in this WP are designed to provide sufficient information and data for making this decision.

1.3.3 Inputs to Decisions

The passerine birds that will be studied along the Tittabawassee River floodplain include the American robin, eastern bluebird, house wren and tree swallow. The decision process regarding the passerine birds will be supported by the following measurements:

- Concentrations of PCDDs and PCDFs in sediments and soils collected from the Tittabawassee River floodplain downstream of Midland, MI and from upstream reference areas.
- Growth (body weight) in chicks measured during nest box studies on the Tittabawassee River floodplain downstream of Midland, MI and at upstream reference areas.
- Reproductive success measured as egg production (no. eggs/nest), hatching success, deformities in hatchlings, and embryo mortality during nest box studies on the Tittabawassee River floodplain downstream of Midland, MI and at upstream reference areas.
- Concentrations of PCDDs and PCDFs in eggs, nestlings, and adult passerines collected from the Tittabawassee River floodplain downstream of Midland, MI and from upstream reference areas.

- Thickness of eggshells collected from the Tittabawassee River floodplain downstream of Midland, MI and from upstream reference areas.
- Observations of passerine dietary composition on the Tittabawassee River floodplain downstream of Midland, MI and at upstream reference areas.
- Concentrations of PCDDs and PCDFs in dietary items, including terrestrial invertebrates, aquatic emergent insects, and various plant tissues (fruiting bodies and other edible tissues such as berries, seeds, and grasses), collected from the Tittabawassee River floodplain downstream of Midland, MI and from upstream reference areas.

1.3.4 Spatial and Temporal Boundaries

The spatial boundaries of the passerine investigations include the study site, an area from the upstream boundary of The Dow Chemical Company to the confluence of the Tittabawassee and Shiawassee Rivers, and upstream reference areas. Specific bird box locations will be coordinated with other studies outlined in this document as well as with local landowners. Downstream study areas will include Smiths Crossing, Tittabawassee Township Park, Freeland Festival Park, and the Imerman Park. Reference areas will include the Sanford site located upstream of Midland, MI on the Tittabawassee River and the Chippewa Nature Center site located upstream of Midland, MI on the Chippewa River. Bird boxes at study site locations will be deployed within the estimated 100-yr Tittabawassee River floodplain.

Bird boxes will be placed at study and reference locations in the spring of 2004, 2005. Tissue samples will be collected beginning in the spring of 2005, after birds have been established in the bird boxes. Egg, nestling, and adult passerine tissue collections will take place during the spring and summer months.

1.3.5 Decision Rules

The occurrence of PCDD/Fs in biota, and other measures of population health are intended to be descriptive and, therefore, do not involve conventional rules for decision making. However, statistical procedures that are appropriate based on the distribution of any given data set will be used for comparing significant differences between data collected from the downstream study sites and the upstream reference area.

1.3.6 Limits of Decision Errors

Specifying limits on decision errors involves defining the possible decision errors and the consequences of making these errors. Typically, this is done by describing the decisions in terms of hypothesis tests or other objective decision criteria and by specifying the hypotheses to be tested using an appropriate statistical model. Limits can also be specified by identifying the decision errors as false-positive and false negative errors. In this study, the type I error (the false positive decision error; α) will be set at 0.05. The type II error (the false negative decision error; β) will be set at 0.2.

1.3.7 Optimized Sampling Design

The details concerning how data will be collected for use in assessing ecological risks to passerine birds are provided in the SOPs (Appendix H). These methods have been tailored to the physical and logistical constraints associated with obtaining endpoint measurements on the receptors of interest in the Tittabawassee River floodplains. If analysis shows that the sample size is too small while the variability is too great to reduce the probability of a type II error, then target sample size may be adjusted to obtain the additional necessary data to address the objectives of these studies.

1.4 Measurement Endpoints

The assessment and measurement endpoints, as well as associated hypotheses for the passerine study plan are presented in Table E-1.

Table E-1. Assessment and Measurement Endpoints and Associated Hypotheses for Passerines.

Receptor	Assessment Endpoint	Measurement Endpoints	Hypotheses (Note 2)
Passerine Birds	Reproductive Success and Population Sustainability	• Observations of dietary composition in Tittabawassee River floodplain study areas and reference areas • Concentrations of COPECs in bird eggs from Tittabawassee River floodplain study areas and reference areas • Concentrations of COPECs in chicks (whole body homogenates) from Tittabawassee River floodplain study areas and reference areas • Concentrations of COPECs in dietary items, including aquatic emergent insects in Tittabawassee River floodplain study areas and reference areas • Reproductive success measured as egg production (no. eggs/nest), hatching success, deformities in hatchlings, and embryo mortality during nest box studies in Tittabawassee River floodplain study areas and reference areas • Growth (body weight) in chicks measured during nest box studies in Tittabawassee River floodplain study areas and reference areas • Thickness of eggshells from Tittabawassee River floodplain study areas and reference areas	• Ha1: The mean egg production (no. eggs/nest) of birds in the Tittabawassee and Sagniaw River floodplain study areas is less than mean egg production in the reference areas • Ha2: Mean hatching success of birds in the Tittabawassee River floodplain study areas is less than hatching success in the reference areas • Ha3: Mean deformities in hatchlings in the Tittabawassee River floodplain study areas is greater than hatchling deformities in the reference areas • Ha4: Mean embryo mortality of birds in the Tittabawassee River floodplain study areas is greater than mortality of embryos in the reference areas • Ha5: Mean chick growth (body weight) of birds in the Tittabawassee River floodplain study areas is less than growth in the reference areas • Ha6: Mean eggshell thickness of eggs collected in nests from the Tittabawassee River floodplain study areas is less than the reference areas • Ha7: Eggshells collected from nests in the Tittabawassee River floodplain study areas and reference areas have mean eggshell thickness less than a thickness of 85% of pre-1947 eggs • Ha8: Mean concentrations of COPECs in chick tissues (whole chick homogenates) and bird eggs collected from the Tittabawassee River floodplain study areas are greater than concentrations in the reference areas • Ha9: Mean concentrations of COPECs in chick tissues (whole chick homogenates) and bird eggs collected from the Tittabawassee River floodplain study areas are greater than the TRVs • Ha10: The mean COPEC exposure concentrations via diets in the Tittabawassee River floodplain study areas are greater than concentrations in the reference areas • Ha11: The mean COPEC exposure concentrations via diets in the Tittabawassee River floodplain study areas are greater than their respective TRVs

Note**:** For clarity, the hypotheses are presented as alternative hypotheses (Ha) because this is the question to be answered. This can be thought of as the inverse of the null hypothesis (Ho). Acceptance of Ha is equivalent to rejection of the null hypothesis.

Note $_2$: Hypotheses are not meant to be aligned with measurement endpoints.

1.4.1 Target Numbers and Types of Samples to be Collected

Sample sizes will be balanced to the extent that nest box utilization allows. The target total sample sizes will be 6 eggs and 6 nestlings per year from both reference and downstream study locations.

1.4.2 Sampling Frequency and Duration

Nest boxes will need to be deployed before the early spring of 2004 to allow nesting in March-May 2004. Nesting success may not be optimal until the return of experienced birds in the spring of 2005. Therefore, effort for this study will commence in early 2004 with productivity measurements beginning in 2005. Nests will be checked every second day to determine the initiation day for the clutch and clutch size. Nest checks will continue daily during the egg incubation period.

1.5 Sampling and Analysis Plan

Studies will be broken down by species and exposure profiles. Studies focusing on American robin and house wren will be used to demonstrate the exposure and impacts of contaminants associated with floodplain soils and the terrestrial food web. Tree swallows will be utilized to examine the exposure and impacts of contaminants associated with sediments and the aquatic food web. During the nesting period, egg production and chick growth will be measured as indicators of reproductive capacity using previously described methods (Secord and McCarty, 1997). Detailed methodologies for nest box monitoring and sample collections are provided in SOP #TR262 - Protocol for Monitoring and Collection of Box-Nesting Passerine Birds (Appendix H).

1.5.1 Nest Box Passerines (Tree swallows/House wrens)

The tree swallow is commonly found in areas surrounding water bodies and occurs throughout the northern half of North America. Tree swallows nest in cavities and can be readily induced to nest in artificial nest boxes (Secord and McCarty, 1997). This species is also considered to be extremely tolerant of human disturbance during nesting. These attributes make the tree swallow an ideal passerine model for the assessment of ecological risk from chemicals.

1.5.1.1 Nest Box Construction

The sampling and analysis of tree swallows and house wrens will follow the procedures developed for examining the effects of PCBs in tree swallows in New York state by the USFWS (Secord and McCarty, 1997; McCarty and Secord, 1999; Secord et al., 1999). Nest boxes will be constructed with the following interior dimensions (12 cm x 12 cm x 20 cm) and a 3.5 cm diameter entrance hole. Each nest box will be mounted on a metal conduit to achieve a nest box height of approximately 1.5 m above ground. Each conduit will be equipped with a 50 cm diameter conical predator guard located below the box. To maximize habitation by tree swallows, nest boxes will be placed at least 10 meters from tall vegetation (Rendell and Robertson, 1990). For house wrens, nest boxes will be place in closer proximity to tall vegetation or forest edges (< 10 m). In addition, to reduce the effect of nest density on reproductive success, nest boxes will be placed at least 20 m apart. To maximize potential for PCDD and PCDF exposures and sampling efficiency, nest boxes will be placed between 10 and 50 meters from the river, in areas of high benthic invertebrate productivity.

1.5.1.2 Nest Box Monitoring

Nest boxes in study and reference sites will be monitored to determine nest attentiveness and abandonment behavior as well as productivity. Nest monitoring will begin in late April of the second breeding season after placement. Nests will be checked every second day to determine the initiation day

for the clutch and clutch size. Nest checks will continue daily during incubation. Incubation will be determined by the presence of the female on the nest or by whether the eggs are warm to the touch. Completed clutches that are cold on two or more consecutive nest checks will be declared abandoned. Eggs in abandoned nests will be left undisturbed until the presence of new nesting material indicates that the adults have resumed nesting and/or no further activity is observed for seven days. After seven days for abandoned clutches or within 5 days of the last hatchling for individual eggs, eggs will be collected for determination of degree of development and PCDD and PCDF content. Study will terminate 14 days after the last egg has hatched.

Nest boxes will be placed at each site, and will be monitored during the nesting season. This period will probably last from mid-March to early-June and will be influenced by the bird's breeding behavior. Each nest box will be monitored for nesting activity, nest attentiveness, adult behavior, and nest abandonment throughout the breeding season. The number of eggs laid, chicks hatched, and fledglings present will be recorded in each nest box on a daily basis throughout the breeding season. Each observation of boxes will last 30 minutes. Nest boxes will be checked between the hours of 10:30am and 3:30pm once every three days until the first egg is laid in an individual nest after which nest boxes will be checked daily. Adult behavior will be observed and recorded on 1-minute time markers. The total number of times the adult(s) come to the nest during the one-minute interval will also be recorded. Additional information can be found in SOP #TR262 - Protocol for Monitoring and Collection of Box-Nesting Passerine Birds, and SOP#TR264 - Protocol for Bird Necropsy, Egg and Shell Examination, and Tissue Archive (Appendix H).

During each observation, nest boxes will be examined for the presence and amount of nesting material and number, age, and weight of eggs. Viable eggs will be collected from each site based on a random selection from actively incubating nests. A maximum of one egg will be collected from any one nest. In addition, all eggs which fail to hatch due to abandonment and or non-viability will be collected for analysis of developmental stage and PCDD and PCDF content.

While examining nestlings, adults will be captured for weight determinations and the collection of diet samples (boluses). Food boluses will be collected from the adult tree swallows mouth. Boluses typically consist of 1 to 50 or more insects that will be transferred to a sample vial containing 75% ethyl alcohol. The sex of the adult tree swallows captured will be recorded and will be based on the presence or absence of a vascularized brood patch, which is found only on females. Female age status will be recorded and will be based on the presence or absence of sub adult plumage.

Nestlings will also be collected for PCDD and PCDF analysis. Chicks will be collected from each site when the mean nestling age is 15 days (1-2 days before fledgling). Chicks will be removed from the nest, weighed, and placed in a collection bag and euthanized using CO_2 asphyxiation. Age and weight will be recorded for each chick.

1.5.2 Natural Nest Passerines (American Robin)

The general approach to evaluating the reproductive success and productivity of robins will be to identify as many robin nests as possible within the Tittabawassee River floodplain and in reference areas upriver of the study sites. In nest identified in the survey, clutch size, hatching success and fledging success will be monitored in each of the selected nests. From each nest, one egg and one nestling will be collected and analyzed for PCDDs and PCDFs concentrations. Finally, the data will be analyzed for statistical relationships between PCDDs and PCDFs and measures of reproductive success and for differences of reproductive success between the study area and the reference locations.

1.5.2.1 Nest Searching

Each area will be searched for nests by foot. Robin nests will be identified based on the appearance of the nests as well as by the presence and behavior of nearby robins. Robin nests are mostly built out of grass or other vegetation and possess and inner mud layer that is lined with fine grass (Sallabanks and James, 1999). Once a nest is located, it will be checked to determine if it contains eggs or nestlings. Nests that are too high to be viewed directly will be evaluated by feel or by use of a mirror on a telescoping pole. If the nest has fresh mud or contains eggs or nestlings, it will be considered active and measurements will be taken. If no adults, eggs, or nestlings are present when a nest if found, the nest will be observed from a distance for up to 20 minutes. If no adults appear, the location will be recorded and revisited again within three to five days to check for adult activity or eggs and to confirm if it was an active robins nest.

The behavior of adult robins in the field will be used as an indicator of the likelihood of a nest being located nearby. Behaviors indicating nearby nesting sites are: male territorial singing, male territorial defense against other males, robin pairs feeding together, defensive robin calling, females carrying nesting material, or robins of either sex carrying food. Using these behaviors, nests will be located by observation of the adults. If nests are found prior to the addition of the mud layer, the nest location will be noted and visited up to five days later to determine if it has been completed. Nest locations will be determined using a hand-held global positioning system unit for use in relocating nest during subsequent field activities. Location of each nest will be hand-drawn on maps.

1.5.2.2 Nest Measurements

Potential predator accessibility will be determined based on three factors, including conspicuousness of the nest. Nest conspicuousness will be considered by rating the volume of foliage within one meter of the nest as low, medium or high. Accessibility of ground predators will be evaluated by rating the proximity of the nest to large branches as low (distal to main trunk, on small branches), medium (on middle sized branches) or high (proximal to main trunk). The isolation of the nest tree or shrub will be assessed by ranking the nest tree's isolation as low (part of continuous vegetation), medium (isolated within continuous vegetation or at the edge of continuous layer of foliage), or high (completely isolated form adjacent vegetation). This index is only relevant for sight-based predators and is based on the premise that such predators use the same habitat features that human observers use to locate nests. This index is not a measure of vulnerability to predators that hunt by scent.

1.5.2.3 Nest Monitoring

Active nests will be monitored at least every three days during the season. To minimize the likelihood of flushing females from nest during critical periods when temperature may stress eggs, nests will not be visited when air temperatures are below 50°F (10°C) or if it is raining. On the first visit to active nests, parental attentiveness will be assessed by evaluating the following parameters: (1) the distance when the female is flushed off the nest when a researcher approaches, (2) the number of calls during a one-minute period with a researcher at the nest, (3) the number of approaches by the adult male or female to a stick or other object held over the nest during a one-minute period , and (4) the closest distance of an adult robin to the nest during the one-minute period.

On each visit to the nest, the number of eggs and nestlings will be recorded. The development of nestlings will also be recorded during each visit and will be based on whether eyes are open and the extent of feather development. Other observations during the visit will include whether the female was flushed from the nest, the presence of adults calling near the nest or if adults were carrying food near the nest. For nests too high to be viewed directly from the ground, observations will be made with binoculars for up to 10 minutes for any adult activity.

Nest outcome will also be recorded. If a nest is not successful, the outcome will be defined as (1) never being initiated, (2) being abandoned, or (3) being depredated. These outcomes will be determined as follows. Nests that were never initiated will be defined as such because either: a) mud or grass linings were never added; b) adults were never observed in the vicinity of the nest; and/or c) eggs were never observed in the nest. Nest will be defined as abandoned if they have been confirmed active during the breeding season but activity ceased prior to completion of the reproductive cycle and there was not evidence of disturbance of the nest. Nest that were defined as depredated if all eggs or nestlings disappeared before the young were old enough to fledge. If young were absent but old enough to fledge, nests were classified as complete or successful.

During each observation, nest boxes will be examined for the presence and amount of nesting material and number, age, and weight of eggs. Viable eggs will be collected from each site based on a random selection from actively incubating nests. A maximum of one egg will be collected from any one nest. In addition, all eggs which fail to hatch due to abandonment and or non-viability will be collected for analysis of developmental stage and PCDD and PCDF content.

While examining nestlings, adults will be captured for weight determinations. The sex of the adults captured will be recorded. Nestlings will be collected from nests with three or more nestlings. Nestlings will be collected at approximately 7 days of age. The age will be estimated from the hatching date or if hatching date is uncertain, from feather development and timing of when eyes opened. At the time when nestlings are determined to be 7 days old, a random nestling will be collected for analysis.

1.5.3 Sample Processing

After samples have been collected and tagged in the field and initial documentation has been completed, samples will be initially processed at a secured laboratory facility. Specific details of processing are included in SOP#TR264 - Protocol for Bird Necropsy, Egg and Shell Examination, and Tissue Archive (Appendix H). Adult, egg and nestling samples will be processed in a clean workspace to prevent contamination of samples. All processing equipment will be cleaned and rinsed between samples. Samples will be labeled with unique sample identification number, collection time and date, and initials of researcher who collected the sample. In addition, processing date and time will be recorded as well as the initials of the processor. Samples will be kept frozen at approximately –20°C prior to chemical analysis.

1.5.4 Prey Items in Diet

Tree swallows feed by catching insects on the wing. Occasionally tree swallows will eat insects from foliage or from the ground. Berries are eaten when insect abundance is low (Ehrlich et al., 1988). House wrens feed on small terrestrial insects, beetles, caterpillars and bugs in low woody vegetation (Degraaf and Yaminski, 2001). American robins primarily feed on worms, terrestrial insects and fruits. Approximately 60% of the robin's diet is vegetable matter and 40% is animal matter (DeGraaf and Yaminski, 2001).

1.5.5 Habitat Suitability

Habitat Suitability Indices (HSIs) provide a tool that wildlife managers can use to predict the distribution and abundance of a species, as well as to quantify and evaluate the effects of human alterations of the environment. HSI values can range from 1.0 for optimal habitat to 0.0 for completely unsuitable habitat. If the HSI predicts that passerine birds could be present in select locations on the Tittabawassee River floodplain, but the monitoring program indicates that they are not, there may be several reasons for their absence. One reason is the effects of chemicals, but other stressors such as human disturbance or predation pressure could account for the discrepancy.

The HSI is defined as:

$$HSI = \frac{\text{Habitat conditions at the site}}{\text{Optimum habitat conditions}}$$

1.5.6 American Robin Habitat Suitability

The HSI that will be used for the American robin was developed by Neigh (2004a) and was based on the U.S. Fish and Wildlife Service Habitat Suitability Index Model (Schamberger, 1982). In order to attain an HSI score of 1.0 for American robins, the following variables are should be present at the site:

- Mud (critical component for nest-building)
- Earthworms (important food item and casings used for nest building)
- Appropriate nesting substrate, such as forked trees with at least a 10 cm diameter at breast height (dbh)
- Foraging habitat (grassland areas with vegetation between 2 and 30 cm in height)
- Fruiting vegetation
- An interspersion of necessary habitat types (for example forested areas for nesting and grassland areas for foraging).

On-site inspection will be necessary to measure HSI components for the American robin (vegetation height, number of fruiting vegetation, number of trees suitable for nesting). Field crews will measure these variables while conducting nest surveys. Habitat Suitability will be calculated according to Neigh, 2004a. American robin abundance will be corrected (if necessary) for HSI according to the method described in Escherich and Rosenberger (1987). Adjustment for habitat suitability differences will occur by using the following equation:

$$\text{Corrected abundance} = \frac{\text{Abundance}}{\text{HSI}}$$

If there are still differences in corrected abundance estimates among areas, these differences may be caused by stressors other than habitat (e.g. PCDD and PCDF exposure).

1.5.7 House Wren and Tree Swallow Habitat Suitability

Currently, there are no habitat suitability models that have been specifically validated by USFWS for the house wren or the tree swallow. Therefore, environmental data will be collected during nest box surveys and used for later habitat suitability calculations Neigh, 2004b. The following environmental variables will be noted for determination of habitat suitability for the house wren and tree swallow:

- View from the nest box (degree of unobstructed view from the entrance of the nest $\leq$ 180°)
- Distance to the nearest tree or perch (perchable limbs include limbs that are separate from the tree canopy or lack foliage)
- Distance from nest box to forest edge (Edge should have > 20 trees that are no greater than 5 m apart)
- Major cover type within 100m radius of the nest.

On-site inspection will be necessary to measure HSI components for the nest box passerines. Field crews will measure these variables while conducting nest surveys. Habitat Suitability will be calculated

according to Neigh, 2004b. Nest box passerine abundance will be corrected (if necessary) for HSI according to the method described in Escherich and Rosenberger (1987). Adjustment for habitat suitability differences will occur by using the following equation:

$$\text{Corrected abundance} = \frac{\text{Abundance}}{\text{HSI}}$$

If there are still differences in corrected abundance estimates among areas, these differences may be caused by stressors other than habitat (e.g. PCDD and PCDF exposure).

1.6 Schedule of Reporting

1.6.1 Exposure analysis

By December of 2005, PCDD, PCDF and other COPEC concentrations in soils, sediments, and passerine dietary food items from the reference and downstream study areas will be available. It is also expected that bolus samples and stomach contents of tree swallows, house wrens, and American robins will have been examined to quantify the various dietary compositions of passerines collected from the reference and downstream study sites. This data will be used to construct a "bottom up" exposure pathway for passerine birds, where COPEC concentrations in lower food web organisms are quantified and extrapolated to predict residue concentrations in bird tissues. Based on residue concentration data, it will be possible to estimate the exposure of passerine birds to PCDDs, PCDFs, and other COPECs.

1.6.2 Effects analysis

By December of 2005, a preliminary "bottom-up" risk evaluation will be possible for passerine birds, such as house wrens, American robins, and tree swallows. It is expected that many passerine bird dietary items will have been collected and analyzed for COPEC concentrations. By December of 2008, residue concentrations of PCDDs, PCDFs, and other COPECs, such as DDT and its metabolites, in passerine eggs, nestlings, and adults will be available for risk calculations based on the "top-down" approach. Passerine productivity data, such as clutch size, % hatch, % fledged etc., is expected to be available in December of 2008. By December of 2008, it is expected that multiple lines of evidence, including risk calculations from both "bottom-up" and "top-down" approaches, as well as passerine productivity data, will be integrated to evaluate risk toward passerine birds inhabiting the downstream study areas on the Tittabawassee River and associated floodplain.

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Appendix F. Study Plan IV - Evaluation of Raptors

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1.0 STUDY PLAN STUDY PLAN IV – EVALUATION OF RAPTORS – STRESSOR EXPOSURE, AND REPRODUCTIVE SUCCESS

1.1 Introduction

To assess whether residues of PCDDs and PCDFs are adversely impacting passerine raptor populations, it is first necessary to assess what extent PCDDs and PCDFs are entering the food web and passing to higher trophic level receptors, such as raptors. It is then necessary to determine whether PCDDs and PCDFs or other COPECs are having any actual adverse effects on raptor populations.

Raptors attract considerable public, regulatory and scientific interest, and as such, are typically high profile receptors of concern in ecological risk assessments. As top predators in terrestrial and aquatic food webs, they have the greatest potential exposure for bioaccumulative contaminants, such as PCDDs and PCDFs. To assess exposure to and effects of PCDDs and PCDFs in the study site and associated reference areas on the Tittabawassee River floodplain, two species of raptors will be investigated in this study. These investigations will focus on both the aquatic and terrestrial food webs by investigating accumulation and effects in bald eagles (*Haliaeetus leucocephalus*) and great horned owls (*Bubo virginianus*).

Great horned owls have been shown to be excellent representatives for contaminant exposures in raptors, in part, because of their high exposure potential, and in part due to specific attributes, which allow for the collection of high quality data (Sheffield, 1997). These attributes include: a foraging range which has a high potential to lie entirely within the Tittabawassee River floodplain, high metabolism rates, year round residency, territorial defense which includes vocalization, regurgitation of undigested prey at easily identified nesting and feeding perches, propensity to nest in constructed nesting platforms, and ease of handling and sampling.

1.2 Purpose and Objectives

Currently, little data exist for estimating raptor exposure to PCDDs and PCDFs and other contaminants in the Tittabawassee River floodplain. As such, there are great uncertainties in the exposure assumptions and pathways for all top predators, including bald eagles and great horned owls. Much of this uncertainty can be minimized through the identification and collection of prey items for analysis and an increased understanding of the home range and behaviors of receptors. By evaluating the magnitude of exposure and the reproductive success of bald eagles and great horned owls feeding at the site, it will be possible to more accurately determine which contaminants are present in raptors and assess whether or not these contaminants are causing adverse effects on raptor populations.

Therefore, the objectives of this study are:

- To conduct an exposure analysis of PCDD and PCDF concentrations in the diets of bald eagles and great horned owls, and to quantify the congener-specific concentrations of PCDDs and PCDFs in raptor tissues;
- To assess raptor health and productivity in the reference and downstream sampling locations;
- To develop bioaccumulation and biomagnification factors for raptors residing in the reference and downstream study locations;

- To assess the potential impact of additional chemical stressors in raptors (PCBs, DDTs and DDT metabolites).

Together these studies will form the most accurate and comprehensive, assessment of the potential effects that PCDDs and PCDFs may pose to raptors within the Tittabawassee River floodplain.

1.3 Data Quality Objectives (DQOs)

1.3.1 Problem Statements

The problem statement relevant to eagles and owls on the Tittabawassee River floodplain that is addressed in this WP is provided below.

- The 2003 MDEQ ERA implicates PCDDs and PCDFs originating from the Tittabawassee River floodplain as posing an unacceptable risk of harm to resident bald eagles via consumption of contaminated fish (Galbraith, 2003). Exposure was estimated by applying literature-based fish/ avian egg BMF values to measured concentrations of PCDDs and PCDFs in four species of fish. This calculation of exposure is characteristic of a screening level ERA, which leads to overly conservative estimations of risk. These risks need to be reassessed by collection of site-specific eagle and owl dietary exposure data and tissue residue concentrations in eagle and owl eggs and nestling plasma. Additionally, abundance and productivity of eagles and great horned owls needs to be assessed on the Tittabawassee River floodplain.

1.3.2 Decision Identification

The decision regarding eagles and owls will be based on answering the following question:

- Do concentrations of PCDDs and PCDFs (expressed as total TEQs) in sediments, soils, prey items, or raptor tissues pose unacceptable risks to eagles and/or owls occurring on the Tittabawassee River floodplain study site located downstream of Midland, MI?

The activities proposed in this WP are designed to provide sufficient information and data for answering this question.

1.3.3 Inputs to Decisions

The decision process regarding the bald eagle and great horned owl will be supported by the following measurements:

- Concentrations of PCDDs and PCDFs in sediments and soils collected from the Tittabawassee River floodplain downstream of Midland, MI and from upstream reference areas.

- Determination of home/foraging range of eagles and owls via visual observations of nests located within the study and reference areas.

- Determination of site-specific prey items in the diets of bald eagles and owls that inhabit the study sites and upstream reference areas. (For eagles prey items will be determined by nest monitoring and by collecting prey remains in and around eagle nests. For owls, this will be determined by examining regurgitated pellets collected near nests.)

- Measures of eggshell thickness from eagle and owl eggs collected from the study sites and associated reference areas.
- PCDDs and PCDFs concentrations in site-specific prey items collected from the study sites and associated references areas.
- PCDDs and PCDFs concentrations in nestling plasma and addled eggs of eagles and owls inhabiting the study sites and associated reference areas.
- Productivity of eagles and owls, measured as number of young fledged/nest, inhabiting the study sites and associated reference areas.

1.3.4 Spatial and Temporal Boundaries

Eagle studies will be conducted on the 100-year Tittabawassee River floodplain both upstream and downstream of Midland, MI. The U.S. Fish and Wildlife Service has been monitoring productivity in multiple bald eagle *(Haliaeetus leucocephalus*) nests within the Tittabawassee river floodplain (Best *et. al.*, 1994). Several nesting eagles have been identified for inclusion in this study. Four eagle nests are located within the target study site. One eagle nest is located upstream of Midland at the Sanford reference site. Additional eagle nests will be included in the study if they are located in comparable reference areas. For example, an eagle nest located on the Au Sable River may be used as an additional reference point in the study. The Au Sable eagles are comparable to the Tittabawassee River eagles because like the Tittabawasse River eagles:

- they are located on the Lake Huron side of the most downstream dam,
- they reside in a riverine habitat with similar prey items,
- they are approximately 10-20 miles inland from Lake Huron, and
- they are nesting along a river accessible to anadramous Lake Huron fish.

Advantages for using the Au Sable river pair of nesting bald eagles are that there is an existing database for these eagles, and an absence of industrial influence and/or contamination from upstream areas (Giesy et al., 1995; Giesy et al., 1994). Thus, this nesting area will be useful in establishing general background levels of PCDDs and PCDFs and PCBs that are due to the consumption of Lake Huron fish.

Owls will be collected from each of the target areas downstream of Midland, MI, including Smiths crossing, Tittabawassee Township Park, Freeland Festival Park, Imerman Park and the Shiawassee National Game Refuge. Owls will also been collected from reference sites. One owl pair has been located within the boundaries of the Tittabawassee Nature Center, and two pairs have been located upstream of Midland, between Sanford and Midland, MI. Appropriate nesting platforms will be constructed where necessary.

Eagle and Owl studies will commence in the spring of 2004. Owl nesting platforms will be constructed and deployed in the spring of 2004. Raptor nest observations will begin in the spring and summer of 2004 and will continue through the spring and summer months of 2005 2006, and 2007. Raptor tissue collections will begin in 2005 and continue until study termination.

1.3.5 Decision Rules

The occurrence of PCDD/Fs in biota, and other measures of population health are intended to be descriptive and, therefore, do not involve conventional rules for decision making. However, statistical procedures that are appropriate based on the distribution of any given data set will be used for comparing

significant differences between data collected from the downstream study sites and the upstream reference area.

1.3.6 Limits of Decision Errors

Specifying limits on decision errors involves defining the possible decision errors and the consequences of making these errors. Typically, this is done by describing the decisions in terms of hypothesis tests or other objective decision criteria and by specifying the hypotheses to be tested using an appropriate statistical model. Limits can also be specified by identifying the decision errors as false-positive and false negative errors. In this study, the type I error (the false positive decision error; α) will be set at 0.05. The type II error (the false negative decision error; β) will be set at 0.2.

1.3.7 Optimized Sampling Design

If analysis shows that the sample size is too small while the variability is too great to reduce the probability of a type II error, then target sample size may be adjusted to obtain the additional necessary data to address the objectives of these studies.

1.4 Measurement Endpoints

The assessment and measurement endpoints, as well as associated hypotheses for the raptor study plan are presented in Table F-1 and Table F-2.

1.4.1 Target Numbers and Types of Samples to be Collected

Addled eggs will be collected from eagle and owl nests. Depending on the results of chemical analyses, fresh eggs may be collected from nests at a rate of 1 egg/nest. In addition, pre-fledged nestlings will be sampled for blood plasma. The target sample sizes for eagle and owl eggs are a total of 6 from reference areas and a total of 6 from study sites downstream of Midland, MI. Likewise, the target sample sizes for eagle and owl plasma are 6 from reference areas and 6 from study sites downstream of Midland, MI.

1.4.2 Sampling Frequency and Duration

This project should be completed in approximately 4 breeding seasons. In the first year, researchers will gather information, acquire collecting permits, locate roosts, set up nest platforms, collect, analyze and identify prey remains in pellets, and observe feeding habits. In the second through forth years, researchers will assess productivity, collect addled eggs and/or egg fragments, and collect blood plasma for contaminant and non- PCDDs and PCDFs related analysis.

Eagle and owl nests will be monitored for productivity measures and feeding habits from mid-summer through the month of December in 2004, 2005, and 2006. Nests will be monitored for 3 daily feeding periods per week from egg inception to fledging. Raptor tissue collections (plasma and eggs) will be conducted in 2005, 2006, 2007, and 2008. Most tissue collections will occur in the late winter and early spring, but may vary based on availability of personnel and other logistical constraints.

Table F-1. Assessment and Measurement Endpoints and Associated Hypotheses for Bald Eagles.

Receptor	Assessment Endpoint	Measurement Endpoints	Hypotheses (Note 2)
Bald Eagle	Reproductive Success and Population Sustainability	• Home/foraging range determinations via visual observations in Tittabawassee River floodplain study areas and reference areas (nest monitoring) • Site specific prey items in Tittabawassee River floodplain study areas and reference areas (nest monitoring) • COPEC concentrations in site-specific prey items (in the Tittabawassee River floodplain study areas and reference areas • COPEC concentrations in eagle tissues (plasma and addled eggs) from Tittabawassee River floodplain study areas and reference areas • Productivity (nest success) measured as young fledged/nest in Tittabawassee River floodplain study areas and reference areas • Eggshell thickness measurements from Tittabawassee River floodplain study areas and reference areas	• Ha1: The mean COPEC concentrations in plasma and addled eggs in the Tittabawassee River floodplain study areas are greater than concentrations in the reference areas • Ha2: The mean COPEC concentration in addled eggs and plasma in the Tittabawassee River floodplain study areas are greater than their respective TRVs • Ha3: The mean COPEC exposure concentrations via diets in the Tittabawassee River floodplain study areas are greater than concentrations in the reference areas • Ha4: The mean COPEC exposure concentrations via diets in the Tittabawassee River floodplain study areas are greater than their respective TRVs • Ha5: Mean productivity (nest success) measured as young fledged/nest in the Tittabawassee River floodplain study areas is less than mean productivity in the reference areas • Ha6: Mean thickness of eagle eggshells collected from nests in the Tittabawassee River floodplain study areas is less than the eggshell thickness in the reference areas • Ha7: Eggshells collected from nests in the Tittabawassee River floodplain study areas and reference area have mean eggshell thickness less than a thickness of 85% of pre-1947 eggs

Note**:** For clarity, the hypotheses are presented as alternative hypotheses (Ha) because this is the question to be answered. This can be thought of as the inverse of the null hypothesis (Ho). Acceptance of Ha is equivalent to rejection of the null hypothesis.

Note $_2$: Hypotheses are not meant to be aligned with measurement endpoints.

Table F-2. Assessment and Measurement Endpoints and Associated Hypotheses for Great Horned Owls.

Receptor	Assessment Endpoint	Measurement Endpoints	Hypotheses (Note 2)
Great Horned Owl	Reproductive Success and Population Sustainability	• Dietary composition of regurgitated pellets collected near nests, measured as 1) frequency of occurrence of each item, 2) percent composition on a numeric basis, and 3) percent composition on a biomass basis in Tittabawassee River floodplain study areas and reference areas • Home/foraging range determinations via visual observations in Tittabawassee River floodplain study areas and reference areas (nest monitoring) • Concentrations of COPECs in eggs in Tittabawassee River floodplain study areas and reference areas • Concentrations of COPECs in fledgling serum in Tittabawassee River floodplain study areas and reference areas • Concentrations of COPECs in dietary items in Tittabawassee River floodplain study areas and reference areas • Productivity (nest success) measured as young fledged/nest in Tittabawassee River floodplain study areas and reference areas • Eggshell thickness measurements from Tittabawassee River floodplain study areas and reference areas	• Ha1: The mean COPEC concentrations in fledgling serum and addled eggs in the Tittabawassee River floodplain study areas are greater than concentrations in the reference areas • Ha2: The mean COPEC concentrations in addled eggs and fledgling serum in the Tittabawassee River floodplain study areas are greater than their respective TRVs • Ha3: The mean COPEC exposure concentrations via diets in the Tittabawassee River floodplain study areas are greater than concentrations in the reference areas • Ha4: The mean COPEC exposure concentrations via diets in the Tittabawassee River floodplain study areas are greater than their respective TRVs • Ha5: Mean productivity (nest success) measured as young fledged/nest, number eggs/nest, hatching success, and hatchling deformities in the Tittabawassee River floodplain study areas is less than mean productivity in the reference areas • Ha6: Mean thickness of owl eggshells collected from nests in the Tittabawassee River floodplain study areas is less than the eggshell thickness in the reference areas • Ha7: Eggshells collected from nests in the Tittabawassee River floodplain study areas and reference areas have mean eggshell thickness less than a thickness of 85% of pre-1947 eggs

Note**:** For clarity, the hypotheses are presented as alternative hypotheses (Ha) because this is the question to be answered. This can be thought of as the inverse of the null hypothesis (Ho). Acceptance of Ha is equivalent to rejection of the null hypothesis.

Note $_2$: Hypotheses are not meant to be aligned with measurement endpoints.

1.5 Sampling and Analysis Plan

1.5.1 Bald Eagles

1.5.1.1 Nest Monitoring

Locations of bald eagle nests have been determined by previous studies of the MSU-ATL, but will be reconfirmed by consultation with the US Fish and Wildlife Service (USFWS). Once nests have been located, portable tree blinds will be erected proximally. Initial visual observations of nest activities will take place before egg laying commences and will continue until eagle nestlings fledge. General observations on eagle behavior will include activity periods, general directions of foraging, etc. To accurately assess the foraging range (percentage of time foraging with the Tittabawassee River proper versus foraging sites along tributaries or other water bodies not hydraulically connected to the river, etc.), the placement of additional observers may be necessary. If USFWS records indicate the potential for migratory behavior, then additional observation events throughout the year (e.g. 3 consecutive days per month) may be conducted to determine the fraction of the year that eagles are on- and off-site.

1.5.1.2 Prey Items

Eagle nests will be observed from blinds to determine what foods they are bringing to the nest and where they are feeding. Similar prey species (or prey remains) will be collected to determine PCDD, PCDF, PCB, and DDE concentrations in prey. This may involve collection and analysis of anadromous fishes (those fish that seasonally migrate upriver from Lake Huron). Other data (besides productivity) that the state has gathered on these nests (e.g., other contaminants, eggshell thinning, etc.) will be obtained and used as appropriate. Bald eagles are banded at 6-9 weeks of age. Prey remains, egg shell fragments and addled eggs will be collected at that time. Prey remain collection will also occur after the nestlings have fledged. See SOP #TR270 - Bald Eagle Observation, Prey Remains Analysis, and Collection of Addled Eggs and Eggshell Fragments, in Appendix H, for more information.

1.5.1.3 Productivity

Bald eagle productivity and nest success (young fledged/nest) will be monitored at all active nest sites. The USFWS eagle productivity and nest success data will also be evaluated and used as appropriate. Nests will be monitored for 3 daily feeding periods per week from egg inception to fledging. If chicks hatch or if the eggs are found to be broken, eggshell fragments will be collected for eggshell thickness measurements (a measure of effect for DDE). If addled eggs of bald eagles are found, they will be collected for PCDD, PCDF, PCB, and DDT and metabolite analysis. Before first flight (6-8 weeks after hatch), fledgling serum samples will be taken and analyzed for residues. A professional tree climber will access nests. Nestlings will be lowered to the ground in a soft bag, weighed, and aged. Up to 20 ml of blood will be drawn from the brachial vein using a 12 ml sterile, disposable syringe and 21-gauge needle. Blood will be transferred immediately to heparinized vacutainers and stored on ice. Samples will be centrifuged within 6 hours of collection and plasma transferred to chemically cleaned (acetone/hexane) glass vials with Teflon lined screw caps. Samples will be frozen until analyses are performed. Additional information can be found in the SOP #TR271 - Bald Eagle Nestling Handling, Banding, and Collection of Blood (Appendix H).

1.5.2 Great Horned Owls

1.5.2.1 Nest Monitoring

Before beginning field observations, four nesting platforms will be constructed within each of the study and reference areas. Assuming 25% occupancy, each study area should have at least one occupied nesting platform. Each area will be searched on foot from December through February to confirm nest occupancy. Hooting call surveys will be utilized to locate additional territorial owl pairs. Adult male and female great horned owl calls (available from Cornell Laboratory of Ornithology) will be broadcast between 1800 and 2200 hours at 0.5 km intervals along the river corridor within each of the study areas. Nests will be considered active once the female is known to be incubating. Once nests have been identified as active, portable tree blinds will be erected proximally at nesting sites for viewing by spotting scopes. Nest disturbance must be minimized during observation since great horned owls may abandon nests subjected to repetitive disturbance. Blinds will be placed at a minimum of 100 m away from a nest. Great care will be taken both in the erection and habitation of the blind. A combination of observational data and literature-based values will be used to develop foraging and home ranges for great horned owls. For more information, see SOP #TR272 - Great Horned Owls– Location of Natural Nests, Hooting Call Surveys, and Construction and Placement of Artificial Platforms (Appendix H).

1.5.2.2 Prey Items

The dietary composition of the great horned owl can easily and accurately be described by analyzing the undigested prey remains in regurgitated pellets (Rusch 1972, Wink et al. 1987). Pellets will be collected from all nesting locations observed within the study area and not just those under observation. Pellet collection will occur on the 4th, 12th, 20th, and 27th days (± 1 day) of each month). In this way, fresh pellets will be available for collection and will reduce the likelihood of overestimating the frequency of occurrence of large prey species (e.g. cottontail rabbit, opossum), because of their tendency to be represented in more than one pellet. Each pellet sample will be placed into individual plastic bags, identified as to nesting pair, dated, frozen and transported to the laboratory. Pellet samples will be thawed and analyzed individually. Diagnostic parts of prey remains will be sorted and matched in order to determine the number of individuals represented in each pellet. Prey items in pellets will be identified to the species level. The proportional distribution of prey items will be summarized in the following ways:

- Frequency of occurrence – the percentage of the total number of pellets in which a given prey species was represented by one or more individuals;
- Percent composition on a numeric basis – the number of individuals for each prey species expressed as a percentage of the total number of individual prey items; and
- Percent composition of biomass – the estimated weight of the individual represented for each prey species expressed as a percentage of the total weight of all prey items.

For more information, see SOP #TR273 - Great Horned Owl Observation, Prey Remains Analysis, and Collection of Addled Eggs and Eggshell Fragments (Appendix H).

1.5.2.3 Productivity

Owl productivity and nest success (young fledged/nest) will be monitored. Historical USFWS owl productivity and nest success data will also be evaluated. Nests will be monitored for 3 daily feeding periods per week from egg inception to fledging. If chicks hatch or if the eggs are found to be broken, eggshell fragments will be collected for eggshell thickness measurements (a measure of effect for DDE) at time of banding. If addled eggs are found, they will be collected for residue analysis. Fledgling serum samples will be taken and analyzed for PCDDs and PCDFs, PCBs, prior to first flight (9 to 10 weeks after

hatch). A professional tree climber will access nests. Nestlings will be lowered to the ground in a soft bag, weighed, and aged. Blood will be drawn from either the brachialas (wing) or tibialis (leg) veins (3 ml per left and right vein for a total of 6 mL per bird) using a 3 ml sterile, disposable syringe and 26-gauge needle. Blood will be transferred immediately to heparinized vacutainers and stored on ice. Samples will be centrifuged within 6 hours of collection and plasma transferred to chemically cleaned (acetone/hexane) glass vials with Teflon lined screw caps. Samples will be frozen until analyses are performed. For more information, see SOP #TR274 - Great Horned Owl Nestling Handling, Banding, and Collection of Blood (Appendix H).

1.6 Schedule of Reporting

1.6.1 Exposure analysis

By December of 2005, PCDD, PCDF and other COPEC concentrations in soils, sediments, and great horned owl and bald eagle dietary food items from the reference and downstream study areas will be available. It is also expected that preliminary dietary composition data from great horned owl pellets and bald eagle nest observations will contribute to quantifying the components of their respective diets. This data will be used to construct a “bottom up” exposure pathway for the raptors, where COPEC concentrations in lower food web organisms are quantified and extrapolated to predict residue concentrations in raptor tissues. Based on residue concentration data, it will be possible to estimate the exposure of great horned owls and bald eagles to PCDDs, PCDFs, and other COPECs.

1.6.2 Effects analysis

By December of 2005, a preliminary bottom-up risk calculation will be possible for great horned owls and bald eagles. It is expected that most if not all, raptor dietary items will have been collected and analyzed for COPEC concentrations. By December of 2008, it is expected that raptor plasma and eggs will have been measured for concentrations of PCDDs, PCDFs, and other COPECs, such as DDT and its metabolites, and this data will be available for risk calculations based on the “top-down” approach. Raptor productivity data, such as clutch size, % hatch, % fledged etc., is expected to be available in December of 2008. By December of 2008, it is expected that multiple lines of evidence, including risk calculations from both “bottom-up” and “top-down” approaches, as well as raptor productivity data, will be integrated to evaluate risk toward great horned owls and bald eagles inhabiting the downstream study areas on the Tittabawassee River and Floodplain.

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Appendix G. Study Plan V - Evaluation of Great Blue Heron and Belted Kingfisher

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1.0 STUDY PLAN V – EVALUATION OF GREAT BLUE HERON AND BELTED KINGFISHER – STRESSOR EXPOSURE, REPRODUCTIVE SUCCESS, AND HABITAT SUITABILITY

1.1 Introduction

To assess whether residues of PCDDs and PCDFs are adversely impacting great blue heron and belted kingfisher populations, it is first necessary to assess what extent PCDDs and PCDFs are entering the food web and passing to higher trophic level receptors, such as these. It is then necessary to determine whether PCDDs and PCDFs or other COPECs are having any actual adverse effects on great blue heron and belted kingfisher populations.

Fish eating birds, because of their position in the food chain, are exposed to bioaccumulating compounds such as PCDDs and PCDFs. Reported effects for PCDDs and PCDFs range from disruptions in reproduction (e.g. egg shell thinning, hormonal changes) to deformities, suppression of the immune system, and behavioral changes (Giesy et al., 1994).

The belted kingfisher (*Ceryle alcyon*) and great blue heron (GBH; *Ardea herodias*), were selected for this study as typical representatives of piscivorous birds in the Tittabawassee River floodplain. Each species has numerous advantages as sentinel species for monitoring bioaccumulating chemicals, such as PCDDs and PCDFs. Both birds are resident and nest in the same area during multiple years (Eckert, 1981; Kelsall and Simpson, 1980). Several studies have been conducted on these piscivorous species to determine their exposure and risk to organic pollutants, such as PCBs, DDTs, PCDDs, PCDFs, and methylmercury (Elliott et al., 1989; Moore et al., 1999; Evers and Lane, 2000). Numerous studies have been carried out using the belted kingfisher (*Ceryle alcyon*) and the GBH (*Ardea herodias*) as monitoring organisms for environmental contaminants (e.g. Elliott et al., 1989; Moore et al., 1999; Evers and Lane, 2000). Because of their ubiquitous nature and fish consumption rates, EPA has classified these species as excellent indicators of contaminants across most of the aquatic ecosystems especially for bioaccumulating substances.

1.2 Purpose and Objectives

Results of previous investigations have demonstrated that some concentrations of PCDDs and PCDFs in Tittabawassee River floodplain soils, sediments and fish downstream of Midland are greater than those from reference locations (MDEQ, 2002, 2003; Hilscherova et al., 2003). Therefore, there is potential exposure of piscivorous birds foraging in these areas of the river to PCDDs and PCDFs. There is no information on the presence or concentration of PCDDs and PCDFs in piscivorous birds that reside within the Tittabawassee River floodplain downstream of Midland, Michigan or from other locations upstream that could be used as reference areas. A search of the published scientific literature on this question failed to find any available information on concentrations of PCDDs and PCDFs in fish eating birds that would be applicable to this Site. As a result, this Study Plan is designed to:

- Provide information on the site-specific dietary exposure and tissue residue concentrations in eggs of both GBH and belted kingfishers,
- Provide measurements of kingfisher and GBH reproductive success in the reference and downstream study locations,
- Develop bioaccumulation and biomagnification factors for belted kingfishers and great blue herons residing within the reference and downstream study locations,

- To assess the toxic potential of additional chemical stressors in raptor tissues (PCBs, DDTs and DDT metabolites),
- Assess habitat suitability at the reference and downstream study locations for belted kingfishers and great blue herons.

These studies will determine whether upper trophic level wildlife are exposed to residues present in Tittabawassee sediments and/or floodplain soils and, if so, to what extent. By measuring exposure to contaminants, we will be able to accurately assess the degree to which these residues pose risks to organisms at the site. By measuring the reproductive success of birds feeding at the site with known exposure to contaminants, we will be able to determine whether contaminants are having or are likely to have any adverse effects on piscivorous bird reproductive endpoints. The use of upstream locations will provide information on 'baseline' contaminant exposure and productivity to allow a realistic assessment of possible effects attributable to PCDDs and PCDFs in the Tittabawassee River floodplain.

1.3 Data Quality Objectives (DQOs)

1.3.1 Problem Statements

The problem statement relevant to the belted kingfisher and the GBH on the Tittabawassee River floodplain that is addressed in this WP is provided below.

- In the ERA conducted by MDEQ the risk for piscivorous birds feeding on fish from the Tittabawassee River floodplain was estimated to be high, and that population effects resulting from this exposure could not be excluded (Galbraith, 2003). This risk assessment was based on a limited number of fish (4 species) that may or may not represent the most relevant dietary items for the belted kingfisher and GBH. Furthermore, no investigations on biologically relevant endpoints such as reproduction were included in the previous risk assessment. In order to reduce uncertainties and identify potential biological effects on piscivorous birds, such as the belted kingfisher and the GBH, an assessment needs to be conducted that specifically addresses PCDD and PCDF exposure and risk. Such a study will help to increase our knowledge of the potential risks of PCDD and PCDF exposure to piscivorous birds on the Tittabawassee River floodplain.

1.3.2 Decision Identification

The decision regarding piscivorous birds will be based on answering the following question:

- Do concentrations of PCDDs and PCDFs in sediments, soils, prey items, and bird tissues pose unacceptable risks to piscivorous birds on the Tittabawassee floodplain downstream of Midland, MI?

The activities proposed in this Work Plan are designed to provide sufficient information and data for making this decision.

1.3.3 Inputs to Decisions

The decision process regarding the piscivorous birds will be supported by the following measurements:

- Concentrations of PCDDs and PCDFs in sediments and soils collected from the Tittabawassee River floodplain downstream of Midland, MI and from upstream reference areas,

- Reproductive success (measured as egg production, hatching success, deformities in hatchlings, embryo mortality, and fledgling success) of kingfishers and GBH inhabiting the Tittabawassee River floodplain downstream of Midland, MI and upstream reference areas,
- Concentrations of PCDDs and PCDFs in kingfisher and GBH eggs collected from the Tittabawassee River floodplain downstream of Midland, MI and from upstream reference areas,
- Thickness of eggshells collected from the Tittabawassee River floodplain downstream of Midland, MI and from upstream reference areas,
- Observations of kingfisher and GBH dietary composition on the Tittabawassee River floodplain downstream of Midland, MI and at upstream reference areas,
- Concentrations of PCDDs and PCDFs in dietary items, including fish, amphibians, aquatic emergent insects, crayfish, and mollusks collected from the Tittabawassee River floodplain downstream of Midland, MI and from upstream reference areas.

1.3.4 Spatial and Temporal Boundaries

The spatial boundaries of the passerine investigations include the study site, a 23-mile area from the upstream boundary of the Dow Chemical Company to the confluence of the Tittabawassee and Shiawassee Rivers, and upstream reference areas. Specific sampling locations will be coordinated with other studies outlined in this document as well as with local landowners. Downstream study areas will include Smiths Crossing, Tittabawassee Township Park, Freeland Festival Park, and Imerman Park. Reference areas will include the Sanford site located upstream of Midland, MI on the Tittabawassee River and the Chippewa Nature Center site located upstream of Midland, MI on the Chippewa River. In each study area, one or more burrows that are suitable for kingfishers or already have been occupied by kingfishers are present. Furthermore, GBH foraging activities have been observed in all these areas. Sampling efforts along the Tittabawassee River will occur within the estimated 100-yr floodplain.

The temporal boundaries consist of comparable time frames for collecting samples from the upstream reference area as well as the two downstream study areas.

1.3.5 Decision Rules

The occurrence of PCDD/Fs in biota, and other measures of population health are intended to be descriptive and, therefore, do not involve conventional rules for decision making. However, statistical procedures that are appropriate based on the distribution of any given data set will be used for comparing significant differences between data collected from the downstream study sites and the upstream reference area.

1.3.6 Limits of Decision Errors

Specifying limits on decision errors involves defining the possible decision errors and the consequences of making these errors. Typically, this is done by describing the decisions in terms of hypothesis tests or other objective decision criteria and by specifying the hypotheses to be tested using an appropriate statistical model. Limits can also be specified by identifying the decision errors as false-positive and false negative errors. In this study, the type I error (the false positive decision error; α) will be set at 0.05. The type II error (the false negative decision error; β) will be set at 0.2.

1.3.7 Optimized Sampling Design

If analysis shows that the sample size is too small while the variability is too great to reduce the probability of a type II error, then target sample size may be adjusted to obtain the additional necessary data to address the objectives of these studies.

1.4 Measurement Endpoints

The assessment and measurement endpoints, as well as associated hypotheses for the raptor study plan are presented in Table G-1.

1.4.1 Target Numbers and Types of Samples to be Collected

The number of breeding pairs and active nests that are present in sampling locations will determine sample sizes. The target sample size for both belted kingfisher and GBH is a total of 6 eggs from reference areas and a total of 6 eggs from areas downstream of the Dow dam.

1.4.2 Sampling Frequency and Duration

The first field season will begin in the spring of 2004. During this time, general and region specific information about the belted kingfisher and the GBH will be gathered. This year will be dedicated to acquiring the necessary collection permits, identifying breeding and foraging areas, and setting up the collection methodologies to be applied throughout the following years (e.g. setting up a permanent endoscope structure for kingfisher burrows and conducting the initial banding study for GBH). During the second, third, and fourth years of the field study (2005-2007), researchers will apply these methodologies to collect data on productivity and collect addled and fresh eggs and/or egg fragments for contaminant related analyses. The field portion of this project should be completed after the 4th breeding season.

Belted kingfisher burrows and GBH nests will be monitored for productivity measures and feeding habits from early-April through the end of September in 2004, 2005, 2006, and 2007. Nests will be monitored for 3 daily feeding periods per week from egg inception to fledging. Tissue collections (eggs) will be conducted in 2005, 2006, and 2007. Egg collections will occur during the early breeding season, but may vary based on availability of personnel and other logistical constraints.

For more detailed information on sampling frequency and duration see SOP #TR265 entitled Protocol for belted Kingfisher (*Ceryle alcyon*) Monitoring and Tissue Collection and SOP #TR266 entitled Protocol for great blue heron (*Ardea heroidas*) Monitoring and Tissue Collection (Appendix H).

Table G-1. Assessment and Measurement Endpoints and Associated Hypotheses for Belted Kingfishers and Great Blue Herons.

Receptor	Assessment Endpoint	Measurement Endpoints	Hypotheses (Note 2)
Kingfishers/ Great Blue Herons	**Reproductive Success and Population Sustainability**	• Home/foraging range determinations via visual observations in Tittabawassee River floodplain study areas and reference areas (nest monitoring) • Observations of dietary composition in Tittabawassee River floodplain study areas and reference areas • Concentrations of COPECs in bird eggs from Tittabawassee River floodplain study areas and reference areas • Concentrations of COPECs in dietary items, including fish, amphibians, and insects, in Tittabawassee River floodplain study areas and reference areas • Reproductive success measured as egg production (no. eggs/nest), hatching success, deformities in hatchlings, and embryo mortality during nest box studies in Tittabawassee River floodplain study areas and reference areas • Thickness of eggshells from Tittabawassee River floodplain study areas and reference areas	• Ha1: The mean egg production (no. eggs/nest) of birds in the Tittabawassee River floodplain study areas is less than mean egg production in the reference areas • Ha2: Mean hatching success of birds in the Tittabawassee River floodplain study areas is less than hatching success in the reference areas • Ha3: Mean deformities in hatchlings in the Tittabawassee River floodplain study areas is greater than hatchling deformities in the reference areas • Ha4: Mean embryo mortality of birds in the Tittabawassee River floodplain study areas is greater than mortality of embryos in the reference areas • Ha5: Mean eggshell thickness of eggs collected in nests from the Tittabawassee River floodplain study areas is less than the reference areas • Ha6: Eggshells collected from nests in the Tittabawassee River floodplain study areas and reference areas have mean eggshell thickness less than a thickness of 85% of pre-1947 eggs • Ha7: Mean concentrations of COPECs in bird eggs collected from the Tittabawassee River floodplain study areas are greater than concentrations in the reference areas • Ha8: Mean concentrations of COPECs in bird eggs collected from the Tittabawassee River floodplain study areas are greater than the TRVs • Ha9: The mean COPEC exposure concentrations via diets in the Tittabawassee River floodplain study areas are greater than concentrations in the reference areas • Ha10: The mean COPEC exposure concentrations via diets in the Tittabawassee River floodplain study areas are greater than their respective TRVs

Note**:** For clarity, the hypotheses are presented as alternative hypotheses (Ha) because this is the question to be answered. This can be thought of as the inverse of the null hypothesis (Ho). Acceptance of Ha is equivalent to rejection of the null hypothesis.

Note $_2$: Hypotheses are not meant to be aligned with measurement endpoints.

1.5 Sampling and Analysis Plan

1.5.1 Belted Kingfisher

General observations on belted kingfisher behavior will include activity periods and general directions of foraging during the nesting season. To accurately assess the foraging range (percentage of time foraging with the Tittabawassee River proper versus foraging sites along tributaries or other water bodies not hydraulically connected to the river) the placement of additional observers may be necessary. Because of the potential migration behavior of belted kingfisher, additional observation events throughout the year (e.g. 3 consecutive days per month) may be conducted to determine the fraction of the year that kingfishers are on- and off-site.

Nest burrows are in open banks (up to 3m in depth) and can be monitored for hatching success and mortalities among the young using an endoscope camera. Burrows will be monitored during the nesting season. This period will probably last from mid-April to July and will be influenced by the bird's breeding behavior.

Fresh eggs will be collected from each site. A maximum of one fresh egg will be collected from any one nest. In addition all eggs which fail to hatch due to abandonment and or non-viability will be collected for analysis of developmental stage and contaminant content. To collect an egg, the burrow will be excavated from the back and the egg will be collected through a pre-installed back door. During egg collection activities, eggshell fragments will also be collected for eggshell thickness measurements. Specific instructions pertaining to kingfisher observations and egg collection procedures are located in SOP #TR265 (Appendix H).

1.5.2 Great Blue Heron

GBH nests on study and reference sites will be monitored to determine nest attentiveness and abandonment behavior, and productivity. Identification of nesting sites/colonies will begin after the birds have returned from their winter grounds in the south. The distance of GBH foraging areas can range up to several miles. GBH will be captured on their foraging grounds and individually banded so that breeding pairs that forage in the study areas can be identified (see SOP #TR266 in Appendix H). General observations on GBH behavior will include activity periods and general directions of foraging during the nesting season. To accurately assess the foraging range (percentage of time foraging within the Tittabawassee River proper versus foraging at sites along tributaries or other water bodies not hydraulically connected to the river) the placement of additional observers may be necessary. Because the GBH migrates south over the winter months, additional observation events throughout the year (e.g. 3 consecutive days per month) will be conducted to determine the time of the year that GBH return to their breeding grounds.

Nests will be monitored during the nesting season. This period will probably last from mid-April to July and will be influenced by the bird's breeding behavior. Active nests will be checked between the hours of 10:30 a.m. and 3:30 p.m. once every three days until the first egg is laid, after which time, nests will be checked daily. Viable eggs will be collected from each site from randomly selected actively incubating nests. A maximum of one viable egg will be collected from any one nest. If possible, the second egg in a clutch will be collected. In addition, all eggs which fail to hatch due to abandonment and or non-viability will be collected for analysis of developmental stage and contaminant content. In order to minimize nest disturbance during observational data collections, the neighboring trees of the nests of interest will be climbed. Only for physical monitoring (e.g. labeling of eggs) and sample collections will the nest tree have to be climbed. A professional tree climber will conduct all nest climbing. Specific instructions pertaining to GBH observations and egg collection procedures are located in SOP #TR266 (Appendix H).

1.5.3 Sample Processing

After samples have been collected and tagged in the field and initial documentation has been completed, samples will be initially processed at a secured laboratory facility. Specific details of processing are included in the associated SOPs (SOP #TR264 - Protocol for Bird Necropsy, Egg and Shell Examination, and Tissue Archive in Appendix H). Egg samples will be processed in a clean workspace to prevent contamination of samples. All processing equipment will be cleaned and rinsed between samples. Samples will be labeled with unique sample identification number, collection time and date, and initials of researcher who collected the sample. In addition, processing date and time will be recorded as well as the initials of the processor. Egg samples will be kept refrigerated at approximately 4°C prior to chemical analysis.

1.5.4 Prey Items in Diet

The diet of the belted kingfisher is mainly composed of fish, but the kingfisher will also feed on crayfish, insects, mollusks, amphibians, reptiles, small mammals, and occasionally fruits (De Graaf and Yamasaki, 2001). The GBH feeds primarily on fish, but also eats aquatic and terrestrial insects, amphibians, reptiles, crustaceans, and occasionally small birds and mammals (De Graaf and Yamasaki, 2001).

1.5.5 Habitat Suitability

Habitat is an area that contains a combination of resources (food, cover, and water) and environmental conditions (temperature, precipitation, etc.) that promotes occupancy by individuals of a given species and allows those individuals to survive and reproduce. Quality of habitat is related to the rates of survival and reproduction of the individuals that live there, the vitality of their offspring, and the length of time the site remains suitable for occupancy (Morrison et al., 1992). Within a given area, there may be specific ecosystem types that will not meet habitat requirements of a particular species. Habitat Suitability Indices (HSIs) provide a tool that wildlife managers can use to predict the distribution and abundance of a species and evaluate the effects of human alterations on the environment. HSI values can range from 1.0 for optimal habitat to 0.0 for completely unsuitable habitat.

On-site inspection will be necessary to measure HSI components for belted kingfishers and GBH. If the HSI predicts that belted kingfisher and or GBH could be present in select locations on the Tittabawassee River floodplain, but the monitoring program indicates that they are not, there may be several reasons for their absence. One reason is the effects of chemicals, but other stressors, such as human disturbance, could account for the discrepancy. Abundance will be corrected (if necessary) for HSI according to the method described in Escherich and Rosenberger (1987).

1.5.5.1 Belted Kingfisher

The HSI for kingfisher will be estimated based on the model described in Prose (1985). Because the model was developed for application within the entire range of the belted kingfisher, including estuarine and lake habitats, the model was adapted, where appropriate, to the specific situation of a river habitat. The model is divided into different components, each representing a life requisite of the belted kingfisher. Suitability indices are derived from suitability indices for the different habitat variables considered, which represent the condition of habitat characteristics (Figure G-1). Each index is given a value from 1 (optimal) to 0 (unsuitable). The different suitability indices for belted kingfisher in the Tittabawassee River will be determined as follows:

- Water suitability index (SIW):

$$SIW = (SIV1 * SIV3 * SIV4)^{1/3} * SIV2 \quad (1)$$

With:

SIV1: Clarity; Transparency ≥ 60cm are considered optimal (Index = 1)

SIV2: Surface obstruction; 100% obstruction are considered non-suitable (Index = 0)

SIV3: Water area that is ≤ 60cm depth.

SIV4: Riffles (between 25% and 75% of water surface area considered optimal = 1)

- Cover suitability index (SIC):

  SIC = SIV5 (2)

  With: SIV5: Stream subsections (each at 40m) in a stretch of 1000m that contain one or more perches (score ≥ 80% considered optimal = 1).

- Reproduction suitability index (SIR):

  SIR = SIV6 (3)

  With: SIV6: Distance to nearest suitable soil bank measured from the waters edge. ≥ 3000m distance are considered non-suitable (Index = 0).

Based on the limiting factor concept, the HSI for the belted kingfisher breeding habitat is equal to the lowest life requisite suitability index for either water (SIW), cover (SIC) or reproductive cover (SIR).

The assumptions to be considered when applying this model are as follows:

- Food requirements are assumed to be present by the habitat variables.
- Birds are assumed to feed within 15m from the shoreline.
- Optimal reproduction conditions are assumed if there is a suitable soil bank for nesting within 3000 m of each 1000 m section of the stream.

For a detailed description of the model described above, refer to Prose (1985).

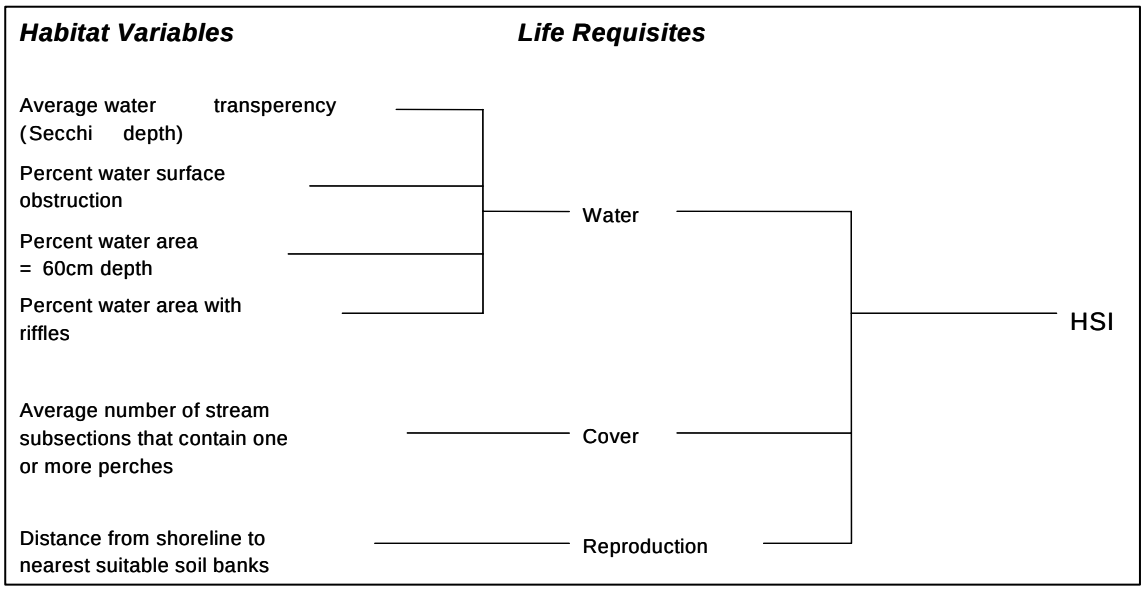

Figure G-1. Relationship of habitat variables, life requisites and HSI for belted kingfisher breeding habitat. (Modified from Prose, 1985)

1.5.5.2 Great Blue Heron

For the GBH, habitat suitability indices will be calculated following the model described by Short and Cooper (1985). The model focuses on use of habitat during the breeding season (spring-summer) by GBHs. The original model was developed to evaluate a wide range of habitats (wetlands, lacustrine and estuarine habitats) for the GBH occupancy. Therefore, the conditions of the model were adapted, where necessary, to fit the specific needs of the Tittabawassee River.

The model consists of two major life requisite components, the food component and the reproduction component. These life requisites are broken down further into suitability indices representing the condition of habitat characteristics for GBH occupancy (Figure G-2). Each index is given a value from 1 (optimal) to 0 (unsuitable). The different suitability indices for GBH in the Tittabawassee River will be determined as follows:

- Foraging suitability index (SIF):

SIF = (SIV1 * SIV2 * SIV3) (4)

With: SIV1: Distance between foraging areas and heronry. Conditions are considered optimal (Index = 1) when foraging habitats are within 1000 m of heronries or potential heronries.

SIV2: Foraging suitability as means of water depth, water clarity, and huntable populations of small fish.

SIV3: Human disturbance of foraging site. Conditions are considered optimal (Index = 1) when there is no disturbance during the 4 hours following sunrise or preceding sunset or of the foraging zone is > 100 m from human activities and habitation.

- Reproductive life suitability index (SIR):

$SIR = (SIV1 * SIV4 * SIV5 * SIV6)^{1/2}$ (5)

With: SIV1: see SIF

SIV4: Potential nest site (grove of trees at least 0.4ha; trees are at least 5 m high; trees with open canopy) over or within 250 m of water.

SIV5: Human disturbance of nest site.

SIV6: Proximity of potential nest site to occupied nest site. Conditions are considered optimal (Index = 1) when suitable trees are within 1000 m of an established heronry.

The HSI for GBH can be determined from the above indices as follows:

$$HSI = (SIV1 * SIV2 * SIV3 * SIV4 * SIV5 * SIV6)^{1/2}$$

The assumptions to be considered when applying this model are as follows:

- Food requirements are assumed to be present by the habitat variables.
- Birds are assumed to feed within 15 m of the shoreline.
- Optimal reproduction conditions are assumed if there is a suitable soil bank for nesting within 3000 m of each 1000 m section of the stream.

For a detailed description of the above-described model please see Short and Cooper (1985).

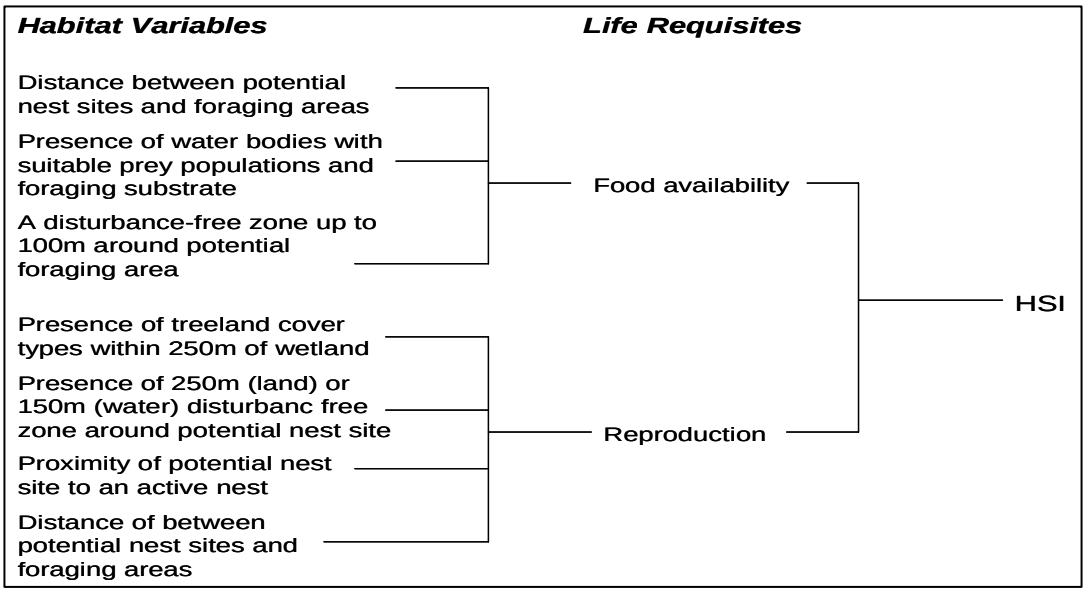

Figure G-2. Relationship of habitat variables, life requisites and HSI for GBH breeding habitat. (Modified from Short and Cooper, 1985)

1.6 Schedule of Reporting

1.6.1 Exposure analysis

By December of 2005, PCDD, PCDF and other COPEC concentrations in soils, sediments, and great blue heron and belted kingfisher dietary food items from the reference and downstream study areas will be available. It is also expected that preliminary dietary composition data from the analysis of prey remains and nest observations will contribute to quantifying the components of their respective diets. This data will be used to construct a "bottom up" exposure pathway for the raptors, where COPEC concentrations

in lower food web organisms are quantified and extrapolated to predict residue concentrations in raptor tissues. Based on residue concentration data, it will be possible to estimate the exposure of great blue herons and belted kingfisher to PCDDs, PCDFs, and other COPECs.

1.6.2 Effects analysis

By December of 2005, a preliminary bottom-up risk calculation will be possible for great blue herons and belted kingfishers. It is expected that most if not all dietary items will have been collected and analyzed for COPEC concentrations. By December of 2008, great blue heron and belted kingfisher eggs will have been measured for concentrations of PCDDs, PCDFs, and other COPECs, and will be available for risk calculations based on the "top-down" approach. Great blue heron and belted kingfisher productivity data, such as clutch size, % hatch, % fledged etc., is expected to be available in December of 2008. By December of 2008, it is expected that multiple lines of evidence, including risk calculations from both "bottom-up" and "top-down" approaches, as well as great blue heron and belted kingfisher productivity data, will be integrated to evaluate risk toward piscivorous birds inhabiting the downstream study areas on the Tittabawassee River and Floodplain. For more detailed information on schedules and reports for this ERA, refer to section 7.0 of the ERA Work Plan.

2.0 REFERENCES

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DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE

3-201
(1/97)

FEDERAL FISH AND WILDLIFE PERMIT

2. AUTHORITY-STATUTES
16 USC 703-712

REGULATIONS (Attached)
50 CFR Part 13
50 CFR 21.23

1. PERMITTEE

DR. MATTHEW J ZWIERNIK
MICHIGAN STATE UNIVERSITY
224 NAT FOOD SAFETY & TOXICOLOGY CENTER
EAST LANSING, MI 48824
U.S.A.

3. NUMBER
MB1025[illegible]-0

4. RENEWABLE
☒ YES
☐ NO

5. MAY COPY
☒ YES
☐ NO

6. EFFECTIVE
04/01/2005

7. EXPIRES
03/31/2008

8. NAME AND TITLE OF PRINCIPAL OFFICER (If #1 is a business)

9. TYPE OF PERMIT
SCIENTIFIC COLLECTING

10. LOCATION WHERE AUTHORIZED ACTIVITY MAY BE CONDUCTED
Tittabawassee River, Michigan
from Midland, Michigan to its confluence with the Shiawassee River

11. CONDITIONS AND AUTHORIZATIONS:

A. GENERAL CONDITIONS SET OUT IN SUBPART D OF 50 CFR 13, AND SPECIFIC CONDITIONS CONTAINED IN FEDERAL REGULATIONS CITED IN BLOCK #2 ABOVE, ARE HEREBY MADE A PART OF THIS PERMIT. ALL ACTIVITIES AUTHORIZED HEREIN MUST BE CARRIED OUT IN ACCORD WITH ALL FOR THE PURPOSES DESCRIBED IN THE APPLICATION SUBMITTED. CONTINUED VALIDITY, OR RENEWAL, OF THIS PERMIT IS SUBJECT TO COMPLETE AND TIMELY COMPLIANCE WITH ALL APPLICABLE CONDITIONS, INCLUDING THE FILING OF ALL REQUIRED INFORMATION AND REPORTS.

B. THE VALIDITY OF THIS PERMIT IS ALSO CONDITIONED UPON STRICT OBSERVANCE OF ALL APPLICABLE FOREIGN, STATE, LOCAL OR OTHER FEDERAL LAW.

C. VALID FOR USE BY PERMITTEE NAMED ABOVE.

D. You are authorized to collect up to the specified number of viable eggs and specimens of the following species of migratory birds to test for polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzo-p-furans (PCDFs) and DDT and its metabolites: American robin, bank swallow, barn swallow, tree swallow, eastern bluebird, and house wren.
You may collect up to:
36 adult samples per species at conclusion of study (year 4);
36 nestling samples per year, per species;
36 viable egg samples per year, per species.
Only one egg may be collected from each active nest, and only from nests containing two or more eggs.

E. You are authorized to salvage migratory birds found dead which you had no part in the killing or death thereof. You are also authorized to salvage abandoned nests and addled eggs after the nesting season. These authorizations do not apply to bald and/or golden eagles or threatened or endangered species.

F. Dead bald or golden eagles must be reported immediately to the National Eagle Repository at 303-287-2110.

G. All specimens must be deposited with the Michigan State University Animal Health Diagnostic Laboratory, East Lansing, Michigan.

H. Authorized subpermittees: Sarah Co[illegible]eld, Michael Fales, Timothy Fredricks, David Hamman, Markus Hecker, Jeremy Moore, Rita Seston, Melissa Shotwell, Karl S[illegible]us, Du[illegible]in Tazelaar, and Lori Williams.

I. Permittees must comply with the attached Standard Conditions for Special Purpose - Salvage and Scientific Collecting.

☒ ADDITIONAL CONDITIONS AND AUTHORIZATIONS ALSO APPLY

REPORTING REQUIREMENTS
ANNUAL REPORT DUE: 1/31

ISSUED BY

CHIEF - MIGRATORY BIRD PERMITS

DATE
03/31/2005

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DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE

3-201
(1/97)

FEDERAL FISH AND WILDLIFE PERMIT

2. AUTHORITY-STATUTES
16 USC 703-712

REGULATIONS *(Attached)*
50 CFR Part 13
50 CFR 21.23

1. PERMITTEE

MATTHEW J ZWIERNIK
MICHIGAN STATE UNIVERSITY
224 NAT FOOD SAFETY & TOXICOLOGY CENTER
EAST LANSING, MI 48824
U.S.A.

3. NUMBER
MB100062-0

4. RENEWABLE
YES
NO

5. MAY COPY
YES
NO

6. EFFECTIVE
04/01/2005

7. EXPIRES
03/31/2008

8. NAME AND TITLE OF PRINCIPAL OFFICER *(If #1 is a business)*

9. TYPE OF PERMIT
SCIENTIFIC COLLECTING

10. LOCATION WHERE AUTHORIZED ACTIVITY MAY BE CONDUCTED
MICHIGAN

11. CONDITIONS AND AUTHORIZATIONS:

A. GENERAL CONDITIONS SET OUT IN SUBPART D OF 50 CFR 13, AND SPECIFIC CONDITIONS CONTAINED IN FEDERAL REGULATIONS CITED IN BLOCK #2 ABOVE, ARE HEREBY MADE A PART OF THIS PERMIT. ALL ACTIVITIES AUTHORIZED HEREIN MUST BE CARRIED OUT IN ACCORD WITH AND FOR THE PURPOSES DESCRIBED IN THE APPLICATION SUBMITTED. CONTINUED VALIDITY, OR RENEWAL, OF THIS PERMIT IS SUBJECT TO COMPLETE AND TIMELY COMPLIANCE WITH ALL APPLICABLE CONDITIONS, INCLUDING THE FILING OF ALL REQUIRED INFORMATION AND REPORTS.

B. THE VALIDITY OF THIS PERMIT IS ALSO CONDITIONED UPON STRICT OBSERVANCE OF ALL APPLICABLE FOREIGN, STATE, LOCAL OR OTHER FEDERAL LAW.

C. VALID FOR USE BY PERMITTEE NAMED ABOVE.

D. Authorized, each year, to collect up to the specified number of viable eggs and blood samples from the following numbers and species of migratory birds (nestlings and adults combined) to test for polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzo-p-furans (PCDFs), and common organic pollutants:

20 great blue heron eggs, and blood samples from 40 great blue herons;
20 belted kingfisher eggs, and blood samples from 40 belted kingfishers;
20 great horned owl eggs, and blood samples from 40 great horned owls;
28 hooded merganser eggs, and blood samples from 56 hooded mergansers;
28 wood duck eggs, and blood samples from 56 wood ducks.

Only one egg may be collected from each active nest, and only from nests containing two or more eggs.

E. You are also authorized to salvage migratory birds found dead in which you had no part in the killing or death thereof, and you may collect non-viable eggs from abandoned nests. These authorizations exclude threatened or endangered species and bald or golden eagles.

F. Authorized subpermittees: Sarah Coefield, Michael Fales, Timothy Fredricks, David Hamman, Michelle Moffat, Jeremy Moore, Pamela Moseley, Rita Seston, Melissa Shotwell, Karl Strause, Dustin Tazelaar, and Lori Williams.

G. You must comply with the attached Standard Conditions for Scientific Collecting and Salvage permits.

ADDITIONAL CONDITIONS AND AUTHORIZATIONS ALSO APPLY

12. REPORTING REQUIREMENTS
ANNUAL REPORT DUE: 1/31

ISSUED BY

TITLE
CHIEF - MIGRATORY BIRD PERMITS

DATE
03/15/2005

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STATE OF MICHIGAN

JENNIFER M. GRANHOLM
GOVERNOR

DEPARTMENT OF NATURAL RESOURCES
LANSING

REBECCA A. HUMPHRIES
DIRECTOR

May 2, 2005

Dr. Matthew Zwiernik
Michigan State University
224 Food Safety and Toxicology Building
East Lansing, Michigan 48824

Dear Dr. Zwiernik:

This letter is your approved Michigan Department of Natural Resources (DNR) Scientific Collector's Permit. Permit number: SC 1252. Issue date: May 2, 2005. Expiration date: August 31, 2008. This permit authorizes the collection and handling of adult and nestling tree swallows (Tachycineta bicolor), bank Swallows (Riparia riparia), barn swallows (Hirundo rusitca), American robins (Turdus migratorius), eastern bluebirds (Sialia sialis), and house wrens (Troglodytes aedon); as well as nests and viable and non-viable eggs from these species as described below. All collection activities shall be for research or educational purposes for Michigan State University. This permit does not authorize activities on private or public property without the approval of the land owner or administrator. A Federal permit is also required.

The following activities are authorized: Up to 36 nestlings, 36 adults, and 36 viable eggs of each species may be handled and/or collected each calendar year. An unspecified number of birds found dead and non-viable eggs may be salvaged. Live specimens may be released or humanely destroyed by cervical dislocation. No more than one viable egg or one live nestling shall be removed from one nest. Pelus samples may be collected from nestling and adults. A ligature may be used on nestlings to restrict swallowing, provided such nestlings are not left unattended. Adults may be banded. Mist nets and nest boxes may be used. If necessary, robins may be collected by use of an air rifle. The DNR, District Eight Law Enforcement Supervisor (Nick Heary, 989-684-9141 extension 8100) shall be contacted prior to use of firearms. Handling and collecting activity may involve observational studies including productivity, nest attentiveness, nesting growth curves, nest weight and neatness, analysis of eggs, nestlings, and whole body tissues. Samples shall be held by Michigan State University Aquatic Toxicology Laboratory, East Lansing, Michigan.

Subpermittees include: Timothy Fredricks, Rita Sutton, Sarah Coefield, Jeremy Moore, Dustin Tazelaar, Melissa Shotwell, David Hamman, Lori Williams, Kim Strause, Michael Fales, and anyone authorized in writing by Dr. Zwiernik.

A report summarizing permitted activities shall be submitted prior to the expiration of this permit. This report shall include species handled, number of animals/eggs handled, and the disposition of specimens for each calendar year for the duration of this permit.

Sincerely,

James S. Janson
Permit Specialist
Wildlife Division
517-373-9329

(SC 1252 Zwiernik 2005)

NATURAL RESOURCES COMMISSION
Keith J. Charters-Chair • Mary Brown • Bob Garner • Gerald Hall • John Madigan • Frank Wheatlake

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STATE OF MICHIGAN

JENNIFER M. GRANHOLM
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DEPARTMENT OF NATURAL RESOURCES
LANSING

REBECCA A. HUMPHRIES
DIRECTOR

May 2, 2005

Dr. Matthew Zwiernik
Michigan State University
224 Food Safety and Toxicology Building
East Lansing, Michigan 48824

Dear Dr. Zwiernik:

This letter is your approved Michigan Department of Natural Resources (DNR) Scientific Collector's Permit. Permit number: SC 1253. Issue date: May 2, 2005. Expiration date: August 31, 2008. This permit authorizes the collection and handling of adult and nestling wood ducks (Aix sponsa), and hooded mergansers (Lophodytes cucullatus); as well as viable and non-viable eggs from these species as described below. All collection activities shall be for research or educational purposes for Michigan State University. This permit does not authorize activities on private or public property without the approval of the land owner or administrator. A Federal permit is also required.

The following activities are authorized: Access to nests and chemical/scientific analysis of collected eggs. Up to 28 viable eggs from each species may be collected each calendar year. No more than one viable egg shall be collected from one nest. Viable eggs shall not be collected from a nest that does not contain two or more viable eggs. An unspecified number of prey remains, regurgitate, non-viable eggs and salvaged adults and/or salvaged nestlings may be collected. Prey remains may include those of protected migratory avian species for further scientific study including identification and/or chemical analyses. Salvaged specimens shall be those that are found dead, injured or diseased. Specimens may be transported from field collection site, and held at sample repository at the MSU Animal Health Diagnostic Laboratory in East Lansing, Michigan for further scientific study including blood sampling, necropsy, and contaminant analyses of tissues. Live salvaged specimens may be transported to licensed wildlife rehabilitation facilities.

Subpermittees include: Rita Seston, Dustin Tazelaar, Sarah Coefield, Timothy Fredricks, Jeremy Moore, Karl Strause, David Hamman, Melissa Shotwell, Marc Hecker, Lori Williams, Michael Fales, and anyone authorized in writing by Dr. Zwiernik.

A report summarizing permitted activities shall be submitted prior to the expiration of this permit. This report shall include species handled, number of animals/eggs handled, and the disposition of specimens for each calendar year for the duration of this permit.

Sincerely,

James S. Janson
Permit Specialist
Wildlife Division
517-373-9329

(SC 1253 Zwiernik 2005)

NATURAL RESOURCES COMMISSION
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GOVERNOR

DEPARTMENT OF NATURAL RESOURCES
LANSING

REBECCA A. HUMPHRIES
DIRECTOR

May 17, 2005

Dr. Matthew Zwiernik
Michigan State University
224 Food Safety and Toxicology Building
East Lansing, Michigan 48824

Dear Dr. Zwiernik:

This letter is your approved Michigan Department of Natural Resources (DNR) Scientific Collector's Permit. Permit number: SC 1254. Issue date: May 17, 2005. Expiration date: August 31, 2008. This permit authorizes the collection and handling of adult and nestling great blue herons (Ardea herodias); as well as viable and non-viable great blue heron eggs as described below. All collection activities shall be for research or educational purposes for Michigan State University. This permit does not authorize activities on private or public property without the approval of the land owner or administrator. A Federal permit is also required.

Blood sampling shall be limited to a single collection per bird. The maximum volume of blood to be collected shall be determined by weight per the following: Each bird shall be weighed and body weight multiplied by 0.07 (assume approximately 7% of a bird's body weight is blood), with that product then multiply by 0.10 (assume it is generally safe to collect 10% of the blood volume without harm to the bird) to determine the amount of blood that can be collected. For example, if an adult bird weighed 1810 g, it should be safe to collect 12.7 cc ([1810 g x 0.07] x 0.1 ~= 12.7 g, and because blood is mostly water, the mass of which is 1g/cc, 12.7 g ~= 12.7 cc).

The following activities are authorized: Access to nests and chemical/scientific analysis of collected eggs, birds, and prey remains. Blood samples may be taken from up to 20 nestlings and 20 adults per calendar year. Up to 20 viable eggs may be collected per calendar year. No more than one viable egg shall be collected from one nest. Viable eggs shall not be collected from a nest that does not contain two or more viable eggs. Birds may be banded or otherwise marked prior to release. Adult birds may be captured using modified, padded leg-hold traps. Up to 20 nestlings and 20 adults may be equipped with radio transmitters per calendar year. Bird handling activities may also include qualitative examination and/or quantitative measurement of physiological health and/or physical characteristics. An unspecified number/amount of non-viable eggs, salvaged juveniles, salvaged adults, prey remains, and regurgitate may be collected or handled. Prey remains may include those of protected migratory avian species for further scientific study including identification and/or chemical analyses. Salvaged specimens shall be those that are found dead, injured or diseased. Specimens may be transported from field collection site, and held at sample repository at the MSU Animal Health Diagnostic Laboratory in East Lansing, Michigan for further scientific study including blood sampling, necropsy, and contaminant analyses of tissues. Live specimens may be transported to licensed wildlife rehabilitation facilities.

Subpermittees include: Reta Sestic, Dustin Vazelaar, Sarah Coefield, Timothy Fredricks, Jeremy Moore, Karl Strause, David Hamman, Melissa Shotwell, Pamela Mosley, Michael Fales, Lori Williams, Michelle Moffat, and anyone authorized in writing by Dr. Zwiernik. A report summarizing permitted activities shall be submitted prior to the expiration of this permit. This report shall include species handled, number of animals/eggs handled, and the disposition of specimens for each calendar year for the duration of this permit.

Sincerely,

James S. Janson
Permit Specialist
Wildlife Division
517-373-9329

(SC 1254 Zwiernik 2005)

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Keith J. Charters-Chair • Mary Brown • Darnell Earley • Bob Garner • Gerald Hall • John Madigan • Frank Wheatlake

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STATE OF MICHIGAN

JENNIFER M. GRANHOLM
GOVERNOR

DEPARTMENT OF NATURAL RESOURCES

LANSING

REBECCA A. HUMPHRIES
DIRECTOR

May 17, 2005

Dr. Matthew Zwiernik
Michigan State University
224 Food Safety and Toxicology Building
East Lansing, Michigan 48824

Dear Dr. Zwiernik:

This letter is your approved Michigan Department of Natural Resources (DNR) Scientific Collector's Permit. Permit number: SC 1255. Issue date: May 17, 2005. Expiration date: August 31, 2008. This permit authorizes the collection and handling of adult and nestling belted kingfishers (Ceryle alcyon); as well as viable and non-viable belted kingfisher eggs as described below. All collection activities shall be for research or educational purposes for Michigan State University. This permit does not authorize activities on private or public property without the approval of the land owner or administrator. A Federal permit is also required.

Blood sampling shall be limited to a single collection per bird. The maximum volume of blood to be collected shall be determined by weight per the following: Each bird shall be weighed and body weight multiplied by 0.07 (assume approximately 7% of a bird's body weight is blood), with that product then multiply by 0.10 (assume it is generally safe to collect 10% of the blood volume without harm to the bird) to determine the amount of blood that can be collected. For example, if an adult bird weighed 136 g, it should be safe to collect 0.95 cc ([136 g x 0.07] x 0.1 ~= 0.95 g, and because blood is mostly water, the mass of which is 1g/cc, 0.95 g ~= 0.95 cc).

The following activities are authorized: Access to nests and chemical/scientific analysis of collected eggs, birds, and prey remains. Up to 20 nestlings may be collected and destroyed per calendar year. Nests may be accessed by excavating the back of the burrow. Up to 20 viable eggs may be collected per calendar year. No more than one viable egg shall be collected from one nest. Viable eggs shall not be collected from a nest that does not contain two or more viable eggs. Blood samples may be taken from up to 20 adults per calendar year. Birds may be banded or otherwise marked prior to release. Adult birds may be captured using mist nets. Up to 20 adults may be equipped with radio transmitters per calendar year. Bird handling activities may also include qualitative examination and/or quantitative measurement of physiological health and/or physical characteristics. An unspecified number/amount of non-viable eggs, salvaged juveniles, salvaged adults, and prey remains may be collected or handled. Prey remains may include those of protected migratory avian species for further scientific study including identification and/or chemical analyses. Salvaged specimens shall be those that are found dead, injured or diseased. Specimens may be transported from field collection site, and held at sample repository at the MSU Animal Health Diagnostic Laboratory in East Lansing, Michigan for further scientific study including blood sampling, necropsy, and contaminant analyses of tissues. Live specimens may be transported to licensed wildlife rehabilitation facilities.

Subpermittees include: Rita Sestu, Pamela Moseley, Michael Fales, Jeremy Moore, Dustin Tazelaar, Melissa Shotwell, Timothy Fredricks, Sarah Coefield, Lori Williams, Michelle Moffat, Karl Strause, Simon Hollamby, and anyone authorized in writing by Dr. Zwiernik. A report summarizing permitted activities shall be submitted prior to the expiration of this permit. This report shall include species handled, number of animals/eggs handled, and the disposition of specimens for each calendar year for the duration of this permit.

Sincerely,

James S. Janson
Permit Specialist
Wildlife Division
517-373-9329

(SC 1255 Zwiernik 2005)

Information Only

NATURAL RESOURCES COMMISSION
Keith J. Charters-Chair • Mary Brown • Darnell Earley • Bob Garner • Gerald Hall • John Madigan • Frank Wheatlake

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STATE OF MICHIGAN

JENNIFER M. GRANHOLM
GOVERNOR

DEPARTMENT OF NATURAL RESOURCES
LANSING

REBECCA A. HUMPHRIES
DIRECTOR

April 27, 2005

Ms. Sarah Coefield
Michigan State University
224 Food Safety and Toxicology Building
East Lansing, Michigan 48824

Dear Ms. Coefield:

This letter is your approved Michigan Department of Natural Resources Scientific Collector's Permit. Permit number: SC 1251. Issue date: April 27, 2005. Expiration date: August 31, 2008. This permit authorizes the collection and handling of adult and nestling Great Horned Owls (Bubo virginianus), Great Horned Owl eggs, and Great Horned Owl parts in the State of Michigan as described below. All collection activities shall be for research or educational purposes for Michigan State University. This permit does not authorize activities on private or public property without the approval of the land owner or administrator. A federal permit is also required.

Any blood sampling authorized must be in compliance with the following: For adult Great Horned Owls, up to 6 cc may be collected per bird. Because of the variable size of nestling birds, the amount of blood that can be safely drawn shall be determined by weight. Each nestling shall be weighed, and body weight multiplied by 0.07 (assume ~7% of a bird's body weight is blood), with that product then multiply by 0.10 (assume it is generally safe to collect 10% of the blood volume without harm to the bird) to determine the amount of blood that can be collected. For example, if a nestling weighed 500 g, it should be safe to collect 3.5 cc ([500 g x 0.07] x 0.1 = 3.5 g, and because blood is mostly water, the mass of which is 1g/cc, 3.5g ~= 3.5 cc).

The following activities are authorized: Blood samples may be taken from up to 20 nestlings and 20 adults per calendar year. An unspecified number of non-viable eggs, salvaged juveniles, salvaged adults, and prey remains may be collected and/or handled. Salvaged specimens shall be those that are found dead, injured or diseased. Prey remains may include those of protected migratory avian species for further scientific study including identification and/or chemical analyses. Samples shall be held by Michigan State University Aquatic Toxicology Laboratory, East Lansing, Michigan. Up to 20 nestlings and 20 adults may be equipped with radio transmitters per calendar year. Bird handling may also include qualitative examination and/or quantitative measurement of physiological health and/or physical characteristics.

Subpermittees include: Dr. Matthew Zwiernik, Jeremy Moore, Dustin Tazelaar, Tim Fredricks, Rita Seston, David Hamman, Karl Strause, Melissa Shotwell, Lori Williams, Pamela Moseley, and anyone authorized in writing by Dr. Matthew Zwiernik.

A report summarizing permitted activities shall be submitted prior to the expiration of this permit. This report shall include species handled, number of animals handled, and the disposition of specimens for each calendar year for the duration of this permit.

Sincerely,

James S. Larson
Permit Specialist
Wildlife Division
517-373-9329

(SC 1251 Coefield 2005)

NATURAL RESOURCES COMMISSION
Keith J. Charters-Chair • Mary Brown • Bob Garner • Gerald Hall • John Madigan • Frank Wheatlake

STEVENS T. MASON BUILDING • P.O. BOX 30028 • LANSING, MICHIGAN 48909-7528
www.michigan.gov/dnr • (517) 373-2329

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STATE OF MICHIGAN

JENNIFER M. GRANHOLM
GOVERNOR

DEPARTMENT OF NATURAL RESOURCES
LANSING

REBECCA A. HUMPHRIES
DIRECTOR

Date Issued: 4/13/2005

SCIENTIFIC COLLECTOR'S PERMIT
Amphibian

Under the provisions of Part 487, Act 451, P.A. 1994, as amended, being section 324.48735, permission is hereby granted to:

Name:	Jeremy Noel Moore	Driver's License No.:	M 600 402 636 977 MI
	Rita Seston		S 235 733 809 1000 WI
	Dustin Tazelaar		T 246 155 497 552 MI
	Matthew J. Zwiernik		Z 652 589 429 273 MI
Address:	Michigan State University		
	218C FSTB		
	East Lansing, MI 48910		

to take, catch, or kill and possess the aquatic species from the waters and land within the jurisdiction of this state, as specified below in the special provisions section. This permit limits the take of aquatic species to the **minimum** number needed.

Any work under this permit shall be **approved in advance** by a fisheries biologist in the Fisheries Management Unit for the watershed where collection will occur. The District Law Supervisor for the county where the permit is being used must also be notified prior to collection.

SPECIAL PROVISIONS:
Permittees, for scientific study associated with the Tittabawassee River Project examining dioxin levels, are authorized to collect and possess up to:

42 green frogs (*Rana clamitans melanota*);
42 northern leopard frogs (*Rana pipiens*), and
42 wood frogs (*Rana sylvatica*).

Individuals will be taken to Michigan State University for contaminant analysis in the lab. After the lab analysis has been completed specimens will be disposed of in a sanitary manner. All other amphibian species encountered while in the field shall be immediately released.

Permitted collection area: flood plains, wetlands, and main branches of the Pine, Chippewa, and Tittabawassee rivers, Saginaw River watershed, Lake Huron Basin.

Permitted collection gear: Dip net, by hand, hook & line.

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Michigan Department of Natural Resources
Fisheries Division
Collector's Permit

A copy of all reports and scientific papers using organisms collected with this permit shall be provided to MDNR, Fisheries Division in addition to a Collector's Report form. Upon completion, permittees shall provide a copy of the resulting thesis/dissertation to the DNR Fisheries Division in Lansing.

GENERAL PROVISIONS: This permit must be in permittee's possession during collection and must be made available upon request of any Department representative. Collection is limited to species not threatened or endangered. This permit is not transferable. This permit does not provide any authorization to circumvent any federal, state, or local laws and ordinances, including, but not limited to restricted entrance to refuges or other areas closed to the public without written permission of the land administrator. For a complete list of provisions, see Guidelines for Holders of Cultural or Scientific Collector's Permits.

Any violation of the conditions of this permit may result in revocation of this permit and misdemeanor penalties of imprisonment for not more than 90 days or a fine of not more than $500 or all of the above. Unless revoked, this permit **expires on 12/31/2005**.

By _____
Kelley D. Smith, Ph.D.
Chief
Fisheries Division

cc: Fisheries Division
Southern Lake Huron Management Unit

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NATURAL RESOURCES COMMISSION
Keith J. Charters-Chair • Mary Brown • Bob Garner • Gerald Hall • John Madigan • Frank Wheatlake

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www.michigan.gov/dnr • (517) 373-2329

Information only

Ministry of Agriculture and Forestry, New Zealand
Te Manatu Ahuwhenua, Ngaherehere, Aotearoa

PERMIT TO IMPORT BIOLOGICAL PRODUCTS OF ANIMAL ORIGIN

This permit is issued under The Biosecurity Act, 1993. Any queries, please contact Import Management, MAF Biosecurity Authority, P O Box 2526, Wellington, (Phone 64 4 4989624, Facsimile 64 4 4744132)

Authorising Officer : **Kevin Corrin** on **08 Oct 2004**

for Chief Technical Officer, Ministry of Agriculture and Forestry, New Zealand, acting under delegated authority.

MINISTRY OF AGRICULTURE & FORESTRY
Official Veterinarian
0216
NEW ZEALAND

Permit for : AgriQuality Wellington
PO Box 31242
Lower Hutt
New Zealand
Attention : Dallas Bishop

Permit No : 2004023967
Replaces Permit No : 2004022646
Expiry Date : 11 Mar 2005
No of Consignments : Multiple
Import Purpose : Research

End Users : Laboratory staff

Shipped From : All Countries

Description of Items	Supplier	Quantity	Measure
1 Kg honey/honey product samples, commercially packaged.	Various	Unlimited	Units
2 kg Wool samples	Various	Unlimited	Units
Antibody preperation from ovine, bovine, cervine, caprine and porcine.	Various	Unlimited	Units
Any meat samples that comply with Import Health Standard MEASAMIC.SPE	Various	Unlimited	Units
Dairy samples	Various	Unlimited	Units
Dead fresh water snails in formalin	Various	Unlimited	Units
Dead marine fish samples	Various	Unlimited	Units
Dead shellfish and marine organisms	Various	Unlimited	Units
Egg powder	Various	Unlimited	Units
Fish food samples	Various	Unlimited	Units
Fish oil	Various	Unlimited	Units
Frozen fish, crustacea, shell-fish	Various	Unlimited	Units
Human & animal effluent	Various	Unlimited	Units

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Ministry of Agriculture and Forestry, New Zealand
Te Manatu Ahuwhenua, Ngaherehere, Aotearoa

Description of Items	Supplier	Quantity	Measure
Irradiated porcine blood, human urine and bovine serum	Various	Unlimited	Units
Milk & dairy products (see standard)	Various	Unlimited	Units
Muscle, liver, kidney, fat, blood, plasma, faeces and urine samples from ovine, bovine, cervine, caprine, murine,sciurine, equine, poultry, ratite, possum, kangaroo and porcine animals.	Various	Unlimited	Units
Pig liver and muscle for chemical analysis from Hawaii.	Various	Unlimited	Units
Rabbit tissue	Various	Unlimited	Units
Salmon samples (less than 10 kgs)	Various	Unlimited	Units
Soil, sediment, sewage and sludge samples for chemical analysis	Various	Unlimited	Units
Water samples for chemical analysis	Various	Unlimited	Units
Whole bird eggs (hatching eggs, ie eggs requiring incubation are not permitted)	Various	Unlimited	Units
Whole bird eggs for analysis only (hatching eggs ie, eggs requiring incubation are not permitted)	Various	Unlimited	Units

Import Health Standard

MEASAMIC.SPE, 25 Jan 2002, MEA - Meat and Meat By-Products Samples from Specified Countries

DAISAMIC.ALL, 11 May 2004, DAI - Dairy Product Samples for Evaluation

FIBTESIC.ALL, 26 Jun 2001, FIB - Importation of animal fibre for testing from all countries

Post Entry Type : Transitional Fac

Transitional Facility : AgriQuality - Wellington
PO Box 31242
Lower Hutt
1B Bell Road, Gracefield
371

Operator : Trish Whitaker
Inspector : Biosecurity-South

Ref :

Special Conditions :

The samples are not required to be inspected by MAF Quarantine Service at the port of arrival but may be directed immediately to the transitional facility specified on this permit.

This facility (ref 371) is to be inspected by a MAF Biosecurity Officer every 3 months for the first year.

Product must be imported into the above transitional facility operating to MAF Reg Standard 154.02.17 (Transitional Facilities Biological Products)

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IMPORTANT INFORMATION FOR PERMIT HOLDERS AND AGENTS

1 You need to ensure that the goods you import comply with the provisions of the specific import health standard(s) and/or entry conditions. The import health standard may be amended during the course of your permit. Import Management will notify you of any significant changes to the import health standard and will re-issue the permit to accommodate these changes.

2 This permit, and compliance with the provisions of the specific import health standard(s) and/or entry conditions, does not guarantee that the goods you import will be given a biosecurity clearance. There are other restrictions in the Biosecurity Act 1993 which apply to the giving of biosecurity clearance.

3 There are a number of other provisions in the Biosecurity Act 1993 which may affect you. If you commit an offence against the Biosecurity Act 1993, heavy penalties under section 157 of the Act might apply.

4 Apart from the Biosecurity Act 1993, there are other laws relating to or prohibiting the importation of goods. This permit, and compliance with the provisions of the specific import health standard(s) and/or entry conditions, does not absolve you of the need to comply with these laws.

5 Unless specifically identified in 'Description of Items' or 'Special Conditions' of the permit, NO new organisms, including genetically modified organisms, are permitted entry under this permit.

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MICHIGAN STATE
UNIVERSITY

MEMORANDUM

TO: Giesy, John P
Zoology
203 Natural Science

FROM: Dr. Donald L. Garling, Chairperson
All-University Committee on Animal Use and Care

DATE: 04/13/2005

SUBJECT: APPROVAL OF APPLICATION TO USE VERTEBRATE ANIMALS IN RESEARCH

This is to notify you that your application, and/or renewal, to use vertebrate animals in research or teaching has been approved by the All-University Committee on Animal Use and Care (AUCAUC). This approval is for a three-year period, beginning on the date of the original approval by the committee. Should your project extend beyond three years, you should resubmit an application to the committee. Yearly, on the anniversary date of the approval, you will be sent a letter which you will be asked to sign and return stating that there have been no alterations to your research project, nor any new people working on this project. Please note that, according to the Policies, Responsibilities and Procedures for Animal Use and Care at Michigan State University, no significant changes may be made to your animal-use plan without prior approval from the AUCAUC. Requests for review of proposed revisions and the names of new people on the project, may be made by submitting an amendment to the AUCAUC. If an Animal Hazard Control form was part of your animal use form, it is your responsibility to post this form on the animal room door and inform the facilities supervisor.

The title of your approved proposal, the date of approval and the AUF number is given below. You should retain this information for future use.

In order to be eligible for research funding from the National Institutes of Health (NIH), Michigan State University has filed with the Office of Laboratory Animal Welfare (OLAW) an assurance document which commits the university to compliance with NIH policy and the Guide for the Care and Use of Laboratory Animals. All principal investigators should be aware of the existence of this formal obligation.

Title: Field Studies in support of Kalamazoo River Ecological Risk Assessment

Application #: 03/04-042-00 **APP #:**

Funded By: Dow Chemical Company

Approved: 04/11/2005 **Expires:** 05/11/2006

DLG/cjf

CC: Dr. Fred C. Dyke, Chairperson
Zoology
203 Natural Science

ALL-UNIVERSITY COMMITTEE ON ANIMAL USE AND CARE

Michigan State University
A620 East Fee Hall
East Lansing, MI
48824-1313
(517) 432-8103
Fax: (517) 482-8105
Email: aucauc@msu.edu
Web: www.aucauc.msu.edu

MSU is an affirmative-action, equal-opportunity institution.

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MICHIGAN STATE
UNIVERSITY

MEMORANDUM

TO: Giesy, John P
Zoology
203 Natural Science

FROM: Dr. Donald L. Garling, Chairperson
All-University Committee on Animal Use and Care

DATE: 04/13/2005

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In order to be eligible for research funding from the National Institutes of Health (NIH), Michigan State University has filed with the Office of Laboratory Animal Welfare (OLAW) an assurance document which commits the university to compliance with NIH policy and the Guide for the Care and Use of Laboratory Animals. All principal investigators should be aware of the existence of this formal obligation.

Title: Protocol for Terrestrial Small Mammal Sampling and Analysis Standard Operating Procedure

Application #: 03/04-044-00 **APP #:**

Funded By: Department of Zoology

Approved: 04/13/2005 **Expires:** 05/17/2006

DLG/cjf

CC: Dr. Fred C. Dyke, Chairperson
Zoology
203 Natural Science

ALL-UNIVERSITY COMMITTEE ON ANIMAL USE AND CARE
Michigan State University
A620 East Fee Hall
East Lansing, MI
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MICHIGAN STATE
UNIVERSITY

MEMORANDUM

TO: Giesy, John P
Zoology
203 Natural Science

FROM: Dr. Donald L. Garling, Chairperson
All-University Committee on Animal Use and Care

DATE: 04/13/2005

SUBJECT: APPROVAL OF APPLICATION TO USE VERTEBRATE ANIMALS IN RESEARCH

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The title of your approved proposal, the date of approval and the AUF number is given below. You should retain this information for future use.

In order to be eligible for research funding from the National Institutes of Health (NIH), Michigan State University has filed with the Office of Laboratory Animal Welfare (OLAW) an assurance document which commits the university to compliance with NIH policy and the Guide for the Care and Use of Laboratory Animals. All principal investigators should be aware of the existence of this formal obligation.

Title: Protocol for Tree Swallow (Tachycineta bicolor) Monitoring and Collection Standard Operating Procedure

Application #: 03/04-045-00 **APP #:**

Funded By: Department of Zoology

Approved: 04/12/05 **Expires:** 05/17/2006

DLG/cjf

CC: Dr. Fred C. Dyer, Chairperson
Zoology
203 Natural Science

ALL-UNIVERSITY COMMITTEE ON ANIMAL USE AND CARE
Michigan State University
A620 East Fee Hall
East Lansing, MI
48824-1313
(517) 432-8103
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UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

Shiawassee National Wildlife Refuge
6975 Mower Road
Saginaw, MI 48601
(989)777-5930

SPECIAL USE PERMIT

Station No. to be Credited — Permit No.
31520 - 05016

Date: May 4,2005

Period of Use (inclusive)
From: May 4,2005
To:

Permitte Name
Michigan State University Aquatic Tox. Lab

Permittee Address
224 Food Safety and Toxicology Bldg.
East Lansing, MI 48824-1302
517-927-0421

Purpose (specify in detail privilege requested, or units of products involved)

Ecological Risk Assessment of the Tittabawassee River and its floodplain. Work will evaluate exposure levels and effects of PCDDs, PCDFs, DDT, and organphosphorus pesticides on a select number of passerine birds, great blue heron, kingfisher, great horned owl, bald eagle, and mink. Work will include dietary analysis, tissue analysis, nesting productivity assessment, egg sampling, Up to 20 GB Herons will be captured with padded leg-hold traps, and will be banded, marked and fitted with transmitters. Up to 20 eggs and nestlings will be sampled.

Description (specify unit numbers: metes and bounds, or other recongizable designations)

This is the first year of a 4-year study. The area of study includes all refuge portions of the Tittabawassee River downstream to the Saginaw River. Further information as to work and personnel involved is attached to this permit.

Amount of fee: $0 if not a fixed payment, specify rate and unit of charge:

- ☐ Payment Exempt - Jusification:
- ☐ Full Payment
- ☐ Partial Payment - Balance of payments to be made as follows:

Record of Payments

Special Conditions

1. Entrance limited to the hours between sunrise and sunset during the above dates only.
2. Refuge Headquarters must be notified prior to entry, for any changes in permit use, and in case of an emergency.
3. Entrance restricted to permittee and assistants listed on attached personnel list.
4. Permit must be in possession of permittee while on the Refuge and a copy on the dash of the vehicles.
5. A final report of activities/findings will be submitted to the Refuge at the end of the study.
6. Permit can be renewed each year during the 4 year study.
7. Permittee's vehicle must not block any roads, gates, or structures. Caution should be taken while driving on unimproved roads. During thaws or extremely wet conditions, road access is NOT allowed.

This permit is issued by the U.S. Fish and Wildlife Service and accepted by the undersigned, subject to the terms, covenants, oblications, and reservations, expressed or implied herein, and to the conditions and requirements appearing on the reverse side.

Permittee Signature

Issuing Officer Signature and Title
REFUGE MANAGER

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MICHIGAN DEPARTMENT OF NATURAL RESOURCES

USE PERMIT

Issued under authority of Act 451, P.A. 1994 as amended. Subject to the provisions of the law and the conditions herein contained, permission is hereby granted to the person named to use State-owned land described for the purpose indicated.

ISSUING UNIT: GLADWIN FOREST MNGMT. UNIT		PERMIT NUMBER: 008-04
PERMIT ISSUED: 10/1/2003	PERMIT EXPIRES: 9/30/2004	BUILDING INVENTORY NUMBER:
PERMITTEE'S TELEPHONE NUMBER: 517-749-5243		PERMITTEE'S S.S./FED. ID NUMBER: 38-6005984
APPLICATION/REVIEW FEE: $75.00	TOTAL CHARGES FOR USE OF LAND: $402	PERFORMANCE BOND AMOUNT: $ N/A
PAY IN INSTALLMENTS OF: $ Receipt 73002	beginning , 19	

NAME OF PERMITTEE Attention: Matt Zwiernik

MSU, Aquatic Tox. Lab., Nat'l Food Safety & Tox. Center

STREET ADDRESS

24 Food Safety & Toxicology Building

CITY: . Lansing STATE: MI ZIP CODE: 48824

DESCRIPTION OF STATE OWNED LAND

Midland County, T15N, R1W, Village of Sanford, section 25, Gov't lot 3.

AUTHORIZED LAND USE

To collect plant and animal samples for a water contamination study from State forest lands.

SPECIAL CONDITIONS AND/OR PENALTIES NOT CITED BELOW

. Proof of Liability Insurance and permission from DNR, Wildlife Division for animal collection required.

. Collection to be done as per attached letter and in line with MSU Tittabawassee River Work and Safety Plans.

DEPARTMENT REPRESENTATIVE TO CONTACT RELATIVE TO OPERATIONS UNDER THIS PERMIT (*PAY ANY INSTALLMENTS AT THIS ADDRESS*)

NAME OF REPRESENTATIVE	DEPARTMENT LOCATION/OFFICE	TELEPHONE NUMBER
Courtney C Borgondy, Unit Mgr., FMFMD	Gladwin Forest Management Unit	989/426-9205 Ext.7604

STREET ADDRESS	CITY	STATE	ZIP CODE
301 N. Silverleaf	Gladwin	MI	48624

THIS PERMIT IS SUBJECT TO THE FOLLOWING CONDITIONS AND REQUIREMENTS:

Hereinafter the Department of Natural Resources shall be referred to as Department.

1.) Unless sooner terminated, this permit shall expire on the date indicated above.

2.) Payment in the amount specified above shall be made prior to use of land indicated above or in installments as indicated above.

3.) Permittee shall maintain the area under permit in a clean and sightly condition.

4.) Requests for permit renewals should be made to the Department Representative 30 days prior to the expiration date of this permit. Such requests shall be considered only when all stipulations in the original permit have been complied with.

5.) The rights accruing under this permit shall not be assigned or transferred without the written consent of the Department Representative.

6.) Permittee shall not commit, cause, or allow to be committed any waste of, or injury to, said premises or any part thereof, nor use the same except for the purpose indicated.

7.) Temporary improvements necessary for the efficient utilization of the said premises may be made as indicated.

8.) Improvements made by the permittee on said premises and not removed within 30 days after cancellation or expiration of this permit, and when such removal shall be requested by the Department Representative shall become attached and remain a part of the premises.

9.) The Department reserves the right:

a.) to dispose of any portion of the premises herein described during the term of this permit. If possible, proper notice of sale or disposition will be given permittee. However, failure to notify permittee will not affect this right.

b.) to lease said premises for exploration and production of any or all minerals, including coal, gas, oil, sand, gravel, etc.

c.) to grant rights-of-way and easements of any kind and nature over and across said premises, and to grant or exercise all other rights and privileges of every kind and nature not herein specifically granted.

10.) LIABILITY. Permittee hereby releases, waives, discharges and covenants not to sue, the State of Michigan, its departments, officers, employees and agents, from any and all liability to Permitttee, its officers, employees and agents, for all losses, injury, death or damage, and any claims or demands therefore, on account of injury to person or property, or resulting in death of Permittee, its officers, employees or agents, whether caused by the State of Michigan, its departments, officers, employees or agents, in reference to the activities of this permit.

11.) INDEMNIFICATION. Permittee hereby covenants and agrees to indemnify and save harmless, the State of Michigan, its departments, officers, employees and agents, from any and all claims and demands, for all loss, injury, death or damage, that any person or entity may have or make, in any manner, arising out of any occurrence related to (1) this permit; (2) the activities authorized by this permit; and (3) the use or occupancy of the premises which are the subject of this permit, as well as any other state-owned lands. This indemnification and save harmless agreement shall extend to all loss, injury, death or damage, proximately caused or arising out of the negligence of the State of Michigan, its departments, officers, employees and agents.

12.) Permittee and occupants are responsible for the payment of all utility bills including water, electricity, gas, etc.

13.) Permittee agrees to comply with all requirements herein, and, if for any reason permittee violates or neglects to fulfill such requirements, this permit shall terminate and permittee shall forfeit all rights and payments made hereunder. Should permittee remain in possession of said premises after cancellation or expiration of this permit, said permittee shall be considered as tenant or tenants holding over without permission and may be evicted from said premises.

I have read the terms and conditions contained in this permit. I agree to abide by same, and assume all the obligations contained herein.

[signature] 9/26/03

Permittee Signature Date

Approved By

Courtney C Borgondy 9-26-03

Department Representative Signature Date

DISTRIBUTION: Permittee & Lansing Office - 1 Signed Original Each
Unit Manager, District, Field Hdqtrs. - 1 Signed Photocopy Each

PR 1138E (Rev. 05/26/1998)

Information Only

Information only

MICHIGAN DEPARTMENT OF NATURAL RESOURCES

USE PERMIT

Issued under authority of Act 451, P.A. 1994 as amended. Subject to the provisions of the law and the conditions herein contained, permission is hereby granted to the person named to use State-owned land described for the purpose indicated.

ISSUING UNIT	PERMIT NUMBER
GLADWIN FOREST MNGMT. UNIT	009-05 (Ext. 008-04)

PERMIT ISSUED	PERMIT EXPIRES	BUILDING INVENTORY NUMBER
10/01/04	9/30/2005	

NAME OF PERMITTEE	PERMITTEE'S TELEPHONE NUMBER	PERMITTEE'S S.S. / FED. I.D. NUMBER
Attention: Matt Zwiernik MSU, Aquatic Toxicology Lab., Nat'l Food Safety & Toxic.	517 749 5243	38-6005984

STREET ADDRESS	APPLICATION/REVIEW FEE	TOTAL CHARGES FOR USE OF LAND	PERFORMANCE BOND AMOUNT
224 Food Safety & Toxicology Building	$0	$	$

CITY	STATE	ZIP CODE	PAY IN INSTALLMENTS OF
E. Lansing	MI	48824	$ per beginning , 19

DESCRIPTION OF STATE OWNED LAND

Midland County, T15N R1W, Village of Sanford, Section 25, Gov't Lot 3

AUTHORIZED LAND USE

To collect plant and animal samples for a water contamination study from State forest lands.

SPECIAL CONDITIONS AND/OR PENALTIES NOT CITED BELOW

NOTE: This extension is to finalize collection of plant and animal samples that was unable to be completed in previous permit #008-04.

1. Proof of Liability Insurance and permission from DNR, Wildlife Division for animal collection required.
2. Collection to be done as per letter dated April 13, 2005 and in line with MSU Tittabawassee River Work and Safety Plans.

DEPARTMENT REPRESENTATIVE TO CONTACT RELATIVE TO OPERATIONS UNDER THIS PERMIT *(PAY ANY INSTALLMENTS AT THIS ADDRESS)*

NAME OF REPRESENTATIVE	DEPARTMENT LOCATION/OFFICE	TELEPHONE NUMBER
Courtney C Borgondy	Gladwin Forest Management Unit	989/426-9205 Ext.7640

STREET ADDRESS	CITY	STATE	ZIP CODE
801 N. Silverleaf	Gladwin	MI	48624-1603

THIS PERMIT IS SUBJECT TO THE FOLLOWING CONDITIONS AND REQUIREMENTS:

Hereinafter the Department of Natural Resources shall be referred to as Department.

1.) Unless sooner terminated, this permit shall expire on the date indicated above.

2.) Payment in the amount specified above shall be made prior to use of land indicated above or in installments as indicated above.

3.) Permittee shall maintain the area under permit in a clean and sightly condition.

4.) Requests for permit renewals should be made to the Department Representative 30 days prior to the expiration date of this permit. Such requests will be considered only when all stipulations in the original permit have been complied with.

5.) The rights accruing under this permit shall not be assigned or transferred without the written consent of the Department Representative.

6.) Permittee shall not commit, cause, or allow to be committed any waste of, or injury to, said premises or any part thereof, nor use the same except for the purpose indicated.

7.) Temporary improvements necessary for the efficient utilization of the said premises may be made as indicated.

8.) Improvements made by the permittee on said premises and not removed within 30 days after cancellation or expiration of this permit, and with such removal shall be requested by the Department Representative shall become attached and remain a part of the premises.

9.) The Department reserves the right:

a.) to dispose of any portion of the premises herein described during the term of this permit. If possible, proper notice of sale or disposition will be given permittee. However, failure to notify permittee will not affect this right.

b.) to lease said premises for exploration and production of any or all minerals, including coal, gas, oil, sand, gravel, etc.

c.) to grant rights-of-way and easements of any kind and nature over and across said premises, and to grant or exercise all other rights and privileges of every kind and nature not herein specifically granted.

10.) LIABILITY. Permittee hereby releases, waives, discharges and covenants not to sue, the State of Michigan, its departments, officers, employees and agents, from any and all liability to Permitttee, its officers, employees and agents, for all losses, injury, death or damage, and any claims or demands therefore, on account of injury to person or property, or resulting in death of Permittee, its officers, employees or agents, whether caused by the State of Michigan, its departments, officers, employees or agents, in reference to the activities of this permit.

11.) INDEMNIFICATION. Permittee hereby covenants and agrees to indemnify and save harmless, the State of Michigan, its departments, officers, employees and agents, from any and all claims and demands, for all loss, injury, death or damage, that any person or entity may have or make, in any manner, arising out of any occurrence related to (1) this permit; (2) the activities authorized by this permit; and (3) the use or occupancy of the premises which are the subject of this permit, as well as any other state-owned lands. This indemnification and save harmless agreement shall extend to all loss, injury, death or damage, proximately caused or arising out of the negligence of the State of Michigan, its departments, officers, employees and agents.

12.) Permittee and occupants are responsible for the payment of all utility bills including water, electricity, gas, etc.

13.) Permittee agrees to comply with all requirements herein, and, if for any reason permittee violates or neglects to fulfill such requirements, this permit shall terminate and permittee shall forfeit all rights and payments made hereunder. Should permittee remain in possession of said premises after cancellation or expiration of this permit, said permittee shall be considered as tenant or tenants holding over without permission and may be evicted from said premises.

I have read the terms and conditions contained in this permit. I agree to abide by same, and assume all the obligations contained herein.

John P Geisy — Permittee Signature — 5/28/05 Date

Approved By — Department Representative Signature — Date

DISTRIBUTION: Permittee & Lansing Office - 1 Signed Original Each
Unit Manager, District, Field Admtrs. - 1 Signed Photocopy Each

PR 1138E (Rev. 05/26/1998)

6/23/05

Information Only