Site Investigation Work Plan

Wauleco Wood Waste Burning
BRRTS #02-37-000006
Wausau, Wisconsin

March 15, 2019
Revision 0

Site Investigation Work Plan

Wauleco Wood Waste Burning
BRRTS #02-37-000006
Wausau, Wisconsin

March 15, 2019
Revision 0

Prepared For
Wauleco, Inc.

Prepared By
TRC Environmental Corporation
708 Heartland Trail, Suite 3000
Madison, WI 53717

Table of Contents

List of Tables

List of Figures

List of Appendices

Section 1
Professional Certification

"I, Kenneth J. Quinn, hereby certify that I am a hydrogeologist as that term is defined in s. NR 712.03 (1), Wis. Adm. Code, am registered in accordance with the requirements of ch. GHSS 2, Wis. Adm. Code, or licensed in accordance with the requirements of ch. GHSS 3, Wis. Adm. Code, and that, to the best of my knowledge, all of the information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs.NR 700 to 726, Wis. Adm. Code."

WISCONSIN
KENNETH J.
QUINN
G-016
MADISON
WI
PROFESSIONAL GEOLOGIST

Kenneth J. Quinn
Senior Project Hydrogeologist / G-016

Section 2
Project Management Plan

Consistent with NR 716.09(2)(a), (b), and (c) Wis. Adm. Code, the following information is provided:

1. Site Address and Location:

   Wauleco, Inc.
   125 Rosecrans Street
   Wausau, WI 54402
   Marathon County
   N½ of SE¼ of Section 35, Township 29 North, Range 7 East

2. Responsible Party:

   Wauleco, Inc.
   1800 North Point Drive
   Stevens Point, WI 54481

   Contact: Mr. Evan Schreiner
   (715) 346-8530

3. Name of the consultant involved with the project:

   TRC Environmental Corporation
   708 Heartland Trail, Suite 3000
   Madison, WI 53717

   Attention: Mr. Bruce Iverson
   Senior Project Manager
   (608) 826-3644
   e-mail: biverson@trcsolutions.com

4. Site Location Map: See Figure 1

Section 3
Introduction

Consistent with NR 716.09(2)(d) Wis. Adm. Code, the following applicable information per NR 716.07 (Site Investigation Scoping) Wis. Adm. Code is provided:

3.1 Site History and Background

The Wauleco, Inc. (Wauleco) facility is located at 125 Rosecrans Street, Wausau, Wisconsin (Figure 1). The property is located in an area of mixed industrial and residential land use. The property is the location of a former window and patio door manufacturer from the early 1900s to the early 1990s. Manufacturing operations ceased in March 1991 and nearly all site buildings were demolished by 1993.

Figure 2 presents an aerial photograph of the operation from 1974 to illustrate the configuration of site features at that point in time. Figure 3 presents the same aerial photograph, but showing additional surrounding site features.

As was common in the wood window manufacturing industry, surface coating on the exterior portions of wood windows manufactured at the site was performed using a wood preservative trade named Woodtox Preprime, manufactured by Kopper Chemical and Coating Company. Woodtox Preprime, commonly referred to as Penta, was a 5% solution of pentachlorophenol (PCP) dissolved in 85% mineral spirits, and 10% inerts. Penta was used at the site from approximately 1944 until 1986.

As was also common in the wood window manufacturing industry, the facility incinerated wood waste for a period of time to fuel an on-site boiler that provided heat for the facility. This boiler was retired from service in 1987.

As discussed in the Wisconsin Department of Natural Resources (WDNR) letter dated January 15, 2019, to date, site investigation and remediation have focused on soil and groundwater. This work plan presents an investigation approach to address questions raised by WDNR concerning the historical combustion of wood waste at the facility.

Additional information regarding the history of facility operations and the wood waste management activities is included in Wauleco's March 15, 2019 response to the WDNR's letter.

3.2 Purpose and Approach

The purpose of this Site Investigation Work Plan (SI Work Plan) is to respond to the request in the WDNR letter "to address aerial deposition of contaminants associated with the combustion of wood waste generated at the facility." We understand that the Department's concern associated with historical combustion of wood waste is that dioxins and furans may have been formed, emitted from the air discharge, and aerially deposited to the soil downwind of the boiler air emission stack. Therefore, the constituents of potential concern (COPCs) for this site investigation are dioxins and furans.

This SI Work Plan is intended to present the proposed sampling and analysis strategy, sampling methods, and other details for the implementation of the proposed Scope of Work to respond to the request.

To develop a logical approach to address this request, the procedures described in this SI Work Plan are based on the following:

- Previous soil investigations have been performed in the area on four occasions by others (see Section 3.3.1) that included analysis for dioxins/furans. The results of these four previous investigations are compiled and summarized in Table 1 and Figure 4.
- Information concerning the boiler(s) and associated stack are being compiled by Wauleco as part of its response to the WDNR letter and will be reviewed by TRC. This information will be used to identify input parameters that will be used to model potential air emission migration from the stack to assess potential aerial deposition (see Section 5.2). Concurrence from the WDNR will be requested on the proposed air model and input parameters to use.
- Background conditions will be evaluated (see Section 5.3) to assist in assessing background soil quality, as defined by NR 700.03(2). Background sample results will be used to assess potential dioxin/furan concentrations from regional background and other localized potential sources of dioxins/furans in soil in the vicinity of Wauleco. Proposed background soil sampling locations will be provided to the WDNR prior to sampling.
- Wauleco understands that the City of Wausau is requesting proposals from consultants to perform additional surface soil sampling in Riverside Park. Wauleco plans to coordinate with the City (see Section 5.4). The results from this investigation will be compiled with the results from the previous four investigations to develop a comprehensive drawing and table summarizing sample locations and results.
- Once concurrence from WDNR is obtained on the air dispersion model and model input parameters, aerial deposition modeling will be performed. The output of the model predicts where aerial deposition is expected to occur. The results of the modeling will be compared to the comprehensive drawing showing historic sample locations and

background soil sample locations will be identified, shared with WDNR and then sampling completed (See Section 5.5).

- Following receipt of the background soil sample results, an assessment will be performed to identify if data gaps are present that need to be addressed. As part of this assessment, soil sampling locations will be selected (see Section 5.6).
- If data gaps are identified, Wauleco will propose additional surface soil sampling (see Section 5.6) to address data gaps in an amendment to this SI Work Plan to be submitted to the WDNR following completion of the foregoing steps.

Because the approach described above requires sequential activities, the proposed locations of additional soil samples, if any, cannot be identified in this SI Work Plan. Addenda to this SI Work Plan (e.g., technical memoranda) will be provided to the WDNR as the sequential activities are completed.

3.3 Previous Investigations and Reports

3.3.1 Previous Investigations

Four soil investigations have been conducted by others, summarized in three reports, including the following:

- During June of 2006, CWE, Inc. (CWE) collected three soil samples, and during December of 2008, CWE collected nine soil samples, as summarized in the CWE Memorandum dated July 8, 2009 (see Appendix A).
- During August of 2017, AECOM collected 12 soil samples at six locations along Thomas Street, as summarized in the AECOM Memorandum dated September 21, 2017 (see Appendix B).
- During January 2018, Sand Creek Consultants (SCC) collected four soil sample along Thomas Street, as summarized in the SCC letter dated February 6, 2018 (see Appendix C).

The results of these 28 soil samples, collected at 22 sample locations, are summarized in Table 1, and depicted on Figure 4.

3.3.2 Department of Health Services Documents

The Wisconsin Department of Health Services (DHS) issued two letters to the City of Wausau based on DHS' review of the results:

- Letter dated August 20, 2018 (see Appendix D).
- Letter dated February 7, 2019 (see Appendix E).

- The risk assessment DHS performed assumed that visitors to Riverside Park would be near the culvert outfall-- located on a steep bank and significantly overgrown with brush vegetation --three times a week for 35 of the 52 weeks a year. The assessment also assumed exposure to the "worst case" highest sample result for the residential exposure scenario.
- The August 20, 2018 DHS letter states that "The culvert is located on a small embankment that is a former railroad at the border between the Wauleco fence line and Riverside Park". However, as shown on Figure 4, the culvert inlet and outlet samples do not border the Wauleco plant property. Rather, they are located well east of the Wauleco former plant property. In addition, runoff to the culvert runs beneath a former railroad track bed and drains an area where creosoted railroad ties have been stored.
- DHS concludes: "Based on the analysis of available data, DHS concludes that exposure to dioxin in surface soil at Riverside Park and at the Thomas Street area are unlikely to be harmful to people." DHS also recommends further investigation of dioxin in soils in the area to better understand the situation. The work planned by Wauleco as a part of this effort, as well as the City of Wausau's expressed intent to perform further sampling or assessment at Riverside Park, can assist in closing any data gaps that may exist.

Section 4
Site Description

Consistent with NR 716.09((2)(e) Wis. Adm. Code, this section provides information on the site setting.

4.1 Site Location and Features

According to the U.S. Geological Survey 7.5-Minute Quadrangle (USGS, see Figure 1), Wauleco is located in the N½ of SE¼ of Section 35, Township 29 North, Range 7 East, at an approximate elevation of 820 feet above mean sea level (amsl). The Site is located within the limits of the City of Wausau, in a mixed industrial, commercial, and residential area, and approximately 500 feet to 1,000 feet west of the Wisconsin River.

Marathon County has a temperate climate with cold winters and warm summers. Total annual precipitation is approximately 32 inches.

4.2 Geology and Hydrogeology

The Wauleco site is located within the Wisconsin River bedrock valley and south of the southern extent of glacial advance. In general, the geology consists of a valley in the PreCambrian bedrock created by pre-glacial erosion with subsequent deposition in the valley of glacial aged outwash and lake deposits. The depth to the top of bedrock at the Wauleco site ranges from 58 feet on the west side of the site at well W-1B to greater than 60 feet near the Wisconsin River at well W-10B. The bedrock valley fill consists of sand, and sand and gravel glacial outwash from the surface to the top of bedrock on the western portion of the Site (i.e., at 58 feet at well W-1B). A continuous silty clay to clayey silt deposit is present on top of bedrock, below the sand and gravel outwash, extending from the center of the site, near well PW-12, to the east, past well W-10B and under the Wisconsin River.

The groundwater in the vicinity of Wauleco occurs within the sand and gravel outwash within the Wisconsin River bedrock valley. Depth to groundwater ranges from approximately 33 feet (at well W-8) upgradient, west of Wauleco, to approximately 19 feet (at well W-10A) near the Wisconsin River shoreline.

Section 5
Sampling and Analysis Strategy

Consistent with NR 716.09(2)(f) and (g) Wis. Adm. Code, this section provides information on the proposed sampling and analysis strategy, and procedures to be used to address potential aerial deposition of COPCs associated with combustion of wood waste at the facility.

5.1 Scope of Work

To achieve the purpose discussed in Section 3.2, the proposed Scope of Work includes the following tasks:

- Aerial Deposition Modeling Methodology (Section 5.2)
- Background Conditions Assessment (Section 5.3)
- Coordination with City of Wausau Proposed Sampling in Riverside Park (Section 5.4)
- Background Sampling (Section 5.5)
- Data Gaps Identification and Sampling (Section 5.6)
- Surface Soil Sampling Procedures (Section 6)

5.2 Aerial Deposition Modeling Methodology

Based on a review of historical documents concerning the operation of a former wood-fired boiler at the site, a state of the science air dispersion model (i.e., AERMOD, version 18081) will be used to predict where wood ash may have been deposited in the area surrounding the Wauleco facility. The purpose is to identify, based on climatological wind data and a computer model, where the ash would have been most frequently deposited. Logically this would also be the locations where soil concentrations of substances present in the ash would be the highest.

To accomplish this goal, TRC will review historical records and documents produced by Wauleco in response to the Department's letter to identify important model input parameters. These factors include the following:

- The size of the wood fired boiler(s) (i.e., how many mmbtu/yr).
- The typical quantity of wood burned in the boiler per year.
- Consideration of any particulate matter (PM) control devices (e.g. cyclones).
- Consideration of USEPA AP-42 emission factors for particulate matter emissions from wood fired boilers.

- Consideration of stack parameters for a boiler of the size used at Wauleco. Critical stack parameters include stack height, stack diameter, airflow volume (actual cubic feet per minute (acfm) of exhaust air) and exhaust air temperature. Based upon a review of historical data and engineering judgment, the following parameters will be identified:
  - Height
  - Diameter
  - Exhaust Temperature
  - Exhaust airflow volume
- Consideration of the approximate dimensions of the building structures present during the period of operations. This would include length, width and height.
- Consideration of the approximate location of the stack for the boiler in UTM83 coordinates. Based on a review of historical photos in conjunction with current aerial photos containing structures still present, the UTM coordinates on NAD83 datum will be estimated.
- Construction of a three dimensional computer model of the facility and the surrounding areas taking into account stack parameters, locations, buildings and terrain elevations.
- Two 5-yr sets of hourly wind data (each having 43,824 hours of possible observations) were processed. These datasets were taken at the Wausau airport. This airport is located approximately 1.5 miles south east of the site. Given similar proximity to Rib Mountain, it is assumed this data set is representative of historical winds at the site. Wind roses of the two contiguous 5-year meteorological periods (1998 to 2002, and 2011 to 2015) show a consistent wind frequency distribution (see Figures 1 and 2 in Appendix F). Because the meteorological data contained in the 2011-2015 data set contains the most comprehensive parameters for use in the latest version of the air quality model, this data set will be used for the AERMOD model estimates of deposition of wood ash. It is noted in the air quality modeling evaluation field, one contiguous 5-year set of hourly meteorological data is assumed to produce similar long term predicted impacts to any other contiguous set from the same location. Therefore, in this case, deposition patterns predicted from the use of the 2011-2015 dataset should represent long term deposition patterns in the area.
- Some features of the AERMOD air dispersion model include the following factors:
  1. This is the air quality model developed by the USEPA and is used all across the country for predicting where emissions plumes travel, and how concentrated they are, with embedded pollutants when they come back to the surface.
  2. The model has a deposition mode in which based on particle sizing and particle density, it will predict where wood ash may be deposited over time. If the model is executed for a long period of time (typical a contiguous 5 year period with hourly wind observations), the model will show patterns of deposition over that time period. The USEPA AP-42 emission factor document presents an estimated

particle size distribution for ash from a wood fired boiler. This document will be referenced to identify particle sizing data, and a density of wood fly ash to use as input parameters.

- The patterns of predicted deposition will be an indicator of where maximum historical deposition of ash from wood burning may have occurred.

After historical records are reviewed, these factors will be evaluated, and the proposed input parameters, along with a reference for the parameters, will be identified. This information will be provided to the WDNR for concurrence prior to developing and running the air dispersion model.

5.3 Background Conditions Assessment

Wausau has a long history of manufacturing and industrial operations, in particular in the general vicinity of the Wauleco site. There are numerous potential additional sources in the area that may have released dioxins, including, but not limited to, other waste incinerators, coal-fired boilers, manufactured gas plants, foundries, paper manufacturers and even residential firewood consumption and backyard burning of yard wastes, household solid waste, and other materials. Potential background industrial sources will be inventoried as part of this assessment.

Background samples will be collected to assess COPCs (e.g., dioxins) for the potential presence of COPCs from potential area air emission sources. This will assist in the determination if COPCs found in the areas identified by the air modeling as being potentially impacted by air emissions from the Wauleco facility could be attributable to other sources. Background samples will be selected after completion of the aerial deposition modeling. Based on the model results, sample locations will be selected to identify background due to:

- Typical urban sources (e.g., solid waste burn barrels, power plants, automotive emissions, etc.).
- Potential industrial sources in the vicinity of Wauleco.

Prior to collecting background and potential local industrial source soil samples, proposed sample locations will be identified and shared with WDNR (Section 5.5).

5.4 Coordination With City of Wausau Proposed Sampling in Riverside Park

Wauleco understands the City of Wausau is requesting proposals from consultants to perform additional surface soil sampling in Riverside Park. Wauleco plans to coordinate with the City, and the results from this investigation will be compiled with the results from the previous four investigations, to develop a comprehensive drawing and table summarizing sample locations and results.

5.5 Background Sampling

Proposed background sample locations will be identified, based on the model results (Section 5.2), background conditions assessment (Section 5.3), and existing sample results (Section 3.3 and 5.4). A technical memorandum setting forth the proposed background sampling locations will be provided to WDNR prior to field sampling activities.

After providing the technical memorandum to the WDNR concerning the proposed background sampling locations, activities to secure access permission for off-site sample locations will begin. Efforts will be made to locate sampling in public rights of way. After off-site access permission/agreements are obtained, background soil sample collection will begin within two weeks. Samples will be collected and analyzed as described in this SI Work Plan.

5.6 Data Gaps Identification and Sampling

A proposed data gap sampling technical memorandum will be prepared proposing soil sample locations, if any, to close data gaps in the distribution of COPCs in the vicinity of Wauleco. This technical memorandum will include information from the air dispersion modeling (Section 5.2), the background conditions assessment (Section 5.3), sampling conducted in Riverside Park (Section 5.4), the soil investigations previously conducted (Section 3.3), and the background sample results (Section 5.5). These data will be interpreted and used to identify if there are data gaps that need to be addressed.

Soil sample locations to fill these data gaps, if any, will be identified on a map showing the locations with the existing and completed background soil sample results.

This technical memorandum will be provided to the WDNR, and concurrence will be requested for the proposed soil sample locations. Upon concurrence from the WDNR of the proposed data gap soil sampling locations, permission to access off-site properties will begin. Efforts will be made to locate sampling in public rights of way. Within 2 weeks of obtaining permission/access agreements, the data gap soil sampling will begin following procedures described in this work plan.

5.7 Site Investigation Report

A Site Investigation Report summarizing the activities discussed in this SI Work Plan will be provided to the WDNR within 60 days of completing all site investigation activities.

Section 6
Surface Soil Sampling Procedures

This section describes the specific sampling equipment and methodology for the collection of soil samples for chemical analysis from the soil sample locations to be determined, as described above.

6.1 Surface Soil Sampling Methods

Hand tools will be used to collect a soil sample from 0 to 6 inches, excluding the vegetative layer at the surface. Hand tools will be selected based on field conditions and may include, but are not limited to: shovel, trowel, tubular soil sampler, or hand auger. If a tubular soil sampler is used, it will be equipped with a disposable plastic sampling liner. Each soil sample will be described in a field log in accordance with the Unified Soil Classification System (USCS).

The material from each sample interval will be placed into a separate, pre-cleaned, stainless-steel or aluminum mixing container for processing. Once the sample material is in the mixing container, the sample will be thoroughly homogenized using a metal spoon, spatula, or other equivalent implement. The homogenized material will be placed in appropriately labeled laboratory sample containers (4 oz. amber glass jars) and placed on ice for transport to the analytical laboratory.

Excess soil material will be used to backfill the soil sample hole. The soil sample probe and any other non-dedicated, non-disposable sampling equipment will be decontaminated in accordance with Section 5.8 prior to collecting the next sample.

6.1.1 Sample Identification

Each sample of soil collected from the soil borings will be assigned a unique alpha-numeric sample descriptor identifying the sample location. The sample ID and depth of collection will be recorded in the field notes.

6.1.2 Sample Shipment and Laboratory Analysis

Samples will be placed on ice immediately after collection for transport to Pace Analytical Laboratory (a Wisconsin certified laboratory). The samples will be analyzed by EPA Method 1613B, reporting the 17 dioxin and furan congeners that are 2,3,7,8-substituted and the associated homolog groups. Laboratory method detection limits are included in Appendix G. The laboratory will be asked to run the sample undiluted to avoid elevated detection limits. If dilution is necessary, the laboratory shall run the sample a second time at a dilution or to correct QA/QC problems. The samples will be shipped overnight to the laboratory under proper chain of custody.

6.1.3 Sample Locations

The final locations of the soil samples will be documented using differential global positioning system (GPS) techniques. A Trimble Geoexplorer handheld GPS unit, with H-Star technology enabled (or equivalent), will be used to collect these locations. Where field conditions permit, carrier-phase signal data will be used for GPS data collection. When collecting GPS location data, field staff will continuously log a sample position until the predicted post-processed accuracy is better than 1 foot, or 30 position readings have been collected. All data collected with the Trimble GPS unit will be post-processed through the software program Trimble Pathfinder Office using nearby reference station Global Navigation Satellite System (GNSS) reference data, as available. GPS and survey data will be projected into the State Plane Wisconsin Central coordinate system (NAD83, US Feet).

6.1.4 Sample Location Abandonment

Holes resulting from sample collection will be backfilled with excess soil from sampling at that location. Abandonment in accordance with NR 141 Wis. Adm. Code is not required due to the shallow depths of sample collection (<10 feet below ground surface).

6.2 Surface Soil Sample Quality Assurance/Quality Control (QA/QC) Samples

The condition of each cooler will be evaluated upon receipt at the laboratory. Samples received on ice are considered preserved at the correct temperature (4°C, ± 2°). Temperature blanks will be measured to assess whether the sample temperature was maintained during sample transport. Temperature blanks consist of a sample container, generally polyethylene, filled with tap water. One temperature blank will be transported with each cooler containing sample containers.

As specified in NR 716.13(6)(b) Wis. Adm. Code, one temperature blank will be included for every shipping container. Additional QA/QC samples for soil samples are not specified in NR 716.13(6), Wis. Adm. Code.

6.3 Decontamination of Equipment

Equipment decontamination will include the following:

6.3.1 Single-Use Sampling Equipment

The materials used will be new and clean and will be placed in plastic for transport to the site. Once used, single-use equipment will be placed in plastic bags and managed as IDW material. Single-use equipment may include, but is not limited to, the following:

- Disposable aluminum trays or pans
- PVC, polycarbonate, acrylic (or similar material) core barrel liners

6.3.2 Non-dedicated Sampling Equipment

Non-dedicated equipment used for sample collection or sample processing will be new or cleaned before its initial use in the field and cleaned again before use at each subsequent sampling site (and between sample intervals). Equipment subject to this decontamination procedure includes, but is not limited to, the following:

- Shovel, trowel, tubular soil sampler, hand auger, or equivalent
- Metal scoops, spatulas, and mixing bowls (if re-used)

Non-dedicated sampling equipment associated with soil sampling can be put into one of two categories:

- Non-sample contacting equipment, *i.e.*, equipment associated with the sampling effort that does not directly contact the sample, or
- Sample contacting equipment, *i.e.*, equipment that comes in direct contact with the sample or portion of sample that will undergo chemical analyses or physical testing.

Both of the above types of equipment are used during soil sampling. Non-sample contacting equipment generally consists of the outer metal part of the tubular soil sampler. Sample contacting equipment includes shovel, trowel, hand auger, homogenization vessels (if not single-use) and scoops/spatulas.

The general procedure for decontaminating non-sample contacting equipment is as follows:

- Hand wash with a brush using a potable water/non-phosphate detergent solution, then,
- Rinse equipment with potable water.

The general procedure for decontaminating sample-contacting equipment is as follows:

- Scrape off as much loose material as possible
- Disassemble the equipment, as appropriate.

- Wash with detergent/potable water solution, using a brush made of inert material to remove any particles or surface film.
- Rinse thoroughly with potable water.
- Rinse with deionized or distilled water from an off-site source.
- Allow equipment to air dry prior to next use.
- Wrap equipment for transport with inert material (aluminum foil or plastic wrap) to prevent direct contact with potentially contaminated material.

Sample containers such as jars and vials are to be pre-sterilized by the manufacturer or supplier. Any equipment whose cleanliness is not confirmed should be decontaminated using the above process prior to use.

Decontamination will be performed in 5-gallon buckets and managed as IDW pending soil sample analytical results (Section 5.9). Decontamination water will be changed out for new, clean solutions at a minimum of once per sampling day.

6.4 Investigation Derived Waste (IDW)

IDW streams generated during this investigation are expected to include decontamination fluids and general refuse (e.g., used personal protective equipment, single-use sampling equipment, and trash). Decontamination fluids will be containerized in sealed 5-gallon buckets. The buckets will be sealed, labeled with the date and contents, and staged at the Wauleco project site pending soil sample analytical results. General refuse will be collected in sealed trash bags and placed in a waste dumpster for disposal as a solid waste.

Section 7
Schedule

Consistent with NR 716.09(2)(h) Wis. Adm. Code, based on the approach described in this SI Work Plan, the targeted schedule is as follows:

- Air dispersion model input parameters will be provided to the WDNR by April 5, 2019.
- Within 30 days of receipt of concurrence from the WDNR on the air dispersion model input parameters, the air dispersion model will be developed/run. Concurrently, the background conditions assessment will be performed. The interpretation of modeling results, background conditions assessment and identification of proposed background soil sample locations will be provided to the WDNR.
- After off-site access permission/agreements are obtained, the background soil sample collection will begin within two weeks.
- Within 60 days of receipt of the background sample analytical results, a proposed data gap sampling technical memorandum will be prepared proposing additional soil sample locations, if any.
- Upon concurrence from the WDNR of the proposed data gap soil sampling locations, permission to access off-site properties will begin.
- After off-site access permission/agreements are obtained, the data gap soil sample collection will begin within two weeks.
- Soil sample results will be provided to WDNR within 10 business days as required by NR 716.14(2), Wis. Adm. Code.
- A Site Investigation Report summarizing the activities discussed in this SI Work Plan will be provided to the WDNR within 60 days of completing all site investigation activities.

Section 8
Technical Review Fee and Responses Requested From WDNR

Wauleco is submitting a technical review fee for this SI Work Plan. Per NR 749 Wis. Adm. Code, Wauleco requests a Technical Assistance letter from the WDNR with a response on whether the WDNR has any comments to this SI Work Plan.

Table 1
Analytical Results of Soil Samples Collected from the Neighborhood East of Wauleco
Wausau, Marathon County, WI

CONSULTANT/INVESTIGATION, SAMPLE LOCATION ID, SAMPLE DEPTH (FT BGS), SAMPLE DATE

ANALYTE	UNITS	NR 720 SOIL RCLs(1) NON-INDUSTRIAL DIRECT CONTACT(2)	NR 720 SOIL RCLs(1) INDUSTRIAL DIRECT CONTACT(2)	CWE 2006(3) 122E	CWE 2006(3) Culv. In.	CWE 2006(3) Culv. Out.	CWE 2008(3) 1003 Emt	CWE 2008(3) 130 Riv	CWE 2008(3) 141 Riv	CWE 2008(3) 120 Riv	CWE 2008(3) 117 Riv 1	CWE 2008(3) 117 Riv 2	CWE 2008(3) Fern	CWE 2008(3) Oak	CWE 2008(3) Weston
				0.33-0.5(6)	0.33-0.5(6)	0.33-0.5(6)	0.33-0.5(6)	0.33-0.5(6)	0.33-0.5(6)	0.33-0.5(6)	0.33-0.5(6)	0.33-0.5(6)	0.33-0.5(6)	0.33-0.5(6)	0.33-0.5(6)
				6/13/2006			12/4/2008								
DIOXIN CONGENERS															
2,3,7,8-TCDD	ng/kg	4.82	21.8	<0.99	2.1	<2.0	<1	<1.8	<1	<1	<1	<1	<1	<1	<1
1,2,3,7,8-PeCDD	ng/kg	4.93	22.3	<4.9	**15**	**11**	<5	<5	<5	<5	**5.1**	**5.6**	<5	<5	<5
1,2,3,4,7,8-HxCDD	ng/kg	49.3	223	6.3	48	23	<5	<5	<5	<5	12	15	<5	<5	<5
1,2,3,6,7,8-HxCDD	ng/kg	49.3	223	17	**140**	**83**	15	6.0	<5	<5	41	44	5.6	<5	<5
1,2,3,7,8,9-HxCDD	ng/kg	49.3	223	11	**60**	36	6.8	5.5	<5	<5	25	27	<5	<5	<5
1,2,3,4,6,7,8-HpCDD	ng/kg	484	2190	270	**2400**	**1400**	260	95	87	120	**1100**	**1100**	170	30	<5
OCDD	ng/kg	16400	74400	1600	**17000**	9300	3000	700	630	830	7600	8200	1200	270	24
FURAN CONGENERS															
2,3,7,8-TCDF	ng/kg	48.4	219	1.7 T	6.7	7.3	2	<3.9	<1	<1	3.5	3.7	1.4	<1	<1
1,2,3,7,8-PeCDF	ng/kg	164	744	<4.9	13	8.7	<5	<5	<5	<5	<5	<5	<5	<5	<5
2,3,4,7,8-PeCDF	ng/kg	16.4	74.4	5.7	**45**	**80**	**76**	<5	<5	<5	16	16	<5	<5	<5
1,2,3,4,7,8-HxCDF	ng/kg	48.5	220	7.3	32	35	24	<5	<5	<5	37 T	12	<5	<5	<5
1,2,3,6,7,8-HxCDF	ng/kg	48.5	220	5.4	34	33	26	<5	<5	<5	19	17	5.9 T	<5	<5
2,3,4,6,7,8-HxCDF	ng/kg	49.3	223	9.0	**59**	**75**	**100**	<5	<5	<5	29	23	<5	<5	<5
1,2,3,7,8,9-HxCDF	ng/kg	49.3	223	<4.9	14	11	6.4	<5	<5	<5	<5	5.0	<5	<5	<5
1,2,3,4,6,7,8-HpCDF	ng/kg	490	2220	94	**550**	480	160	43	27	42	350	350	83	19	<5
1,2,3,4,7,8,9-HpCDF	ng/kg	490	2220	8.5	40	31	13	<5	<5	<5	20	20	<5	<5	<5
OCDF	ng/kg	16400	74400	130	950	710	170	49	36	53	520	550	170	34	<10
PENTACHLOROPHENOL															
Pentachlorophenol (PCP)	ug/kg	1020	3970	--	--	--	--	--	--	--	--	--	--	--	--

ANALYTE	AECOM(4) B-1	AECOM(4) B-1	AECOM(4) B-2	AECOM(4) B-2	AECOM(4) B-3	AECOM(4) B-3	AECOM(4) B-4	AECOM(4) B-4	AECOM(4) B-5	AECOM(4) B-5	AECOM(4) B-6	AECOM(4) B-6	Sand Creek Consultants(5) B-101	Sand Creek Consultants(5) B-102	Sand Creek Consultants(5) B-103	Sand Creek Consultants(5) B-104
	1-4	4-6	1-4	6-8	1-2	10-12	1-2	10-12	1-4	10-12	1-4	8-10	0.67(7)	0.67(7)	0.67(7)	0.67(7)
	8/25/2017												1/9/2018			
DIOXIN CONGENERS																
2,3,7,8-TCDD	<0.63	<0.15	<2.6 D	<0.10	<0.064	<0.10	<0.094	<0.094	<0.079	<0.079	<0.11	<0.071	< 0.28	<0.41	<0.23	<0.23
1,2,3,7,8-PeCDD	<0.18	<0.15	<1.4 D	<0.085	0.45 J	<0.11	<0.046	<0.084	<0.062	<0.069	<0.087	<0.075	2.3 J	0.74 EIJ	0.48 EIJ	0.56 J
1,2,3,4,7,8-HxCDD	<0.11	<0.11	<2.1 D	<0.12	<0.20 IJ	<0.097	<0.055	<0.075	<0.069	<0.054	<0.096	<0.066	3.10	1.1 J	0.55 EIJ	0.69 J
1,2,3,6,7,8-HxCDD	<0.10	<0.11	<1.9 IJD	<0.11 IJ	3.5 J	<0.086	<0.093	<0.061	<0.055	<0.054	<0.087	<0.081	15	4.2 J	2.2 J	3.6 J
1,2,3,7,8,9-HxCDD	<0.082	<0.12	<2.0 D	<0.12	1.9 J	<0.099	<0.094	<0.071	<0.061	<0.053	<0.090	<0.073	7.6	2.4 J	1.4 J	1.9 J
1,2,3,4,6,7,8-HpCDD	0.20 J	0.12 J	140 D	2.0 J	65	<0.14	0.46 J	<0.18 IJ	0.28 J	<0.13 IJ	<0.16 IJ	<0.15 IJ	290	85	50	81
OCDD	0.99 BJ	0.70 BJ	7500 D	50	520	0.27 BJ	3.1 J	5.4 J	4.6 J	6.0 J	5.6 J	6.4 J	2000	570	380	650
FURAN CONGENERS																
2,3,7,8-TCDF	<0.54	<0.18	<2.5 D	<0.096	<1000.080 IJ	<0.095	<0.11	<0.071	<0.068	<0.052	<0.11	<0.090	2.9 V	0.87 J	<0.46	<0.26
1,2,3,7,8-PeCDF	<0.27	<0.17	<1.3 D	<0.12	0.31 J	<0.075	<0.057	<0.097	<0.096	<0.087	<0.19	<0.12	2.0 J	0.70 J	<0.52	0.42 J
2,3,4,7,8-PeCDF	<0.20	<0.20	<1.4 D	<0.082	0.95 J	<0.063	<0.033	<0.049	<0.056	<0.049	<0.10	<0.060	9.8	2.0 J	1.1 J	1.2 J
1,2,3,4,7,8-HxCDF	<0.086	<0.12	<2.0 D	<0.098	1.4 J	<0.11	<0.061	<0.054	<0.041	<0.040	<0.065	<0.074	5.8	2.0 EIJ	1.3 J	1.5 J
1,2,3,6,7,8-HxCDF	<0.084	<0.11	<2.0 D	<0.087	1.6 J	<0.086	<0.061	<0.045 IJ	<0.030	<0.036	<0.053	<0.071	6.7	1.8 J	0.99 J	1.2 J
2,3,4,6,7,8-HxCDF	<0.085	<0.10	<2.5 D	<0.075	1.8 J	<0.086	<0.068	<0.039	<0.040	<0.037	<0.055	<0.063	11 EP	2.7 J	1.2 J	1.6 J
1,2,3,7,8,9-HxCDF	<0.12	<0.15	<4.1 D	<0.13	<0.13 IJ	<0.18	<0.13	<0.056	<0.049	<0.045	<0.068	<0.058	1.3 J	0.36 J	<0.12	<0.20
1,2,3,4,6,7,8-HpCDF	<0.074	<0.084	9.1 JD	0.22 J	23	<0.057	0.19 J	<0.055	0.048 J	0.068 J	<0.093	0.11 J	120	30	17	26
1,2,3,4,7,8,9-HpCDF	<0.085	<0.11	<3.1 D	<0.13	1.0 J	<0.096	<0.57	<0.074	<0.054 IJ	<0.059	0.13 J	<0.074	4.0 J	0.96 EIJ	0.81 J	1.0 J
OCDF	<0.17	<0.14	<3.0 IJD	0.51 J	33	<0.14	0.23 J	<0.17	<0.13	<0.14 IJ	0.26 J	0.11 IJ	190	36	19	42
PENTACHLOROPHENOL																
Pentachlorophenol (PCP)	<40.5	<37.7	<39.9	<38.6	<39.7	<37.8	<40.3	<37.9	<37.5	<38.4	<38.4	<39.1	--	--	--	--

Footnotes:

(1) RCLs from WDNR RCL Spreadsheet (December 2018 Update).
(2) Value is the generic RCL for exposure by direct contact.
(3) From CWE letter titled "July 2009 Memorandum Regarding PCP and Dioxin Concentrations" dated July 8, 2009.
(4) From AECOM memorandum titled "Results for Phase 2 Environmental Sampling Investigation, Thomas Street Phase II" dated September 21, 2017. Note that samples were also analyzed for 2-chlorophenol, 2,4-dichlorophenol, phenol, 2,3,4,6-tetrachlorophenol, 2,4,5-trichlorophenol, and 2,4,6-trichlorophenol, which were not detected.
(5) From Sand Creek Consultants (SCC) letter titled "Thomas Street Proposed Construction Corridor" dated February 6, 2018. Note that the results presented here match those from the SCC summary table and one of the enclosed lab reports. In another enclosed lab report for the same samples, the results reported as J-flagged here are reported as not detected.
(6) Depth of 0.33-0.5 feet is approximate. The CWE letter notes that dioxin/furan concentrations measured in soil samples were found at the base of the A horizon, generally 4 to 6 inches below the land surface.
(7) The Sand Creek Consultants letter notes that soil samples were collected from depths of approximately 8 inches, near the base of the topsoil, after first drilling 4 to 5 inches through the frost layer.

Prepared by: L. Auner, 2/18/2019
Checked by: B. Wachholz, 2/25/2019
Revised by: L. Auner, 3/8/2019

Abbreviations:

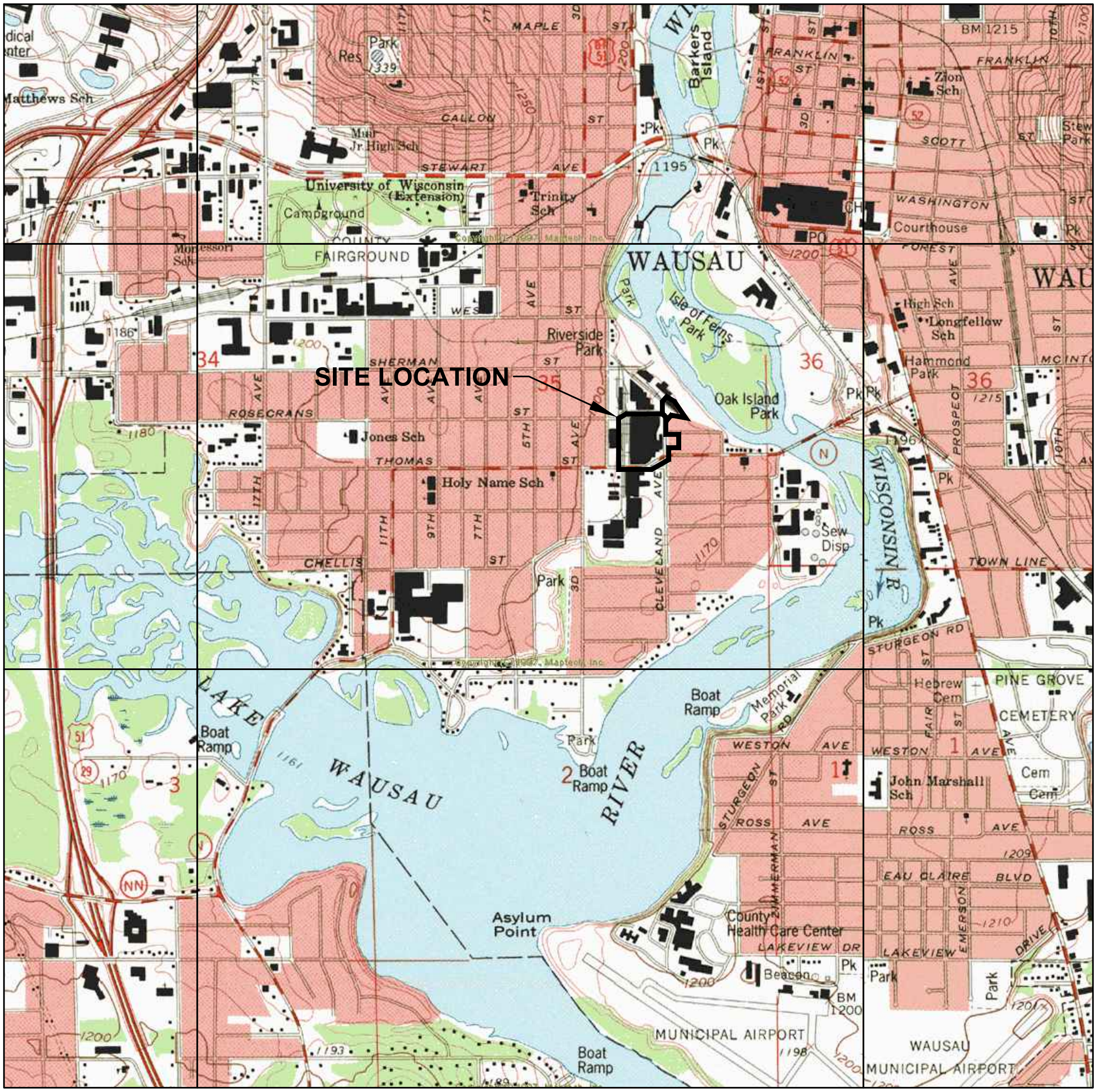
TCDD: Tetrachlorodibenzo-p-dioxin
PeCDD: Pentachlorodibenzo-p-dioxin
HxCDD: Hexachlorodibenzo-p-dioxin
HpCDD: Heptachlorodibenzo-p-dioxin
OCDD: Octachlorodibenzo-p-dioxin
TCDF: Tetrachlorodibenzofuran
PeCDF: Pentachlorodibenzofuran
HxCDF: Hexachlorodibenzofuran
HpCDF: Heptachlorodibenzofuran
OCDF: Octachlorodibenzofuran

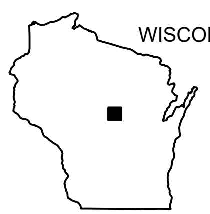
Notes:

1. RCL = NR 720 Residual Contaminant Level
2. ng/kg: nanograms per kilogram; equivalent to parts per trillion
3. ug/kg = micrograms per kilogram, equivalent to ppb
4. **Bold blue** values indicate concentration exceeds Non-Industrial Direct-Contact RCL
5. **Bold purple** values indicate concentration exceeds Industrial Direct-Contact RCL
6. -- = Not analyzed or not included in report referenced
7. TRC has not performed a data validation/data usability review of others' analytical results.

Data Qualifiers:

J = Estimated value
B = Less than 10x higher than the method blank level
E = Estimated maximum possible concentration
T = Estimated maximum concentraion
I = Interference present
P = PCDE interference
D =Result obtained from analysis of diluted sample
V = Results verified by confirmation analysis





QUADRANGLE LOCATION

NOTE

BASE MAP DEVELOPED FROM THE WAUSAU WEST AND WAUSAU EAST, WISCONSIN 7.5 MINUTE U.S.G.S. TOPOGRAPHIC QUADRANGLE MAPS, DATED 1993. PART OF SECTION 35, T29N, R8E

TRC
708 Heartland Trail
Suite 3000
Madison, WI 53717
Phone: 608.826.3600

PROJECT:	WAULECO, INC. 125 ROSECRANS STREET WAUSAU, WISCONSIN
TITLE:	SITE LOCATION MAP

DRAWN BY:	B. YUNUSOV
CHECKED BY:	K. QUINN
APPROVED BY:	B. IVERSON
DATE:	MARCH 2019
PROJ. NO.:	189597
FILE:	189597.0008.01.FIG1.dwg

FIGURE 1

DRAWING NAME: J:\Wauleco\189597 - Annual 2019\0008\189597.0008.01.FIG1.dwg --- PLOT DATE: March 15, 2019 - 9:50AM --- LAYOUT: FIGURE 1 SITE LOCATION MAP

8.5x11 --- USER: BYunusov --- ATTACHED XREFS: --- ATTACHED IMAGES: 0-EC; 0-EN; 0-ES; 0-WC; 0-WN; 0-WS; 00-EC; 00-EN; 00-ES;

Version: 2017-10-21

LEGEND

PARCEL BOUNDARY

APPROXIMATE WAULECO PROPERTY BOUNDARY

NOTES

1. BASE MAP IMAGERY FROM MARATHON COUNTY, 1974.
2. PARCELS ARE FROM WISCONSIN STATE CARTOGRAPHE RS OFFICE, STATE PARCEL DOWNLOAD ON MARCH 20, 2018 .

N

0 200 400 Feet

1 " = 200 '

1:2,400

PROJECT:	WAULECO, INC. 125 ROSENCRANS STREET WAUSAU, WISCONSIN
TITLE:	1974 SITE LAYOUT
DRAWN BY:	J. PAPEZ
CHECKED BY:	K. QUINN
APPROVED BY:	B. IVERSON
DATE:	MARCH 2019
PROJ NO.:	189597.0003-T1
	FIGURE 2
FILE NO.:	189597-019.mxd

TRC

708 Heartland Trail, Suite 3000
Madison, WI 53717
Phone: 608.826.3600
www.trcsolutions.com

TRC - GIS

Coordinate System: NAD 1983 StatePlane Wisconsin Central FIPS 4802 Feet (Foot US)
Map Rotation: 0

Plot Date: 3/15/2019, 10:07:03 AM by SMAJOR -- LAYOUT: ANSI B(11"x17")
Path: S:\1-PROJECTS\Wauleco\MadisonArchive\2013_189597\189597-019.mxd

LEGEND

PARCEL BOUNDARY

APPROXIMATE WAULECO PROPERTY BOUNDARY

NOTES

1. BASE MAP IMAGERY FROM MARATHON COUNTY, 1974.
2. PARCELS ARE FROM WISCONSIN STATE CARTOGRAPHE RS OFFICE, STATE PARCEL DOWNLOAD ON MARCH 20, 2018 .

N

0 400 800 Feet

1 " = 400 '

1:4,800

PROJECT:

WAULECO, INC.
125 ROSENCRANS STREET
WAUSAU, WISCONSIN

TITLE:

SURROUNDING AREA SITE LAYOUT

DRAWN BY:	J. PAPEZ	PROJ NO.:	189597.0003-T1
CHECKED BY:	K. QUINN		
APPROVED BY:	B. IVERSON	**FIGURE 3**	
DATE:	MARCH 2019		

TRC

708 Heartland Trail, Suite 3000
Madison, WI 53717
Phone: 608.826.3600
www.trcsolutions.com

FILE NO.: 189597-018.mxd

TRC - GIS

Coordinate System: NAD 1983 StatePlane Wisconsin Central FIPS 4802 Feet (Foot US)
Map Rotation: 0

Plot Date: 3/15/2019, 10:08:33 AM by SMAJOR -- LAYOUT: ANSI B(11"x17")
Path: S:\1-PROJECTS\Wauleco\MadisonArchive\2013_189597\189597-018.mxd

LEGEND

- AECOM SOIL SAMPLE LOCATION (2017)
- CWE SOIL SAMPLE LOCATION (2006)
- CWE SOIL SAMPLE LOCATION (2008)
- SCC SOIL SAMPLE LOCATION (2018)
- PARCEL BOUNDARY
- APPROXIMATE WAULECO PROPERTY BOUNDARY

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 9/01/2016.
2. PARCELS ARE FROM WISCONSIN STATE CARTOGRAPHE RS OFFICE, STATE PARCEL DOWNLOAD ON MARCH 20, 2018.
3. SAMPLING LOCATIONS ARE APPROXIMATE BASED ON GEOREFERENCED FIGURES FROM AECOM, CWE, AND SCC.
4. SAMPLE LOCATION FOR CWE (2008) SAMPLE WESTON NOT SHOWN ON FIGURE, LOCATED APPROXIMATELY 5 MILES SOUTHEAST OF AREA SHOWN ON FIGURE.

N

0 250 500 Feet

1 " = 250 '

1:3,000

PROJECT:

WAULECO, INC.
125 ROSENCRANS STREET
WAUSAU, WISCONSIN

TITLE:

SUMMARY OF PREVIOUS SAMPLE LOCATIONS

DRAWN BY:	S. MAJOR	PROJ NO.:	189597.0003-T1
CHECKED BY:	L. AUNER		
APPROVED BY:	B. IVERSON	**FIGURE 4**	
DATE:	MARCH 2019		

TRC
708 Heartland Trail, Suite 3000
Madison, WI 53717
Phone: 608.826.3600
www.trcsolutions.com

FILE NO.: 189597-017.mxd

TRC - GIS

Coordinate System: NAD 1983 StatePlane Wisconsin Central FIPS 4802 Feet (Foot US)
Map Rotation: 0

Plot Date: 3/15/2019, 12:08:33 PM by SMAJOR -- LAYOUT: ANSI B(11"x17")
Path: S:\1-PROJECTS\Wauleco\MadisonArchive\2013_189597\189597-017.mxd

Appendix A
CWE July 8, 2009 Memorandum

CWE, Inc. 5707 Schofield Avenue, P.O. Box 107, Weston, WI 54476-0107 Toll Free: (800) 261-5707
Phone: (715)359-9400 Fax: (715)355-4199 Email: general@cwengineers.com Web: www.cwengineers.com

July 8, 2009

Mr. Ted A. Warpinski
Friebert, Finerty, & St. John, S.C.
Two Plaza East – Suite 1250
330 East Kilbourn Avenue
Milwaukee, WI 53202

RE: **Wauleco/SNE Facility, Wausau, WI**
CWE Project # 36510600

Subject: **July 2009 Memorandum Regarding PCP and Dioxin Concentrations**

Dear Mr. Warpinski:

Enclosed for your review and use are three copies of a Memorandum that I prepared summarizing my evaluation of the PCP and dioxin concentrations at and near the above-referenced site. A *.pdf file of the document was emailed to you.

I thank you for allowing CWE to provide technical assistance with this project and we look forward to our continued involvement.

Best regards,
CWE, Inc

Peter D. Arntsen, M.S., P.H.
Senior Hydrologist

Enclosures: Memorandum (3 copies)

CWE, Inc. 5707 Schofield Avenue, P.O. Box 107, Weston, WI 54476-0107 WI only: (800)261-5707
Phone: (715)359-9400 Fax: (715)355-4199 Email: general@cwengineers.com Web: www.cwengineers.com

MEMORANDUM

To: Ted Warpinski, Friebert, Finerty, & St. John, S.C.

From: Peter Arntsen, CWE, Inc. PA 7/8/09

Date: July 8, 2009

RE: Wauleco/SNE Site, Wausau, WI

Subject: Historic Concentrations of Pentachlorophenol and Dioxins

1.0 Purpose of This Document

The former Wauleco / SNE property was the site of a window manufacturing facility that used pentachlorophenol (PCP) as a wood preservative between 1945 and 1986. Dioxins and furans (collectively known as "dioxins") originating from the PCP have been found both onsite and in a residential area that occurs immediately to the east of this industrial property. It is assumed that the dioxins migrated to the residential area primarily in the form of airborne dust. The PCP and dioxins represent a potential health threat to humans who are exposed through the inhalation of dust, the ingestion of contaminated soil, and/or dermal contact. The purpose of this document is to supplement the CWE Memorandum dated January 18, 2008, and to further characterize the PCP and dioxin concentrations that existed in onsite and offsite locations through time.

2.0 Estimated Neighborhood Concentrations

2.1 Measured Dioxin Concentrations

Table 1 (attached) lists the total dioxin/furan concentrations measured in soil samples (sample locations are shown in Figure 1, attached) collected from the residential area adjacent to the former Wauleco/SNE facility and other locations, along with their associated toxicity equivalents (TEQ) (using World Health Organization 2005 (WHO05) values). The significance of these values is linked to an understanding of how these contaminants migrated to the locations where they were found (at the base of the A horizon, generally 4 to 6 inches below the land surface). Dioxins were derived from the site primarily in the form of wind-blown dust (i.e., dioxins are attached to fine-grained soil particles that were entrained and transported by wind erosion). Dust particles settled downwind of the facility in the residential neighborhood, where they landed on the soil surface. The fact that dioxins are now found at the base of the A horizon implies that vertical migration has occurred subsequent to the deposition of contaminated dust. This happens as rainwater infiltrates into the subsurface and soil is mixed through bioturbation processes. Consequently, the dioxin concentrations measured in the soil samples collected during 2006 and 2008 do not represent the actual surface concentrations to which residents are and were exposed. Rather, these concentrations represent the toxicity of a mixture between dioxin-contaminated dust and the uncontaminated soil material present in the A horizon. Dioxin concentrations at the land surface during the period of deposition would have been much higher, especially within the fine-grained soil fraction where dioxins reside and which is most likely to be inhaled, ingested, or absorbed onto the skin.

It is also important to recognize that the samples collected in the residential neighborhood came from a depth at which the rate of dioxin degradation is greatly reduced. At the land surface, the exposure to sunlight causes dioxins to break down through photolysis, which results in a half-life that can vary between 1 and 9 years. At depths of greater than few centimeters (beyond the depth of sunlight penetration), dioxins are much more resistant to degradation, and the environmental half-life ranges from 13 to as much as 100 years

2.2 Normalization of Neighborhood Dioxin Data

2.2.1 Assigning Values to Non Detections

It is important to assign values to the "Not Detected" laboratory results, because assuming that non detections equal zero will underestimate the toxicity equivalents (TEQ) of the samples (it is more likely that undetected congeners were actually present but in concentrations below the detection limits). A simple way to address this problem is to set no detects equal to one-half the detection limit, but this arbitrary method can still lead to underestimating (or overestimating) the true sample toxicity. For this data analysis, values were assigned to no detects based on a prorated percentage of the total dioxins/furans measured in the sample. A prorated percentage was derived from the four samples (Culv in, Culv out, 117 Riv, and 117 Riv 2) in which most or all congeners were detected. If the prorated value resulted in values greater than the reported detection limit, a value equal to 90% of the detection limit was used. The analysis results using the substituted values for the no detects are presented in Table 2 (attached).

2.2.2 Adjusting Values to a Single Date

The neighborhood soil samples collected in 2006 were "normalized" to the 2008 samples by using a 20-year half-life to decrease the 2006 concentrations. Literature sources suggest that dioxin half-lives at depths below the zone of photolysis and pedoturbation (mechanical mixing in the upper soil profile) are on the order of 13 to 100 years. A 20-year half-life was selected in this case because it is appropriate for the zone near the base of the A-horizon (from whence the samples were collected). The normalized results are presented in Table 3 (attached).

2.3 Selection of Values Representative of Neighborhood Soils

Of the twelve soil samples collected during 2006 and 2008, ten are considered discrete samples and two (the 117 Riv samples) are considered duplicates. For the purpose of data analysis, an average value of the duplicate samples was used. Therefore, eleven sets of sample data were available for consideration. Of these eleven data sets, the Weston sample was collected to represent "background" conditions and thus is not representative of the neighborhood. Similarly, the Oak Island sample, though "downwind" of the Wauleco/SNE site, is located too far away for its dioxin concentrations to be considered representative of impacts to the neighborhood. The Fern Island sample, on the other hand, was included in this analysis, because both its dioxin concentrations and its congener distribution clearly reflect the same contaminant source (PCP) as the neighborhood. Therefore, the data set used for evaluating dioxin concentrations in the neighborhood includes nine samples: 122E, Culv. In., Culv. Out, 1003 Emt, 130 Riv, 141 Riv, 120 Riv, Fern, and the average of 117 Riv.

For discussion and evaluation purposes, it is desirable to have a single concentration to represent the residential neighborhood. Simply calculating a mean value from the nine neighborhood samples is not satisfactory, because the likelihood that this relatively small data set adequately represents the entire population of values is low. Therefore, it is appropriate to use the EPA-recommended procedure of estimating an upper confidence limit (95% UCL) from the data set. An EPA program called ProUCL was used to analyze the data and make a UCL calculation based on the data distribution that is the best fit (e.g., normal, lognormal, or gamma). The results of using ProUCL for the nine neighborhood samples identified above is a UCL value of **77.73 ng/kg TEQ**. This value is assumed to be the best representation of the total dioxin toxicity equivalent at the sampled depth (i.e. base of "A"-horizon) in the neighborhood during 2008. Concentrations at the land surface are expected to be this high or higher. Printouts of the ProUCL Model Output are attached.

2.4 Timeline of Neighborhood Dioxin Concentrations

Reconstructing dioxin concentrations through time in the residential neighborhood depends in part on the understanding of how onsite conditions varied through time. This section describes the history of the site as it relates to the generation and release of dioxin-contaminated soils.

Based on comments from former employees, handling practices of the wood preservative remained generally consistent over the life of the facility. Anecdotal reports indicate that spills and leaks of various magnitudes were a regular occurrence (at what regularity is unclear). Given a starting year of 1945 (reportedly the year use of PCP preservatives began), releases of PCP (and dioxins) to the soils in the "hot-spot" area would have occurred almost immediately. As the releases continued over time, an essentially steady-state condition for soil contaminant concentrations developed: first in the "hot-spot" area and subsequently in the on-site "non-hot-spot" area. Continued releases that occurred after the steady-state conditions were achieved would have served to increase the reservoir of the contaminated material, rather that continuing to increase the soil contaminant concentrations. Although the transport of contaminated dust to the neighborhood would have started as soon as PCP was released onsite, it is assumed that steady-state conditions were not reached until five years after operations began.

Contaminated soils transported off-site to the neighborhood occurred mainly through air entrainment and deposition. Assuming relatively consistent weather conditions year to year, and given the steady-state on-site soil contaminant levels discussed previously, a uniform mass of contaminants would have been deposited each year. Because the rate of dioxin removal (i.e. half-life) would have been much less than the rate of accumulation (i.e., deposition), the neighborhood dioxin concentrations would have increased arithmetically over time for as long as the site area exposed to wind erosion remained the same.

The most significant change in site conditions with respect to the offsite migration of PCP and dioxins was the construction of the "Sash Line" building 1971. This building was constructed in a location that would have minimized the ability of wind to erode hot spot soils as compared to pre-construction conditions. Therefore, dioxin concentrations in the neighborhood would have peaked around 1971. Absent additional loading, the dioxins would have degraded based on an effective half-life (the effective half-life is the decrease in concentrations at a particular location due to the summation of all influencing factors: i.e. those related to degradation and transport). The contaminated zone of interest is the soil surface, and a half-life of nine years was selected because this is a conservative value for the soil zone where dioxins are directly exposed to sunlight (dioxin half-lives in this zone range from 1 to 9 years). Therefore, the calculated UCL for the neighborhood soil sample was projected back in time to 1971 using the 9-year half-life, then projected back to 1950 assuming an arithmetic accumulation. The time-adjusted UCL TEQ values are presented in Table 4.

3.0 Onsite Concentrations

3.1 Soil Concentrations and Risk Assessment

At the outset it should be noted that the soil data available from the SNE/Wauleco site were collected in an effort to characterize the degree and extent of contamination, not to provide the information that is needed for risk assessment. In this regard, the pentachlorophenol (PCP) concentrations that were measured represent a conservative (or minimum) estimate of the true risk. The reason for this is that the soil samples were comprised of the full range of grain sizes present, whereas the contaminants of concern (PCP and dioxins) are associated largely with fine-grained fraction of the soil, which is also the fraction that is most likely to be inhaled or ingested by humans. Had the PCP analyses been conducted on the silt and clay-sized particles only, the concentrations would no doubt have been much higher (silt and clay comprise between 5 and 65 percent of the soil by weight, so PCP concentrations within that size fraction could be as much as 20 times the values measured in bulk samples). Therefore, using the site PCP data for risk assessment is a conservative approach to estimating the actual risk.

3.2 Hot Spot PCP Concentrations

The so-called "hot spot" for this site encompasses all locations where operational practices led to the long-term release of PCP to the environment. Included in the hot spot are the former dip room and adjacent drying room, a storage room (where dipped products were also sometimes placed to dry), an electrical room (where PCP had at one time leaked from a transmission line), a paint room, and an associated courtyard (formerly the location of a PCP storage tank). The rooms were enclosed in covered buildings, but the courtyard was not. Borings revealed that an unenclosed area located between the dipping operations and railroad loading docks to the west was also highly contaminated by PCP, so this is also considered part of the hot spot.

The nature of site operations and activities within the hot spot suggests that PCP was frequently added to the land surface through dripping, spilling, leaking, etc. As a result, the surface soils would have become saturated with PCP early in the history of this facility and have remained saturated thereafter until the use of PCP was discontinued in 1986. Therefore, there is no need to try to reconstruct PCP concentrations through time in the hot spot area. It can be assumed that soils reached their 1986 concentrations within five years of operations and that these levels persisted from 1950 until 1986.

Soils within the hot spot are characterized by extremely high PCP concentrations at the surface and the penetration of PCP down to the water table (20 to 30 feet below the surface). Although this part of the site was extensively investigated, a majority of the soil samples were collected at depths of greater than 4 feet. However, there are 24 samples from the hot spot that were taken within 2 feet of the surface (see Table 4), and these are used to estimate a representative PCP concentration for that area. Notice that half of the data set in Table 1 was collected in 1991 or 1992, five to six years after the use of PCP was discontinued. The data collected in 1991 and

1992 are minimum estimates of the actual concentrations during facility operations, because the PCP had already been subjected to a period of degradation without any input of new PCP.
The data in Table 5 were used in the EPA-recommended program called ProUCL to calculate a 95% UCL value for the hot spot area. Because ProUCL showed that three of the values in the dataset are statistical outliers (the values from Site 2, Site 12, and Sample 8), the program was run for three different scenarios: (1) using all 24 values, (2) using all but the value from Sample 8, and (3) using the 21 values that do not include Site 2, Site 12, and Sample 8. The results are summarized in Table 6.

Table 5: Near-Surface PCP Concentrations Collected within the "Hot Spot"

Sample Name	Date Collected	Sample Location	Sample Depth	PCP (mg/kg)
Site 1	06/19/1986	Dip tank room	0.5 feet	5,000
Site 2	06/19/1986	Dip tank room	0.5 feet	14,000
Site 3	06/19/1986	Dip tank room	Surface	2,000
Site 4	08/05/1986	Storage (electric) room	Surface	5,867
Site 5	08/05/1986	Storage (electric) room	Surface	31
Site 6	08/05/1986	Storage (electric) room	Surface	2,200
Site 7	08/05/1986	Storage (electric) room	Surface	7,333
Site 8	08/05/1986	Storage (electric) room	Surface	4,067
Site 9	08/05/1986	Electrical Shop	Surface	8,667
Site 10	08/05/1986	Electrical Shop	Surface	6,666
Site 11	08/05/1986	Electrical Shop	Surface	4,333
Site 12	08/05/1986	Electrical Shop	Surface	13,333
B-700	March 1991	Railroad loading dock	1 – 3 feet	47.2
B-703	03/05/1991	West of storage (electric) room	Below wood	26.7
B-704	03/05/1991	West of dip tank room	Below wood	370
B-705	03/05/1991	West of drying room	Below wood	1.86
B-707	03/05/1991	Paint room	Below wood	5.56
B-709	03/05/1991	Storage (electric) room	0 – 1.5 feet	12.1
Sample 3	09/26/1991	East of loading docks	0 – 1.5 feet	1,260
Sample 4	09/26/1991	East of loading docks	0 – 1.5 feet	6.3
Sample 5	09/26/1991	North of storage (electric) room	0 – 1.5 feet	2,670
Sample 7	09/26/1991	Paint room	0 – 1.5 feet	51.4
Sample 8	09/26/1991	Paint room	0 – 1.5 feet	66,000
B-1003	Dec 1992	West of dip tank room	2 – 4 feet	1,270

Table 6: Representative PCP Concentrations in "Hot Spot" Soils

Data Set	ProUCL Results (PCP in mg/kg)		
	Mean	Median	95% UCL
Entire data set (all 24 values listed in Table 5)	6,051	2,100	13,515
Data set excluding Sample 8	3,444	2,000	7,370
Data set excluding Site 2, Site 12, Sample 8	2,471	1,270	5,526

Although it could be argued that the three values identified as statistical outliers should not be ignored (in fact, if more data were available, these values might not be considered outliers), it is safe to assume that the remaining 21 values are a fair representation of the hot spot conditions. Therefore, **5,526 mg/kg** is taken as the representative PCP concentration for the hot spot area.

3.3 Hot Spot Dioxin Concentrations

To translate the representative hot spot PCP concentration into an equivalent total dioxin/furan concentration requires knowledge about the percentage of dioxins present within the PCP that was used at this facility. Soil sample data collected by Keystone Environmental Resources, Inc. in 1986 indicate that the fraction of dioxins to PCP in the soil as a results of spillage ranged from 0.17 to 1.24 percent dioxins, with an average dioxin/furan content of 0.5 percent. Multiplying the hot spot PCP concentration of 5,526 mg/kg by 0.5 percent yields a representative total dioxin concentration of **27.6 mg/kg**.

Of equal importance is the toxicity equivalent (TEQ) associated with the total dioxin/furan concentration. Based on soil samples collected in the adjacent residential neighborhood, the average TEQ is 0.45 percent of the total dioxin/furan concentration measured. Assuming that the onsite congener profile was similar to what is found in the neighborhood soil samples, the 27.6 mg/kg translates to a TEQ value of 0.124 mg/kg or **124,000 ng/kg**.

3.4 Non-Hot Spot PCP Concentrations

PCP is known to have occurred across the entire site, but concentrations outside of the hot spot are less well-characterized, because few of the samples collected from non-hot spot areas were taken at the land surface. To maximize the available dataset, it is useful to estimate surface soil concentrations from concentrations measured at depth. There are two onsite borings that have sufficient data to create depth-concentration profiles (these relationships are shown in Figure 2).

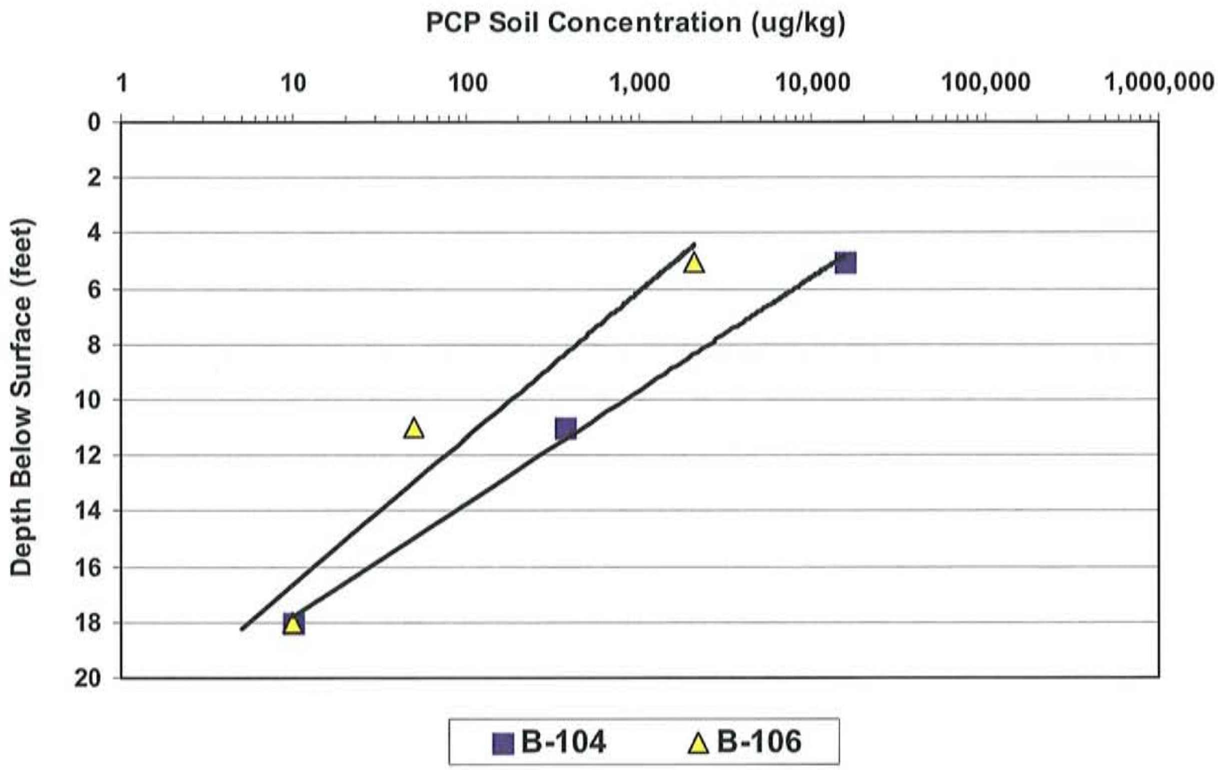


Figure 2: PCP Soil Concentrations with Depth in B-104 and B-106

What is evident from Figure 2 is that PCP concentrations change rapidly with depth, by roughly an order of magnitude every 5 feet. Although some locations suggest a smaller rate of change, others reveal much greater rates (e.g., concentrations change by two orders of magnitude over a distance of 2 feet in B-1003), so Figure 2 provides a reasonable means for extrapolating the values measured at depth to the land surface.

Table 7 summarizes the data that are available from non-hot spot areas, including some values that are extrapolated to the land surface using the relationship inferred from Figure 2. Note that the values measured in B-1, B-2, and B-3 were not extrapolated to the land surface, because the concentrations at these locations do not appear to vary with depth. Note also that values less than the detection limit were set equal to the one-half the detection limit.

The data in Table 7 were used in the EPA-recommended program called ProUCL to calculate a 95% UCL value for the hot spot area. Because ProUCL showed that three of the values in the dataset are statistical outliers (the values from SS13-1B, B-1, and B-2), the program was run for three different scenarios: (1) using all 29 values, (2) using all but the value from SS13-1B, and (3) using the 26 values that do not include SS13-1B, B-1, and B-2. The results are summarized in Table 8.

Table 7: PCP Concentrations Collected within Non-Hot Spot Areas

Sample Name	Date Collected	Sample Depth	PCP (mg/kg)	
			Actual	Extrapolated
B-1	1978	4 – 5 feet	175	175
B-2	1978	4 – 5 feet	97	97
B-3	1978	4 – 5 feet	35	35
B-800	March 1991	1 – 3 feet	0.3	0.75
B-801	March 1991	1 – 3 feet	0.53	1.325
B-802	March 1991	1 – 3 feet	1.04	2.34
B-803	March 1991	1 – 3 feet	< 0.01	0.0125
B-804	March 1991	1 – 3 feet	0.102	0.255
B-805	March 1991	1 – 3 feet	0.104	0.26
B-806	March 1991	1 – 3 feet	0.25	0.625
B-900	06/18/1992	7 – 9 feet	0.0349	1.745
B-901	06/19/1992	7 – 9 feet	0.0914	4.57
B-902	06/17.1992	5 – 7 feet	< 0.01	0.10
B-903	06/18/1992	7 – 9 feet	0.255	12.75
B-904	06/17/1992	7 – 9 feet	0.23	11.5
B-905	06/18/1992	7 – 9 feet	0.0548	2.74
B-1000	12/15/1992	3 – 5 feet	0.0139	0.099
B-1001	Dec 1992	3 – 5 feet	< 0.01	0.357
B-1002	Dec 1992	3 – 5 feet	0.152	1.08
B-1004	Dec 1992	2 – 4 feet	0.243	0.972
B-1005	Dec 1992	4 – 6 feet	< 0.01	0.0625
B-1006	Dec 1992	2 – 4 feet	0.0710	0.284
B-1007	Dec 1992	4 – 6 feet	0.064	0.8
SS13-1A	03/22/2001	1 foot	0.44	0.733
SS13-1B	03/22/2001	1 foot	320	533.44
SS13-1C	05/07/2001	2 feet	3.2	8
SSPW24W-03	04/24/2006	3 feet	3.7	14.8
SSPW24S-01	04/24/2006	1 foot	15	25.005
SSPW24N-01	04/24/2006	1 foot	0.18	0.300

Table 8: Representative PCP Concentrations in Non-Hot Spot Soils

Data Set	ProUCL Results (PCP in mg/kg)		
	Mean	Median	95% UCL
Entire data set (all 29 values listed in Table 7)	32.13	1.08	151.6
Data set excluding SS13-1B	14.23	1.03	57.8
Data set excluding SS13-1B, B-1, and B-2	4.86	0.89	9.2

Although it could be argued that the three values identified as statistical outliers should not be ignored (in fact, if more data were available, these values might not be considered outliers), it is safe to assume that the remaining 26 values are a fair representation of non-hot spot conditions.

This would suggest that the value of 9.2 mg/kg is the representative PCP concentration for the non-hot spot area.

3.5 Non-Hot Spot Dioxin Concentrations

Using the ratios discussed previously for total dioxins in PCP and the TEQ in total dioxins, the resulting values for the non-hot-spot area are 0.046 mg/kg total dioxins and 207 ng/kg TEQ.

These results suggest that the quantification of non-hot spot area PCP concentrations was overly conservative, because the 2006 offsite dioxin TEQ values were measured as high as 100 ng/kg, and that value would have been much higher during the time of facility operation (calculations indicate values would have been greater than 1,000 TEQ in the residential neighborhood). The most likely reason for the overly conservative non-hot spot estimate is the fact that there is no accounting for the effect of time. All but the B-1, B-2, and B-3 samples were collected at least five years after the site operations ceased, and during that time period degradation might have lowered the PCP concentrations. Given that the hot spot PCP concentrations are generally above 1,000 mg/kg, it is reasonable to assume that the values measured in B-1 through B-3 are more indicative of non-hot spot areas during the time of operation than are the values from post- 1986 samples. The average PCP concentration of B-1, B-2, and B-3 is roughly **100 mg/kg**, which is midway between the two higher UCL values in Table 8. Using this as a representative non-hot spot PCP concentration translates to a total dioxin TEQ value of **2,250 ng/kg.**

List of Tables

List of Figures

List of Attachments

Attachments

Table 1: Analysis Results and TEQ Calculations of Soil Samples Collected from the Neighborhood East of Wauleco/SNE Property -As reported by Laboratory

Sample Identification		Laboratory Results (ng dioxin per kg soil)											
Sample Identification		122E	Culv. In.	Culv. Out.	1003 Emt	130 Riv	141 Riv	120 Riv	117 Riv 1	Fern	117 Riv 2	Oak	Weston
Map Location		A	B	C	1	2	3	4	5	6	7	8	9
Dioxin Congeners													
2,3,7,8-TCDD	ng/kg	<0.99	2.1	<2.0	<1	<1.8	<1	<1	<1	<1	<1	<1	<1
Total TCDD	ng/kg	6.7	10	14	7.9	<1.8	3.3	5.7	15	3.5	22	<1	<1
1,2,3,7,8-PeCDD	ng/kg	<4.9	15	11	<5	<5	<5	<5	5.1	<5	5.6	<5	<5
Total PeCDD	ng/kg	<4.9	84	71	<5	<5	<5	<5	40	<5	48	<5	<5
1,2,3,4,7,8-HxCDD	ng/kg	6.3	48	23	<5	<5	<5	<5	12	<5	15	<5	<5
1,2,3,6,7,8-HxCDD	ng/kg	17	140	83	15	6.0	<5	<5	41	5.6	44	<5	<5
1,2,3,7,8,9-HxCDD	ng/kg	11	60	36	6.8	5.5	<5	<5	25	<5	27	<5	<5
Total HxCDD	ng/kg	110	780	570	85	58	25	34	310	34	360	<5	<5
1,2,3,4,6,7,8-HpCDD	ng/kg	270	2,400	1,400	260	95	87	120	1,100	170	1,100	30	<5
Total HpCDD	ng/kg	460	4,300	2,800	500	190	170	230	2,000	300	2,000	58	<5
1,2,3,4,6,7,8,9-OCDD	ng/kg	1600	17,000	9,300	3,000	700	630	830	7,600	1,200	8,200	270	24
Furan Congeners													
2,3,7,8-TCDF	ng/kg	*1.7*	6.7	7.3	2.0	<3.9	<1	<1	3.5	1.4	3.7	<1	<1
Total TCDF	ng/kg	43	110	190	140	4.8	18	24	110	16	110	12	5.6
1,2,3,7,8-PeCDF	ng/kg	<4.9	13	8.7	<5	<5	<5	<5	<5	<5	<5	<5	<5
2,3,4,7,8-PeCDF	ng/kg	5.7	45	80	76	<5	<5	<5	16	<5	16	<5	<5
Total PcCDF	ng/kg	69	550	880	880	49	28	33	260	12	250	45	<5
1,2,3,4,7,8-HxCDF	ng/kg	7.3	32	35	24	<5	<5	<5	*37*	<5	12	<5	<5
1,2,3,6,7,8-HxCDF	ng/kg	5.4	34	33	26	<5	<5	<5	19	*5.9*	17	<5	<5
2,3,4,6,7,8-HxCDF	ng/kg	9.0	59	75	100	<5	<5	<5	29	<5	23	<5	<5
1,2,3,7,8,9-HxCDF	ng/kg	<4.9	14	11	6.4	<5	<5	<5	<5	<5	5.0	<5	<5
Total HxCDF	ng/kg	150	990	1200	1600	64	40	52	580	60	560	27	<5
1,2,3,4,6,7,8-HpCDF	ng/kg	94	550	480	160	43	27	42	350	83	350	19	<5
1,2,3,4,7,8,9-HpCDF	ng/kg	8.5	40	31	13	<5	<5	<5	20	<5	20	<5	<5
Total HpCDF	ng/kg	250	1,400	1,200	540	87	51	78	870	190	850	38	<5
1,2,3,4,6,7,8,9-OCDF	ng/kg	130	950	710	170	49	36	53	520	170	550	34	<10
Total Dioxin/Furan	**ng/kg**	**2,819**	**26,174**	**16,935**	**6,923**	**1,202**	**1,001**	**1,340**	**12,305**	**1,986**	**12,950**	**484**	**30**

ng/kg: nanograms per kilogram; equivalent to parts per trillion.
italics signify the value is the estimated maximum concentration

TCDD: Tetrachlorodibenzo-p-dioxin
PeCDD: Pentachlorodibenzo-p-dioxin
HxCDD: Hexachlorodibenzo-p-dioxin
HPCDD: Heptachlorodibenzo-p-dioxin
OCDD: Octachlorodibenzo-p-dioxin

TCDF: Tetrachlorodibenzofuran
PeCDF: Pentachlorodibenzofuran
HxCDF: Hexachlorodibenzofuran
HPCDF: Heptachlorodibenzofuran
OCDF: Octachlorodibenzofuran

PL 003414

Table 1: Analysis Results and TEQ Calculations of Soil Samples Collected from the Neighborhood East of Wauleco/SNE Property -As reported by Laboratory

WHO_{05} TEF: Toxic Equivalent Factor established by the World Health Organization in 2005

Sample Identification / Map Location		WHO_{05} TEF	Toxicity Equivalents (WHO_{05}) (ng dioxin TEQ per kg soil) 122E A	Culv. In. B	Culv. Out. C	1003 Emt 1	130 Riv 2	141 Riv 3	120 Riv 4	117 Riv 1 5	Fern 6	117 Riv 2 7	Oak 8	Weston 9
Dioxin Congeners														
2,3,7,8-TCDD	ng/kg	1	<0.99	2.1	<2.0	<1	<1.8	<1	<1	<1	<1	<1	<1	<1
Total TCDD	ng/kg													
1,2,3,7,8-PeCDD	ng/kg	1	<4.9	15	11	<5	<5	<5	<5	5.1	<5	5.6	<5	<5
Total PeCDD	ng/kg													
1,2,3,4,7,8-HxCDD	ng/kg	0.1	0.63	4.8	2.3	<5	<5	<5	<5	1.2	<5	1.5	<5	<5
1,2,3,6,7,8-HxCDD	ng/kg	0.1	1.7	14	8.3	1.5	0.60	<5	<5	4.1	0.56	4.4	<5	<5
1,2,3,7,8,9-HxCDD	ng/kg	0.1	1.1	6	3.6	0.68	0.55	<5	<5	2.5	<5	2.7	<5	<5
Total HxCDD	ng/kg													
1,2,3,4,6,7,8-HpCDD	ng/kg	0.01	2.7	24	14	2.6	0.95	0.87	1.2	11	1.7	11	0.30	<5
Total HpCDD	ng/kg													
1,2,3,4,6,7,8,9-OCDD	ng/kg	0.0003	0.48	5.1	2.79	0.90	0.21	0.19	0.25	2.3	0.36	2.5	0.081	0.0072
Furan Congeners														
2,3,7,8-TCDF	ng/kg	0.1	0.17	0.67	0.73	0.20	<3.9	<1	<1	0.35	0.14	0.37	<1	<1
Total TCDF	ng/kg													
1,2,3,7,8-PeCDF	ng/kg	0.03	<4.9	0.39	0.261	<5	<5	<5	<5	<5	<5	<5	<5	<5
2,3,4,7,8-PeCDF	ng/kg	0.3	1.7	14	24	23	<5	<5	<5	4.8	<5	4.8	<5	<5
Total PcCDF	ng/kg													
1,2,3,4,7,8-HxCDF	ng/kg	0.1	0.73	3.2	3.5	2.4	<5	<5	<5	3.7	<5	1.2	<5	<5
1,2,3,6,7,8-HxCDF	ng/kg	0.1	0.54	3.4	3.3	2.6	<5	<5	<5	1.9	0.59	1.7	<5	<5
2,3,4,6,7,8-HxCDF	ng/kg	0.1	0.9	5.9	7.5	10	<5	<5	<5	2.9	<5	2.3	<5	<5
1,2,3,7,8,9-HxCDF	ng/kg	0.1	<4.9	1.4	1.1	0.64	<5	<5	<5	<5	<5	0.50	<5	<5
Total HxCDF	ng/kg													
1,2,3,4,6,7,8-HpCDF	ng/kg	0.01	0.94	5.5	4.8	1.6	0.43	0.27	0.42	3.5	0.83	3.5	0.19	<5
1,2,3,4,7,8,9-HpCDF	ng/kg	0.01	0.085	0.40	0.31	0.13	<5	<5	<5	0.20	<5	0.20	<5	<5
Total HpCDF	ng/kg													
1,2,3,4,6,7,8,9-OCDF	ng/kg	0.0003	0.039	0.285	0.213	0.051	0.015	0.011	0.016	0.16	0.051	0.17	0.010	<10
Total Dioxin/Furan	**ng/kg**		**12**	**106**	**88**	**46**	**2.8**	**1.3**	**1.9**	**44**	**4.2**	**42**	**0.58**	**0.0072**

Ratio of Total Dioxin Toxicity Equivalents to Total Dioxin/Furan Congener Concentration

TEQ	12	106	88	46	2.8	1.3	1.9	44	4.2	42	0.58	0.0072
TDC	2,819	26,174	16,935	6,923	1,202	1,001	1,340	12,305	1,986	12,950	484	30
TEQ/TDC	0.0042	0.0040	0.0052	0.0067	0.0023	0.0013	0.0014	0.0036	0.0021	0.0033	0.0012	0.00024

Arithmetic Mean: **0.0030**
Geometric Mean: **0.0023**

TEQ: Total Dioxin Toxicity Equivalents (ng/kg)
TDC: Total Dioxin/Furan Congeners (ng/kg)

PL 003415

Table 2: Analysis Results and TEQ Calculations of Soil Samples Collected from the Neighborhood East of Wauleco/SNE Property - Using Substituted Values for No Detects

Sample Identification / Map Location		122E A	Culv. In. B	Culv. Out. C	1003 Emt 1	130 Riv 2	141 Riv 3	120 Riv 4	117 Riv 1 5	Fern 6	117 Riv 2 7	Oak 8	Weston 9
		Laboratory Results (ng dioxin per kg soil)											
Dioxin Congeners													
2,3,7,8-TCDD	ng/kg	0.25	2.1	1.51	0.62	0.11	0.090	0.12	0.90	0.18	0.90	0.044	0.0038
Total TCDD	ng/kg	6.7	10	14	7.9	1.24	3.3	5.7	15	3.5	22	0.50	0.031
1,2,3,7,8-PeCDD	ng/kg	1.46	15	11	3.6	0.62	0.52	0.69	5.1	1.0	5.6	0.25	0.015
Total PeCDD	ng/kg	4.41	84	71	4.5	4.3	3.6	4.8	40	4.5	48	1.7	0.11
1,2,3,4,7,8-HxCDD	ng/kg	6.3	48	23	4.5	1.6	1.3	1.8	12	2.6	15	0.64	0.039
1,2,3,6,7,8-HxCDD	ng/kg	17	140	83	15	6.0	4.3	4.5	41	5.6	44	2.1	0.13
1,2,3,7,8,9-HxCDD	ng/kg	11	60	36	6.8	5.5	2.1	2.9	25	4.2	27	1.0	0.063
Total HxCDD	ng/kg	110	780	570	85	58	25	34	310	34	360	4.5	0.86
1,2,3,4,6,7,8-HpCDD	ng/kg	270	2,400	1,400	260	95	87	120	1,100	170	1,100	30	2.6
Total HpCDD	ng/kg	460	4,300	2,800	500	190	170	230	2,000	300	2,000	58	4.8
1,2,3,4,6,7,8,9-OCDD	ng/kg	1600	17,000	9,300	3,000	700	630	830	7,600	1,200	8,200	270	24
Furan Congeners													
2,3,7,8-TCDF	ng/kg	*1.7*	6.7	7.3	2.0	1.95	0.50	0.50	3.5	1.4	3.7	0.50	0.50
Total TCDF	ng/kg	43	110	190	140	4.8	18	24	110	16	110	12	5.6
1,2,3,7,8-PeCDF	ng/kg	4.41	13	8.7	3.2	0.54	0.45	0.60	4.5	0.89	5.8	0.22	0.013
2,3,4,7,8-PeCDF	ng/kg	5.7	45	80	76	2.7	2.2	3.0	16	4.5	16	1.1	0.066
Total PcCDF	ng/kg	69	550	880	880	49	28	33	260	12	250	45	2.5
1,2,3,4,7,8-HxCDF	ng/kg	7.3	32	35	24	2.2	1.8	2.4	37	3.6	12	0.87	0.053
1,2,3,6,7,8-HxCDF	ng/kg	5.4	34	33	26	1.8	1.5	2.0	19	*5.9*	17	0.74	0.045
2,3,4,6,7,8-HxCDF	ng/kg	9.0	59	75	100	3.2	2.7	3.6	29	4.5	23	1.3	0.080
1,2,3,7,8,9-HxCDF	ng/kg	1.40	14	11	6.4	0.59	0.49	0.66	4.5	1.0	5.0	0.24	0.015
Total HxCDF	ng/kg	150	990	1200	1600	64	40	52	580	60	560	27	1.5
1,2,3,4,6,7,8-HpCDF	ng/kg	94	550	480	160	43	27	42	350	83	350	19	0.78
1,2,3,4,7,8,9-HpCDF	ng/kg	8.5	40	31	13	2.0	1.6	2.2	20	3.2	20	0.79	0.048
Total HpCDF	ng/kg	250	1,400	1,200	540	87	51	78	870	190	850	38	1.9
1,2,3,4,6,7,8,9-OCDF	ng/kg	130	950	710	170	49	36	53	520	170	550	34	1.2
Total Dioxin/Furan	**ng/kg**	**2,823**	**26,174**	**16,935**	**6,927**	**1,207**	**1,005**	**1,345**	**12,305**	**1,990**	**12,950**	**491**	**42.5**
Totals as reported by lab		2819	26174	16935	6923	1202	1001	1340	12305	1986	12950	484	30

ng/kg: nanograms per kilogram; equivalent to parts per trillion.

italics signify the value is the estimated maximum concentration

TCDD: Tetrachlorodibenzo-p-dioxin
PeCDD: Pentachlorodibenzo-p-dioxin
HxCDD: Hexachlorodibenzo-p-dioxin
HPCDD: Heptachlorodibenzo-p-dioxin
OCDD: Octachlorodibenzo-p-dioxin

TCDF: Tetrachlorodibenzofuran
PeCDF: Pentachlorodibenzofuran
HxCDF: Hexachlorodibenzofuran
HPCDF: Heptachlorodibenzofuran
OCDF: Octachlorodibenzofuran

Blue values indicate assigned concentrations based on fraction of total dioxins/furans
Red values indicate assigned concentrations at 90% of the detection limit

Concentrations for Non Detects are the product of the total dioxins/furans measured in the samples multiplied by the adjustment factor determined from the fours samples with fewest Non Detects. Resultant concentrations greater than the respective detecti

PL 003416

Table 2: Analysis Results and TEQ Calculations of Soil Samples Collected from the Neighborhood East of Wauleco/SNE Property - Using Substituted Values for No Detects

WHO_{05} TEF: Toxic Equivalent Factor established by the World Health Organization in 2005

Sample Identification / Map Location		WHO_{05} TEF	Toxicity Equivalents (WHO_{05}) (ng dioxin TEQ per kg soil) 122E A	Culv. In. B	Culv. Out. C	1003 Emt 1	130 Riv 2	141 Riv 3	120 Riv 4	117 Riv 1 5	Fern 6	117 Riv 2 7	Oak 8	Weston 9
Dioxin Congeners														
2,3,7,8-TCDD	ng/kg	1	0.25	2.1	1.51	0.62	0.11	0.09	0.12	0.90	0.18	0.90	0.04	0.00
Total TCDD	ng/kg													
1,2,3,7,8-PeCDD	ng/kg	1	1.46	15	11	3.58	0.62	0.52	0.69	5.1	1.0	5.6	0.25	0.02
Total PeCDD	ng/kg													
1,2,3,4,7,8-HxCDD	ng/kg	0.1	0.63	4.8	2.3	0.45	0.16	0.13	0.18	1.2	0.26	1.5	0.06	0.00
1,2,3,6,7,8-HxCDD	ng/kg	0.1	1.7	14	8.3	1.5	0.60	0.43	0.45	4.1	0.56	4.4	0.21	0.01
1,2,3,7,8,9-HxCDD	ng/kg	0.1	1.1	6	3.6	0.68	0.55	0.21	0.29	2.5	0.42	2.7	0.10	0.01
Total HxCDD	ng/kg													
1,2,3,4,6,7,8-HpCDD	ng/kg	0.01	2.7	24	14	2.6	0.95	0.87	1.2	11	1.7	11	0.30	0.026
Total HpCDD	ng/kg													
1,2,3,4,6,7,8,9-OCDD	ng/kg	0.0003	0.48	5.1	2.79	0.90	0.21	0.19	0.25	2.3	0.36	2.5	0.081	0.0072
Furan Congeners														
2,3,7,8-TCDF	ng/kg	0.1	0.17	0.67	0.73	0.20	0.20	0.05	0.05	0.35	0.14	0.37	0.050	0.050
Total TCDF	ng/kg													
1,2,3,7,8-PeCDF	ng/kg	0.03	0.132	0.39	0.261	0.095	0.016	0.014	0.018	0.135	0.027	0.175	0.007	0.000
2,3,4,7,8-PeCDF	ng/kg	0.3	1.7	14	24	23	0.809	0.674	0.902	4.8	1.337	4.8	0.33	0.02
Total PcCDF	ng/kg													
1,2,3,4,7,8-HxCDF	ng/kg	0.1	0.73	3.2	3.5	2.4	0.22	0.18	0.24	3.7	0.359	1.2	0.09	0.01
1,2,3,6,7,8-HxCDF	ng/kg	0.1	0.54	3.4	3.3	2.6	0.18	0.15	0.20	1.9	0.59	1.7	0.07	0.00
2,3,4,6,7,8-HxCDF	ng/kg	0.1	0.9	5.9	7.5	10	0.32	0.27	0.36	2.9	0.450	2.3	0.13	0.01
1,2,3,7,8,9-HxCDF	ng/kg	0.1	0.14	1.4	1.1	0.64	0.06	0.05	0.07	0.450	0.098	0.50	0.02	0.00
Total HxCDF	ng/kg													
1,2,3,4,6,7,8-HpCDF	ng/kg	0.01	0.94	5.5	4.8	1.6	0.43	0.27	0.42	3.5	0.83	3.5	0.19	0.008
1,2,3,4,7,8,9-HpCDF	ng/kg	0.01	0.085	0.40	0.31	0.13	0.020	0.016	0.022	0.20	0.032	0.20	0.008	0.000
Total HpCDF	ng/kg													
1,2,3,4,6,7,8,9-OCDF	ng/kg	0.0003	0.039	0.285	0.213	0.051	0.015	0.011	0.016	0.16	0.051	0.17	0.010	0.00036
Total Dioxin/Furan	**ng/kg**		**14**	**106**	**89**	**51**	**5.5**	**4.1**	**5.5**	**45**	**8.4**	**43**	**2.0**	**0.2**

Totals as reported by lab

Ratio of Total Dioxin Toxicity Equivalents to Total Dioxin/Furan Congener Concentration

TEQ	14	106	89	51	5.5	4.1	5.5	45	8.4	43	1.95	0.1732
TDC	2,823	26,174	16,935	6,927	1,207	1,005	1,345	12,305	1,990	12,950	491	42
TEQ/TDC	0.0049	0.0040	0.0053	0.0073	0.0045	0.0041	0.0041	0.0037	0.0042	0.0034	0.0040	0.00408

Arithmetic Mean: **0.0045**

Geometric Mean: **0.0044**

ConcentraTEQ: Total Dioxin Toxicity Equivalents (ng/kg)

determine TDC: Total Dioxin/Furan Congeners (ng/kg)

PL 003417

Table 3: Analysis Results and TEQ Calculations of Soil Samples Collected from the Neighborhood East of Wauleco/SNE Property - Normalized to 2008 using a 20-year Half-life

		Laboratory Results (ng dioxin per kg soil)											
Sample Identification		122E	Culv. In.	Culv. Out.	1003 Emt	130 Riv	141 Riv	120 Riv	117 Riv 1	Fern	117 Riv 2	Oak	Weston
Map Location		A	B	C	1	2	3	4	5	6	7	8	9
Dioxin Congeners													
2,3,7,8-TCDD	ng/kg	0.23	1.9	1.39	0.62	0.11	0.090	0.12	0.90	0.18	0.90	0.044	0.0038
Total TCDD	ng/kg	6.1	9	13	7.9	1.24	3.3	5.7	15	3.5	22	0.50	0.031
1,2,3,7,8-PeCDD	ng/kg	1.34	14	10	3.6	0.62	0.52	0.69	5.1	1.0	5.6	0.25	0.015
Total PeCDD	ng/kg	4.05	77	65	4.5	4.3	3.6	4.8	40	4.5	48	1.7	0.11
1,2,3,4,7,8-HxCDD	ng/kg	5.8	44	21	4.5	1.6	1.3	1.8	12	2.6	15	0.64	0.039
1,2,3,6,7,8-HxCDD	ng/kg	16	128	76	15	6.0	4.3	4.5	41	5.6	44	2.1	0.13
1,2,3,7,8,9-HxCDD	ng/kg	10	55	33	6.8	5.5	2.1	2.9	25	4.2	27	1.0	0.063
Total HxCDD	ng/kg	101	716	523	85	58	25	34	310	34	360	4.5	0.86
1,2,3,4,6,7,8-HpCDD	ng/kg	248	2,202	1,285	260	95	87	120	1,100	170	1,100	30	2.6
Total HpCDD	ng/kg	422	3,946	2,569	500	190	170	230	2,000	300	2,000	58	4.8
1,2,3,4,6,7,8,9-OCDD	ng/kg	1468	15,600	8,534	3,000	700	630	830	7,600	1,200	8,200	270	24
Furan Congeners													
2,3,7,8-TCDF	ng/kg	*1.6*	6.1	6.7	2.0	1.95	0.50	0.50	3.5	1.4	3.7	0.50	0.50
Total TCDF	ng/kg	39	101	174	140	4.8	18	24	110	16	110	12	5.6
1,2,3,7,8-PeCDF	ng/kg	4.05	12	8.0	3.2	0.54	0.45	0.60	4.5	0.89	5.8	0.22	0.013
2,3,4,7,8-PeCDF	ng/kg	5.2	41	73	76	2.7	2.2	3.0	16	4.5	16	1.1	0.066
Total PcCDF	ng/kg	63	505	808	880	49	28	33	260	12	250	45	2.5
1,2,3,4,7,8-HxCDF	ng/kg	6.7	29	32	24	2.2	1.8	2.4	37	3.6	12	0.87	0.053
1,2,3,6,7,8-HxCDF	ng/kg	5.0	31	30	26	1.8	1.5	2.0	19	*5.9*	17	0.74	0.045
2,3,4,6,7,8-HxCDF	ng/kg	8.3	54	69	100	3.2	2.7	3.6	29	4.5	23	1.3	0.080
1,2,3,7,8,9-HxCDF	ng/kg	1.28	13	10	6.4	0.59	0.49	0.66	4.5	1.0	5.0	0.24	0.015
Total HxCDF	ng/kg	138	908	1101	1600	64	40	52	580	60	560	27	1.5
1,2,3,4,6,7,8-HpCDF	ng/kg	86	505	440	160	43	27	42	350	83	350	19	0.78
1,2,3,4,7,8,9-HpCDF	ng/kg	7.8	37	28	13	2.0	1.6	2.2	20	3.2	20	0.79	0.048
Total HpCDF	ng/kg	229	1,285	1,101	540	87	51	78	870	190	850	38	1.9
1,2,3,4,6,7,8,9-OCDF	ng/kg	119	872	652	170	49	36	53	520	170	550	34	1.2
Total Dioxin/Furan	**ng/kg**	**2,591**	**24,019**	**15,541**	**6,927**	**1,207**	**1,005**	**1,345**	**12,305**	**1,990**	**12,950**	**491**	**42.5**
Totals as reported by lab		2819	26174	16935	6923	1202	1001	1340	12305	1986	12950	484	30

ng/kg: nanograms per kilogram; equivalent to parts per trillion.

italics signify the value is the estimated maximum concentration

TCDD: Tetrachlorodibenzo-p-dioxin
PeCDD: Pentachlorodibenzo-p-dioxin
HxCDD: Hexachlorodibenzo-p-dioxin
HPCDD: Heptachlorodibenzo-p-dioxin
OCDD: Octachlorodibenzo-p-dioxin

TCDF: Tetrachlorodibenzofuran
PeCDF: Pentachlorodibenzofuran
HxCDF: Hexachlorodibenzofuran
HPCDF: Heptachlorodibenzofuran
OCDF: Octachlorodibenzofuran

Blue values indicate assigned concentrations based on fraction of total dioxins/furans

Red values indicate assigned concentrations at 90% of the detection limit

Concentrations for Non Detects are the product of the total dioxins/furans measured in the samples multiplied by the adjustment factor determined from the fours samples with fewest Non Detects. Resultant concentrations greater than the respective detecti

PL 003418

Table 3: Analysis Results and TEQ Calculations of Soil Samples Collected from the Neighborhood East of Wauleco/SNE Property - Normalized to 2008 using a 20-year Half-life

WHO$_{05}$ TEF: Toxic Equivalent Factor established by the World Health Organization in 2005

Sample Identification		WHO$_{05}$	Toxicity Equivalents (WHO$_{05}$) (ng dioxin TEQ per kg soil)											
Map Location		TEF	122E A	Culv. In. B	Culv. Out. C	1003 Emt 1	130 Riv 2	141 Riv 3	120 Riv 4	117 Riv 1 5	Fern 6	117 Riv 2 7	Oak 8	Weston 9
Dioxin Congeners														
2,3,7,8-TCDD	ng/kg	1	0.23	1.92708	1.39	0.62	0.11	0.09	0.12	0.90	0.18	0.90	0.04	0.00
Total TCDD	ng/kg													
1,2,3,7,8-PeCDD	ng/kg	1	1.34	13.76486	10.09423	3.58	0.62	0.52	0.69	5.1	1.0	5.6	0.25	0.02
Total PeCDD	ng/kg													
1,2,3,4,7,8-HxCDD	ng/kg	0.1	0.578124	4.404755	2.110612	0.45	0.16	0.13	0.18	1.2	0.26	1.5	0.06	0.00
1,2,3,6,7,8-HxCDD	ng/kg	0.1	1.560017	12.8472	7.6	1.5	0.60	0.43	0.45	4.1	0.56	4.4	0.21	0.01
1,2,3,7,8,9-HxCDD	ng/kg	0.1	1.009423	5.505944	3.303566	0.68	0.55	0.21	0.29	2.5	0.42	2.7	0.10	0.01
Total HxCDD	ng/kg													
1,2,3,4,6,7,8-HpCDD	ng/kg	0.01	2.477675	22.02378	12.8472	2.6	0.95	0.87	1.2	11	1.7	11	0.30	0.026
Total HpCDD	ng/kg													
1,2,3,4,6,7,8,9-OCDD	ng/kg	0.0003	0.440476	4.680052	2.560264	0.90	0.21	0.19	0.25	2.3	0.36	2.5	0.081	0.0072
Furan Congeners														
2,3,7,8-TCDF	ng/kg	0.1	0.156002	0.61483	0.66989	0.20	0.20	0.05	0.05	0.35	0.14	0.37	0.050	0.050
Total TCDF	ng/kg													
1,2,3,7,8-PeCDF	ng/kg	0.03	0.121	0.357886	0.239509	0.095	0.016	0.014	0.018	0.135	0.027	0.175	0.007	0.000
2,3,4,7,8-PeCDF	ng/kg	0.3	1.6	12	22	23	0.809	0.674	0.902	4.8	1.337	4.8	0.33	0.02
Total PcCDF	ng/kg													
1,2,3,4,7,8-HxCDF	ng/kg	0.1	0.66989	2.936503	3.211801	2.4	0.22	0.18	0.24	3.7	0.359	1.2	0.09	0.01
1,2,3,6,7,8-HxCDF	ng/kg	0.1	0.50	3.120035	3.028269	2.6	0.18	0.15	0.20	1.9	0.59	1.7	0.07	0.00
2,3,4,6,7,8-HxCDF	ng/kg	0.1	0.825892	5.414178	6.88243	10	0.32	0.27	0.36	2.9	0.450	2.3	0.13	0.01
1,2,3,7,8,9-HxCDF	ng/kg	0.1	0.13	1.28472	1.009423	0.64	0.06	0.05	0.07	0.450	0.098	0.50	0.02	0.00
Total HxCDF	ng/kg													
1,2,3,4,6,7,8-HpCDF	ng/kg	0.01	0.862598	5.047115	4.404755	1.6	0.43	0.27	0.42	3.5	0.83	3.5	0.19	0.008
1,2,3,4,7,8,9-HpCDF	ng/kg	0.01	0.078001	0.37	0.28	0.13	0.020	0.016	0.022	0.20	0.032	0.20	0.008	0.000
Total HpCDF	ng/kg													
1,2,3,4,6,7,8,9-OCDF	ng/kg	0.0003	0.035789	0.261532	0.195461	0.051	0.015	0.011	0.016	0.16	0.051	0.17	0.010	0.00036
Total Dioxin/Furan	**ng/kg**		**13**	**97**	**82**	**51**	**5.5**	**4.1**	**5.5**	**45**	**8.4**	**43**	**2.0**	**0.2**

Totals as reported by lab

Ratio of Total Dioxin Toxicity Equivalents to Total Dioxin/Furan Congener Concentration

TEQ	13	97	82	51	5.5	4.1	5.5	45	8.4	43	1.95	0.1732
TDC	2,591	24,019	15,541	6,927	1,207	1,005	1,345	12,305	1,990	12,950	491	42
TEQ/TDC	0.0049	0.0040	0.0053	0.0073	0.0045	0.0041	0.0041	0.0037	0.0042	0.0034	0.0040	0.00408

Arithmetic Mean: **0.0045**
Geometric Mean: **0.0044**

ConcentraTEQ: Total Dioxin Toxicity Equivalents (ng/kg)
determineTDC: Total Dioxin/Furan Congeners (ng/kg)

Using UCL for all samples except Weston, Oak, and Using an average of the 117 River Street samples.

Concentrations over time calculations

Equation for first order decay (going back in time): $[Ct_{x-}]/[Ct_0] = e^{kt}$

Half-life = ln2/k
k = Decay constant = ln2/Half-life
t = time between T_o and T_{x-}
T_0 = Date at time 0
Tx- = Date at time x in past
Ct_o = concentration at time 0
Ct_{x-} = concentration at time X in past

9	Half-life	years	
0.0770164	k	years^{-1}	
12/4/2008	T_0	start date	
77.73	Ct_0	ng/kg	Average total TEQ of neighborhood soil samples for 2008

6/13/1971	Date at start of half-life degradation
6/13/1950	Date at start of arithmetic addition.
20.999316	Period of arithmetic addition (years)
1393.6675	Concentration (ng/kg) at start of half-life degration (end of arithmetic add
66.367281	Annual increase in concentration (ng/kg)

Projecting back in time using half-life only

	Date (T_{x-})	t	k x t	e^kt	Ct_x
Time 0	**12/4/2008**				**77.73 ng/kg**
	6/13/2007	1.478439	0.11	1.12	87.10422 ng/kg
	6/12/2006	2.478439	0.19	1.21	94.07776 ng/kg
	6/12/2005	3.478439	0.27	1.31	101.6096 ng/kg
	6/12/2004	4.478439	0.34	1.41	109.7444 ng/kg
	6/13/2003	5.478439	0.42	1.52	118.5305 ng/kg
	6/12/2002	6.478439	0.50	1.65	128.0201 ng/kg
	6/12/2001	7.478439	0.58	1.78	138.2693 ng/kg
	6/12/2000	8.478439	0.65	1.92	149.3391 ng/kg
	6/13/1999	9.478439	0.73	2.08	161.2952 ng/kg
	6/12/1998	10.47844	0.81	2.24	174.2084 ng/kg
	6/12/1997	11.47844	0.88	2.42	188.1555 ng/kg
	6/12/1996	12.47844	0.96	2.61	203.2192 ng/kg
	6/13/1995	13.47844	1.04	2.82	219.4889 ng/kg
	6/12/1994	14.47844	1.12	3.05	237.0611 ng/kg
	6/12/1993	15.47844	1.19	3.29	256.0401 ng/kg
	6/12/1992	16.47844	1.27	3.56	276.5387 ng/kg
	6/13/1991	17.47844	1.35	3.84	298.6783 ng/kg
	6/12/1990	18.47844	1.42	4.15	322.5904 ng/kg
	6/12/1989	19.47844	1.50	4.48	348.4169 ng/kg
	6/12/1988	20.47844	1.58	4.84	376.311 ng/kg
	6/13/1987	21.47844	1.65	5.23	406.4384 ng/kg
	6/12/1986	22.47844	1.73	5.65	438.9777 ng/kg
	6/12/1985	23.47844	1.81	6.10	474.1222 ng/kg
	6/12/1984	24.47844	1.89	6.59	512.0803 ng/kg
	6/13/1983	25.47844	1.96	7.12	553.0773 ng/kg
	6/12/1982	26.47844	2.04	7.69	597.3565 ng/kg
	6/12/1981	27.47844	2.12	8.30	645.1807 ng/kg
	6/12/1980	28.47844	2.19	8.96	696.8337 ng/kg
	6/13/1979	29.47844	2.27	9.68	752.6221 ng/kg
	6/12/1978	30.47844	2.35	10.46	812.8768 ng/kg
	6/12/1977	31.47844	2.42	11.29	877.9555 ng/kg
	6/12/1976	32.47844	2.50	12.20	948.2444 ng/kg
	6/13/1975	33.47844	2.58	13.18	1024.161 ng/kg
	6/12/1974	34.47844	2.66	14.23	1106.155 ng/kg
	6/12/1973	35.47844	2.73	15.37	1194.713 ng/kg
	6/12/1972	36.47844	2.81	16.60	1290.361 ng/kg
	6/13/1971	37.47844	2.89	17.93	1393.667 ng/kg
	6/12/1970	38.47844	2.96	19.37	1505.244 ng/kg
	6/12/1969	39.47844	3.04	20.92	1625.754 ng/kg
	6/12/1968	40.47844	3.12	22.59	1755.911 ng/kg
	6/13/1967	41.47844	3.19	24.40	1896.489 ng/kg
	6/12/1966	42.47844	3.27	26.35	2048.321 ng/kg
	6/12/1965	43.47844	3.35	28.46	2212.309 ng/kg
	6/12/1964	44.47844	3.43	30.74	2389.426 ng/kg
	6/13/1963	45.47844	3.50	33.20	2580.723 ng/kg
	6/12/1962	46.47844	3.58	35.86	2787.335 ng/kg
	6/12/1961	47.47844	3.66	38.73	3010.488 ng/kg
	6/12/1960	48.47844	3.73	41.83	3251.507 ng/kg
	6/13/1959	49.47844	3.81	45.18	3511.822 ng/kg
	6/12/1958	50.47844	3.89	48.80	3792.978 ng/kg
	6/12/1957	51.47844	3.96	52.70	4096.642 ng/kg
	6/12/1956	52.47844	4.04	56.92	4424.618 ng/kg
	6/13/1955	53.47844	4.12	61.48	4778.852 ng/kg
	6/12/1954	54.47844	4.20	66.40	5161.446 ng/kg
	6/12/1953	55.47844	4.27	71.72	5574.67 ng/kg
	6/12/1952	56.47844	4.35	77.46	6020.976 ng/kg
	6/13/1951	57.47844	4.43	83.66	6503.014 ng/kg
	6/12/1950	58.47844	4.50	90.36	7023.644 ng/kg
	6/12/1949	59.47844	4.58	97.59	7585.955 ng/kg
	6/12/1948	60.47844	4.66	105.41	8193.285 ng/kg
	6/13/1947	61.47844	4.73	113.85	8849.237 ng/kg
	6/12/1946	62.47844	4.81	122.96	9557.704 ng/kg
	6/12/1945	63.47844	4.89	132.80	10322.89 ng/kg

Projecting back in time using half-life and arithmetic addition

	Date (T_{x-})	t	k x t	e^kt	Ct_x
Time 0	**12/4/2008**				**77.73 ng/kg**
	6/13/2007	1.478439	0.11	1.12	87.10422 ng/kg
	6/12/2006	2.478439	0.19	1.21	94.07776 ng/kg
	6/12/2005	3.478439	0.27	1.31	101.6096 ng/kg
	6/12/2004	4.478439	0.34	1.41	109.7444 ng/kg
	6/13/2003	5.478439	0.42	1.52	118.5305 ng/kg
	6/12/2002	6.478439	0.50	1.65	128.0201 ng/kg
	6/12/2001	7.478439	0.58	1.78	138.2693 ng/kg
	6/12/2000	8.478439	0.65	1.92	149.3391 ng/kg
	6/13/1999	9.478439	0.73	2.08	161.2952 ng/kg
	6/12/1998	10.47844	0.81	2.24	174.2084 ng/kg
	6/12/1997	11.47844	0.88	2.42	188.1555 ng/kg
	6/12/1996	12.47844	0.96	2.61	203.2192 ng/kg
	6/13/1995	13.47844	1.04	2.82	219.4889 ng/kg
	6/12/1994	14.47844	1.12	3.05	237.0611 ng/kg
	6/12/1993	15.47844	1.19	3.29	256.0401 ng/kg
	6/12/1992	16.47844	1.27	3.56	276.5387 ng/kg
	6/13/1991	17.47844	1.35	3.84	298.6783 ng/kg
	6/12/1990	18.47844	1.42	4.15	322.5904 ng/kg
	6/12/1989	19.47844	1.50	4.48	348.4169 ng/kg
	6/12/1988	20.47844	1.58	4.84	376.311 ng/kg
	6/13/1987	21.47844	1.65	5.23	406.4384 ng/kg
	6/12/1986	22.47844	1.73	5.65	438.9777 ng/kg
	6/12/1985	23.47844	1.81	6.10	474.1222 ng/kg
	6/12/1984	24.47844	1.89	6.59	512.0803 ng/kg
	6/13/1983	25.47844	1.96	7.12	553.0773 ng/kg
	6/12/1982	26.47844	2.04	7.69	597.3565 ng/kg
	6/12/1981	27.47844	2.12	8.30	645.1807 ng/kg
	6/12/1980	28.47844	2.19	8.96	696.8337 ng/kg
	6/13/1979	29.47844	2.27	9.68	752.6221 ng/kg
	6/12/1978	30.47844	2.35	10.46	812.8768 ng/kg
	6/12/1977	31.47844	2.42	11.29	877.9555 ng/kg
	6/12/1976	32.47844	2.50	12.20	948.2444 ng/kg
	6/13/1975	33.47844	2.58	13.18	1024.161 ng/kg
	6/12/1974	34.47844	2.66	14.23	1106.155 ng/kg
	6/12/1973	35.47844	2.73	15.37	1194.713 ng/kg
	6/12/1972	36.47844	2.81	16.60	1290.361 ng/kg
Start of half-life degrada	**6/13/1971**	**37.47844**	**2.89**	**17.93**	**1393.667 ng/kg**
	6/12/1970	38.47844	2.96	19.37	1327.3 ng/kg
	6/12/1969	39.47844	3.04	20.92	1260.933 ng/kg
	6/12/1968	40.47844	3.12	22.59	1194.566 ng/kg
	6/13/1967	41.47844	3.19	24.40	1128.198 ng/kg
	6/12/1966	42.47844	3.27	26.35	1061.831 ng/kg
	6/12/1965	43.47844	3.35	28.46	995.4638 ng/kg
	6/12/1964	44.47844	3.43	30.74	929.0965 ng/kg
	6/13/1963	45.47844	3.50	33.20	862.7292 ng/kg
	6/12/1962	46.47844	3.58	35.86	796.3619 ng/kg
	6/12/1961	47.47844	3.66	38.73	729.9947 ng/kg
	6/12/1960	48.47844	3.73	41.83	663.6274 ng/kg
	6/13/1959	49.47844	3.81	45.18	597.2601 ng/kg
	6/12/1958	50.47844	3.89	48.80	530.8928 ng/kg
	6/12/1957	51.47844	3.96	52.70	464.5255 ng/kg
	6/12/1956	52.47844	4.04	56.92	398.1583 ng/kg
	6/13/1955	53.47844	4.12	61.48	331.791 ng/kg
	6/12/1954	54.47844	4.20	66.40	265.4237 ng/kg
	6/12/1953	55.47844	4.27	71.72	199.0564 ng/kg
	6/12/1952	56.47844	4.35	77.46	132.6891 ng/kg
	6/13/1951	57.47844	4.43	83.66	66.32185 ng/kg
	6/12/1950	58.47844	4.50	90.36	-0.045426 ng/kg
	6/12/1949	59.47844	4.58	97.59	-66.41271 ng/kg
	6/12/1948	60.47844	4.66	105.41	-132.78 ng/kg
	6/13/1947	61.47844	4.73	113.85	-199.1473 ng/kg
	6/12/1946	62.47844	4.81	122.96	-265.5145 ng/kg
	6/12/1945	63.47844	4.89	132.80	-331.8818 ng/kg

J:\DRAFT\36510600 Wausau Dioxin Sampling\CAD\Compilation Map.dwg, 2008 CWE Sampling, 12/30/2008 2:47:41 PM

General UCL Statistics for Full Data Sets

User Selected Options

From File	J:\DRAFT\36510600 Wausau Dioxin Sampling\Offsite.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

TEQ

General Statistics

Number of Valid Observations	9	Number of Distinct Observations	8

Raw Statistics		Log-transformed Statistics	
Minimum	4.1	Minimum of Log Data	1.411
Maximum	97	Maximum of Log Data	4.575
Mean	34.5	Mean of log Data	2.912
Median	13	SD of log Data	1.26
SD	35.84		
Coefficient of Variation	1.039		
Skewness	0.88		

Warning: There are only 9 Values in this data

Note: It should be noted that even though bootstrap methods may be performed on this data set,
the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.822	Shapiro Wilk Test Statistic	0.876
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	56.71	95% H-UCL	225.6
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	103.5
95% Adjusted-CLT UCL	57.89	97.5% Chebyshev (MVUE) UCL	132.9
95% Modified-t UCL	57.3	99% Chebyshev (MVUE) UCL	190.6
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.692	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	49.87		
MLE of Mean	34.5		
MLE of Standard Deviation	41.48		
nu star	12.45		
Approximate Chi Square Value (.05)	5.527	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0231	95% CLT UCL	54.15
Adjusted Chi Square Value	4.592	95% Jackknife UCL	56.71
		95% Standard Bootstrap UCL	53.03
Anderson-Darling Test Statistic	0.583	95% Bootstrap-t UCL	63.44

Anderson-Darling 5% Critical Value	0.746	95% Hall's Bootstrap UCL	58.09
Kolmogorov-Smirnov Test Statistic	0.226	95% Percentile Bootstrap UCL	53.97
Kolmogorov-Smirnov 5% Critical Value	0.288	95% BCA Bootstrap UCL	55.34
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	86.57
		97.5% Chebyshev(Mean, Sd) UCL	109.1
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	153.4
95% Approximate Gamma UCL	77.73		
95% Adjusted Gamma UCL	93.56		
Potential UCL to Use		Use 95% Approximate Gamma UCL	77.73

Appendix B
AECOM September 21, 2017 Memorandum

AECOM
200 Indiana Avenue
Stevens Point, WI 54481
www.aecom.com

715 341 8110 tel
715 341 7390 fax

Memorandum

To: Eric Lindman, City of Wausau

Cc: Allen Wesolowski and Kevin Fabel, City of Wausau; Ryan Barz, AECOM

Subject: Results for Phase 2 Environmental Sampling Investigation, Thomas Street Phase II

From: Kyle Wagoner

Date: September 21, 2017

Please find the attached tabulated analytical results for six Phase 2 soil borings recently completed by AECOM for the proposed Thomas Street Phase II reconstruction project. Soil boring locations are shown on the attached figures. AECOM's subcontract driller, Geiss Soil & Samples, LLC, advanced and sampled the borings on August 25, 2017.

All six soil borings were sampled within existing Thomas Street right-of-way (Borings B-1, B-2, B-5, and B-6) and city-owned property (Borings B-3 and B-4) located in the immediate vicinity and downgradient of the Wauleco site. Soil boring depths generally matched estimated excavation depths during the future construction.

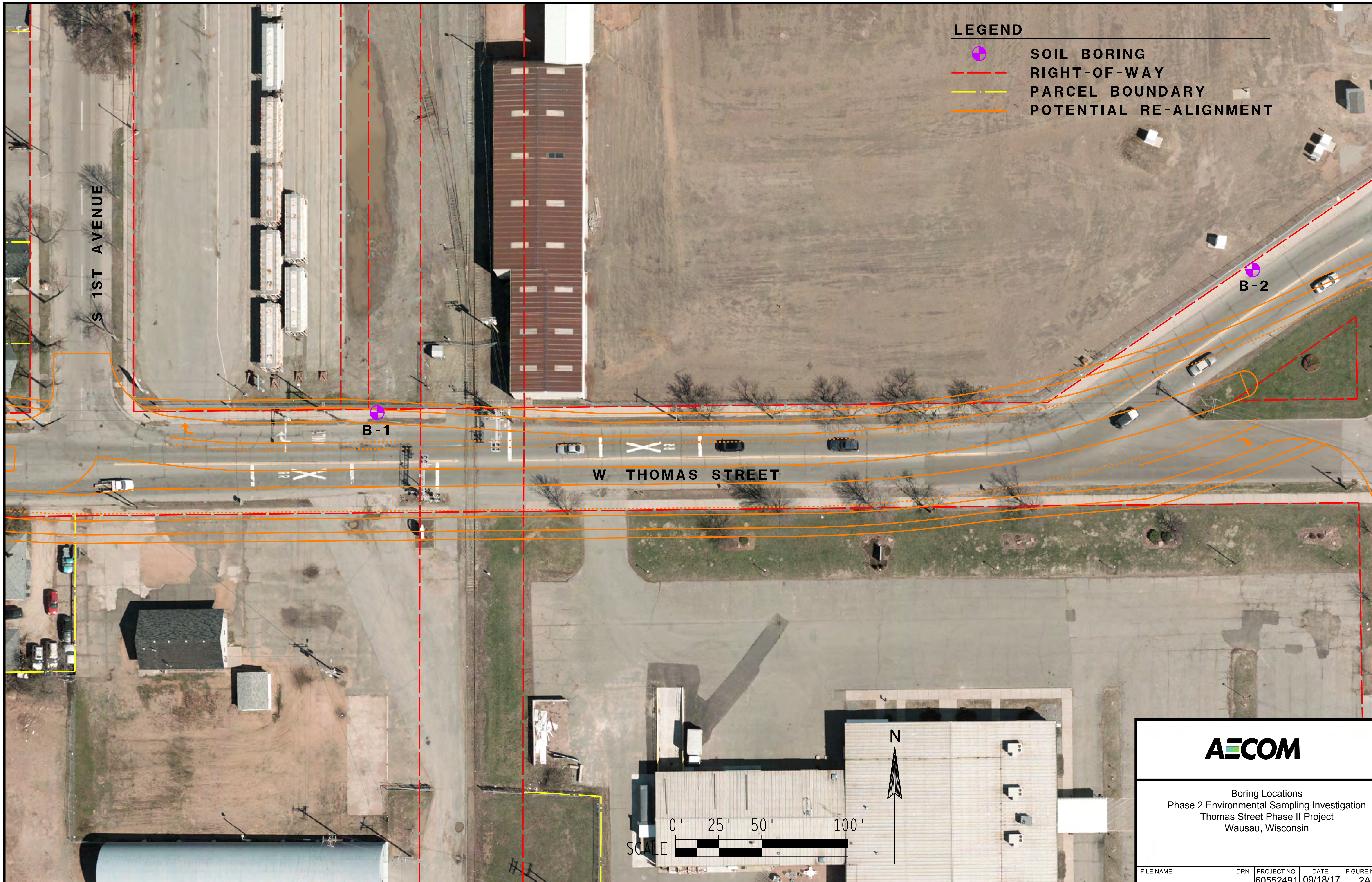
AECOM's subcontract laboratory, Pace Analytical Services (Pace), analyzed shallow and deep soil samples collected from each boring for volatile organic compounds (VOCs), pentachlorophenol (PCP) and daughter compounds, and Dioxins/Furans. Pace reported that VOCs and PCP/daughter compounds were not detected in any of the samples. Various low-level Dioxin and Furan compounds were detected in every soil sample analyzed at concentrations significantly below Wisconsin's Chapter NR 720 Direct Contact Residual Contaminant Levels (D-C RCLs) for industrial and non-industrial sites. The laboratory results reported by Pace and comparisons to Wisconsin regulatory standards for soil are summarized in the attached table.

Pace is currently analyzing one groundwater sample for VOCs, PCP/daughter compounds and Dioxins/Furans. The sample was collected from Boring B-6 at a depth interval of approximately 10-12 feet. The analytical results are anticipated to be available in early October. Groundwater was not encountered in Borings B-1 through B-5.

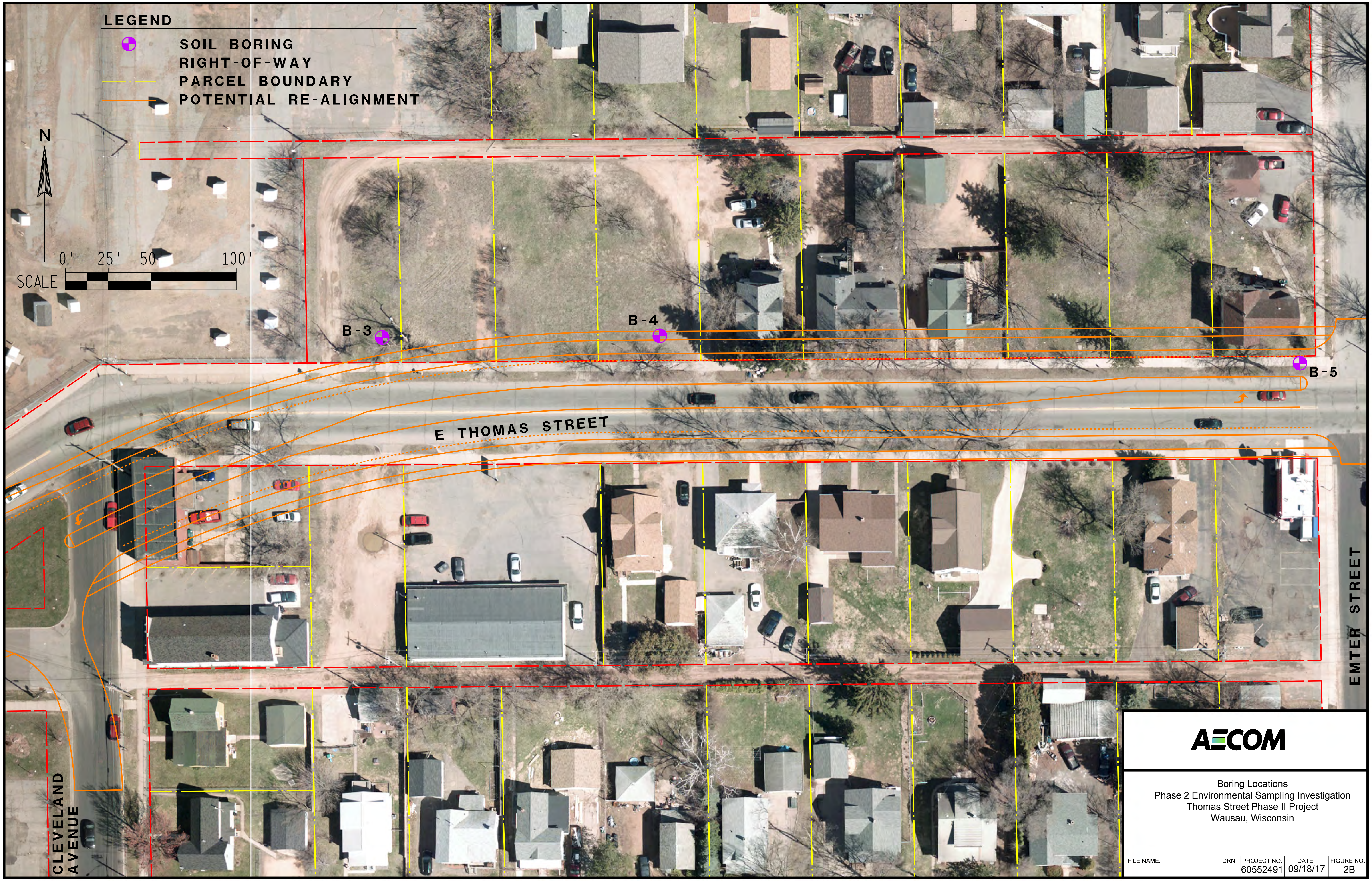
At your request, the tabulated analytical results and figures have also been provided to Matthew Thompson of the Wisconsin Department of Natural Resources - Eau Claire office for review.

AECOM's final report of the Phase 2 investigation results is anticipated to be completed by mid-October 2017.

Based on AECOM's review and evaluation of the laboratory analytical results, it is our opinion the Thomas Street Phase II reconstruction project should continue to move forward.



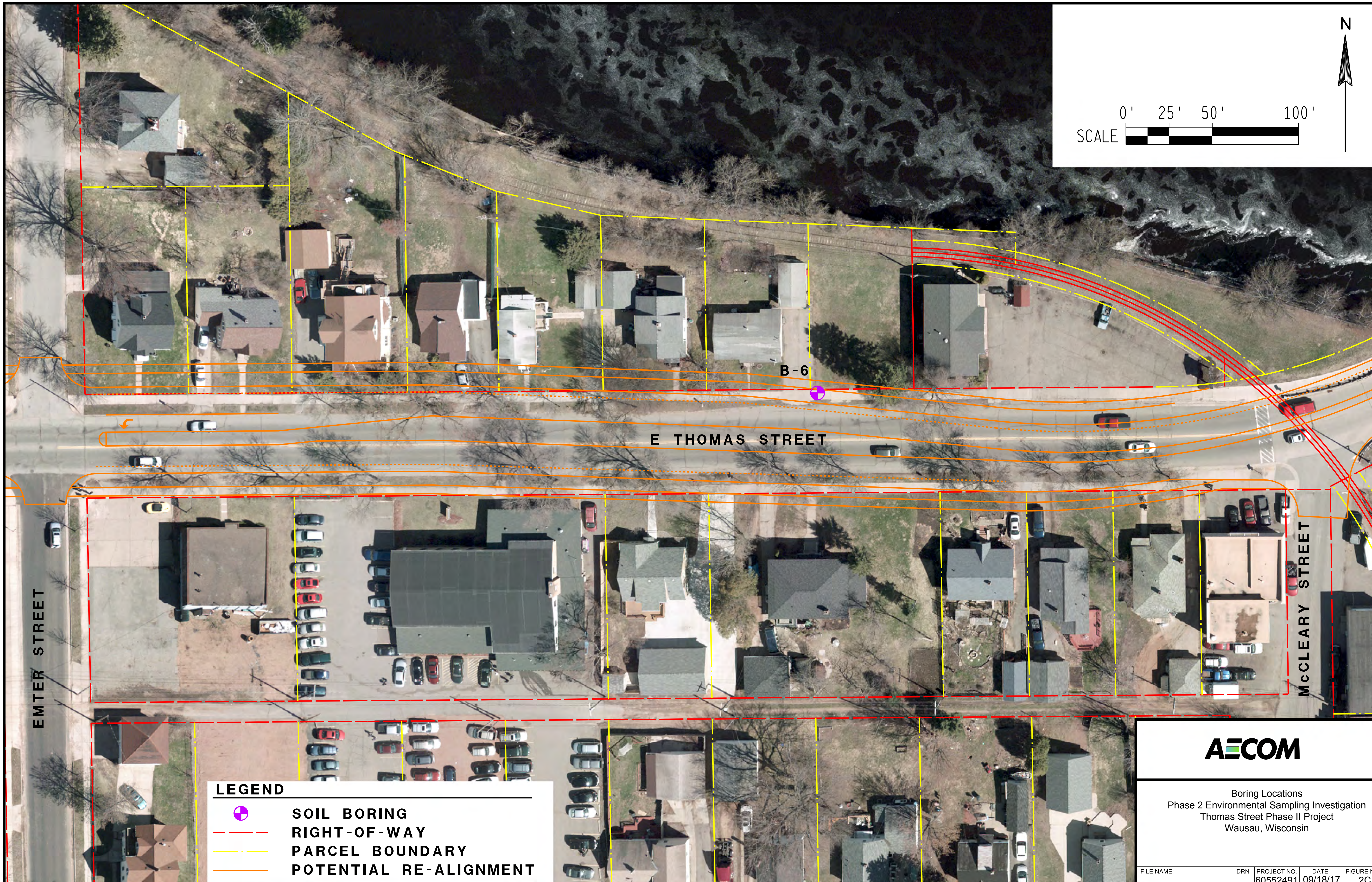
LEGEND
SOIL BORING
RIGHT-OF-WAY
PARCEL BOUNDARY
POTENTIAL RE-ALIGNMENT
S 1ST AVENUE
W THOMAS STREET
B-1
B-2
N
0' 25' 50' 100'
SCALE
AECOM
Boring Locations
Phase 2 Environmental Sampling Investigation
Thomas Street Phase II Project
Wausau, Wisconsin
FILE NAME:
DRN
PROJECT NO.
60552491
DATE
09/18/17
FIGURE NO.
2A



AECOM

Boring Locations
Phase 2 Environmental Sampling Investigation
Thomas Street Phase II Project
Wausau, Wisconsin

FILE NAME:	DRN	PROJECT NO.	DATE	FIGURE NO.
		60552491	09/18/17	2B



N
SCALE
0' 25' 50' 100'
B-6
E THOMAS STREET
EMTER STREET
McCLEARY STREET
LEGEND
SOIL BORING
RIGHT-OF-WAY
PARCEL BOUNDARY
POTENTIAL RE-ALIGNMENT
AECOM
Boring Locations
Phase 2 Environmental Sampling Investigation
Thomas Street Phase II Project
Wausau, Wisconsin
FILE NAME:
DRN
PROJECT NO. 60552491
DATE 09/18/17
FIGURE NO. 2C

Table 1
Soil Sample Analytical Results

Phase 2 Environmental Sampling Investigation
Thomas Street Phase II Project
City of Wausau, Wisconsin
AECOM Project No. 60552491

				Soil Boring ID:	B-1	B-1	B-2	B-2	B-3	B-3
				Sample Depth (feet):	1-4'	4-6'	1-4'	6-8'	1-2'	10-12'
				Sample Date:	8/25/2017	8/25/2017	8/25/2017	8/25/2017	8/25/2017	8/25/2017
				Sample Matrix:	soil	soil	soil	soil	soil	soil
				PID:	<1	<1	<1	<1	<1	<1
Analyte	Analytical Method	Direct Contact RCLs		Soil-to-Groundwater Pathway RCLs	Results					
		Non-Industrial	Industrial							
Volatile Organic Compounds (ug/kg)										
Detected VOCs	EPA 8260	--	--	--	None Detected	None Detected	None Detected	None Detected	None Detected	None Detected
Pentachlorophenol and Daughter Products (ug/kg)										
Detected PCP and Daughter Products	EPA 8270	--	--	--	None Detected	None Detected	None Detected	None Detected	None Detected	None Detected
Dioxins and Furans (ug/kg)										
2,3,7,8-TCDF	EPA 8280	0.0484	0.219	NE	<0.00054	<0.00018	<0.0025 D	<0.000096	<1.000080 IJ	<0.000095
Total TCDF	EPA 8280	NE	NE	NE	<0.00054	<0.00018	<0.0025 D	<0.000096	0.0072	<0.000095
2,3,7,8-TCDD	EPA 8280	0.00482	0.0218	0.03	<0.00063	<0.00015	<0.0026 D	<0.00010	<0.000064	<0.00010
Total TCDD	EPA 8280	NE	NE	NE	<0.00063	0.00018 J	<0.0026 D	<0.00010	0.0012	0.00025 J
1,2,3,7,8-PeCDF	EPA 8280	0.164	0.744	NE	<0.00027	<0.00017	<0.0013 D	<0.00012	0.00031 J	<0.000075
2,3,4,7,8-PeCDF	EPA 8280	0.016	0.074	NE	<0.00020	<0.00020	<0.0014 D	<0.000082	0.00095 J	<0.000063
Total PeCDF	EPA 8280	NE	NE	NE	<0.00024	<0.00018	<0.0013 D	<0.00010	0.018	<0.000069
1,2,3,7,8-PeCDD	EPA 8280	0.00493	0.022	NE	<0.00018	<0.00015	<0.0014 D	<0.000085	0.00045 J	<0.00011
Total PeCDD	EPA 8280	NE	NE	NE	<0.00018	<0.00015	<0.0014 D	<0.000085	0.0024 J	<0.00011
1,2,3,4,7,8-HxCDF	EPA 8280	0.0485	0.22	NE	<0.000086	<0.00012	<0.0020 D	<0.000098	0.0014 J	<0.00011
1,2,3,6,7,8-HxCDF	EPA 8280	0.0485	0.22	NE	<0.000084	<0.00011	<0.0020 D	<0.000087	0.0016 J	<0.000086
2,3,4,6,7,8-HxCDF	EPA 8280	0.0493	0.223	NE	<0.000085	<0.00010	<0.0025 D	<0.000075	0.0018 K	<0.000086
1,2,3,7,8,9-HxCDF	EPA 8280	0.0493	0.223	NE	<0.00012	<0.00015	<0.0041 D	<0.00013	<0.00013 IJ	<0.00018
Total HxCDF	EPA 8280	0.0493	NE	NE	<0.000093	<0.00012	0.013 JD	0.00032 J	0.037	<0.00012
1,2,3,4,7,8-HxCDD	EPA 8280	0.0493	0.223	NE	<0.00011	<0.00011	<0.0021 D	<0.00012	<0.00020 IJ	<0.000097
1,2,3,6,7,8-HxCDD	EPA 8280	0.0493	0.223	NE	<0.00010	<0.00011	<0.0019 IJD	<0.00011 IJ	0.0035 J	<0.000086
1,2,3,7,8,9-HxCDD	EPA 8280	0.0493	0.223	NE	<0.000082	<0.00012	<0.0020 D	<0.00012	0.0019 J	<0.000099
Total HxCDD	EPA 8280	0.049	0.223	NE	<0.000098	<0.00011	0.0056 JD	<0.00012	0.025	<0.000094
1,2,3,4,6,7,8-HpCDF	EPA 8280	0.49	2.22	NE	<0.000074	<0.000084	0.0091 JD	0.00022 J	0.023	<0.000057
1,2,3,4,7,8,9-HpCDF	EPA 8280	0.49	2.22	NE	<0.000085	<0.00011	<0.0031 D	<0.00013	0.0010 J	<0.000096
Total HpCDF	EPA 8280	NE	NE	NE	<0.000079	<0.000096	0.030 JD	0.00022	0.051	<0.000077
1,2,3,4,6,7,8-HpCDD	EPA 8280	0.484	2.19	NE	0.00020 J	0.00012 J	0.14 D	0.0020 J	0.065	<0.00014
Total HpCDD	EPA 8280	NE	NE	NE	0.00020 J	0.00033 J	0.24 D	0.0038 J	0.13	<0.00014
OCDF	EPA 8280	16.4	74.4	NE	<0.00017	<0.00014	<0.0030 IJD	0.00051 J	0.033	<0.00014
OCDD	EPA 8280	16.4	74.4	NE	0.00099 BJ	0.00070 BJ	7.5 D	0.050	0.52	0.00027 BJ

Notes:
Direct Contact RCLs are Not-To-Exceed values from the WDNR's NR 720 RCL spreadsheet, updated March 2017.
Groundwater Pathway RCLs are Soil-to-Groundwater values (DF 2.00) from the WDNR's NR 720 RCL spreadsheet, updated March 2017.
Bold result indicates any RCL exceedance. All results were reported below WI regulatory limits.
PID: Photoionization Detector
B: Less than 10x higher than method blank level
D: Result obtained from analysis of diluted sample
I: Interference present
J: Estimated value
NE: Not Established
RCL: Residual Contaminant Level
ug/kg: micrograms per kilogram

Abbreviations:

Dioxins
TCDD Tetrachlorodibenzo-p-dioxin
PeCDD Pentachlorodibenzo-p-dioxin
HxCDD Hexachlorodibenzo-p-dioxin
HxCDD Hexachlorodibenzo-p-dioxin
HxCDD Hexachlorodibenzo-p-dioxin
HpCDD Heptachlorodibenzo-p-dioxin
OCDD Octachlorodibenzo-p-dioxin

Furans
TCDF Tetrachlorodibenzofuran
PeCDF Pentachlorodibenzofuran
PeCDF Pentachlorodibenzofuran
HxCDF Hexachlorodibenzofuran
HxCDF Hexachlorodibenzofuran
HxCDF Hexachlorodibenzofuran
HxCDF Hexachlorodibenzofuran
HpCDF Heptachlorodibenzofuran
HpCDF Heptachlorodibenzofuran
OCDF Octachlorodibenzofuran

Table 1 (Cont.)
Soil Sample Analytical Results

Phase 2 Environmental Sampling Investigation
Thomas Street Phase II Project
City of Wausau, Wisconsin
AECOM Project No. 60552491

				Soil Boring ID:	B-4	B-4	B-5	B-5	B-6	B-6
				Sample Depth (feet):	1-2'	10-12'	1-4'	10-12'	1-4'	8-10'
				Sample Date:	8/25/2017	8/25/2017	8/25/2017	8/25/2017	8/25/2017	8/25/2017
				Sample Matrix:	soil	soil	soil	soil	soil	soil
				PID:	<1	<1	<1	<1	<1	<1
Analyte	**Analytical Method**	**Direct Contact RCLs**		**Soil-to-Groundwater Pathway RCLs**	**Results**					
		Non-Industrial	**Industrial**							
Volatile Organic Compounds (ug/kg)										
Detected VOCs	EPA 8260	--	--	--	None Detected	None Detected	None Detected	None Detected	None Detected	None Detected
Pentachlorophenol and Daughter Products (ug/kg)										
Detected PCP and Daughter Products	EPA 8270	--	--	--	None Detected	None Detected	None Detected	None Detected	None Detected	None Detected
Dioxins and Furans (ug/kg)										
2,3,7,8-TCDF	EPA 8280	0.0484	0.219	NE	<0.00011	<0.000071	<0.000068	<0.000052	<0.00011	<0.000090
Total TCDF	EPA 8280	NE	NE	NE	<0.00011	<0.000071	<0.000068	<0.000052	<0.00011	<0.000090
2,3,7,8-TCDD	EPA 8280	0.00482	0.0218	0.03	<0.000094	<0.000094	<0.000079	<0.000079	<0.00011	<0.000071
Total TCDD	EPA 8280	NE	NE	NE	0.00014 J	0.00017 J	<0.000079	0.00016 J	<0.00011	0.00032 J
1,2,3,7,8-PeCDF	EPA 8280	0.164	0.744	NE	<0.000057	<0.000097	<0.000096	<0.000087	<0.00019	<0.00012
2,3,4,7,8-PeCDF	EPA 8280	0.016	0.074	NE	<0.000033	<0.000049	<0.000056	<0.000049	<0.00010	<0.000060
Total PeCDF	EPA 8280	NE	NE	NE	<0.000045	<0.000073	<0.000076	<0.000068	<0.00014	0.00045 J
1,2,3,7,8-PeCDD	EPA 8280	0.00493	0.022	NE	<0.000046	<0.000084	<0.000062	<0.000069	<0.000087	<0.000075
Total PeCDD	EPA 8280	NE	NE	NE	<0.000046	<0.000084	<0.000062	<0.000069	<0.000087	<0.000075
1,2,3,4,7,8-HxCDF	EPA 8280	0.0485	0.22	NE	<0.000061	<0.000054	<0.000041	<0.000040	<0.000065	<0.000074
1,2,3,6,7,8-HxCDF	EPA 8280	0.0485	0.22	NE	<0.000061	<0.000045 IJ	<0.000030	<0.000036	<0.000053	<0.000071
2,3,4,6,7,8-HxCDF	EPA 8280	0.0493	0.223	NE	<0.000068	<0.000039	<0.000040	<0.000037	<0.000055	<0.000063
1,2,3,7,8,9-HxCDF	EPA 8280	0.0493	0.223	NE	<0.00013	<0.000056	<0.000049	<0.000045	<0.000068	<0.000058
Total HxCDF	EPA 8280	0.0493	NE	NE	<0.000081	<0.000048	<0.000040	<0.000040	<0.000060	0.00017 J
1,2,3,4,7,8-HxCDD	EPA 8280	0.0493	0.223	NE	<0.000055	<0.000075	<0.000069	<0.000054	<0.000096	<0.000066
1,2,3,6,7,8-HxCDD	EPA 8280	0.0493	0.223	NE	<0.000093	<0.000061	<0.000055	<0.000054	<0.000087	<0.000081
1,2,3,7,8,9-HxCDD	EPA 8280	0.0493	0.223	NE	<0.000094	<0.000071	<0.000061	<0.000053	<0.000090	<0.000073
Total HxCDD	EPA 8280	0.049	0.223	NE	<0.000081	<0.000069	<0.000062	0.00013 J	0.00013 J	0.00010 J
1,2,3,4,6,7,8-HpCDF	EPA 8280	0.49	2.22	NE	0.00019 J	<0.000055	0.000048 J	0.000068 J	<0.000093	0.00011 J
1,2,3,4,7,8,9-HpCDF	EPA 8280	0.49	2.22	NE	<0.00057	<0.000074	<0.000054 IJ	<0.000059	0.00013 J	<0.000074
Total HpCDF	EPA 8280	NE	NE	NE	0.00033 J	<0.000065	0.000048 J	0.000068 J	<0.00016 IJ	0.00011 J
1,2,3,4,6,7,8-HpCDD	EPA 8280	0.484	2.19	NE	0.00046 J	<0.00018 IJ	0.00028 J	<0.00013 IJ	<0.00016 IJ	<0.00015 IJ
Total HpCDD	EPA 8280	NE	NE	NE	0.00091 J	<0.00018	0.00028 J	0.00057 J	<0.00016	0.00080 J
OCDF	EPA 8280	16.4	74.4	NE	0.00023 J	<0.00017	<0.00013	<0.00014 IJ	0.00026 J	0.00011 IJ
OCDD	EPA 8280	16.4	74.4	NE	0.0031 J	0.0054 J	0.0046 J	0.0060 J	0.0056 J	0.0064 J

Notes:
Direct Contact RCLs are Not-To-Exceed values from the WDNR's NR 720 RCL spreadsheet, updated March 2017.
Groundwater Pathway RCLs are Soil-to-Groundwater values (DF 2.00) from the WDNR's NR 720 RCL spreadsheet, updated March 2017.
Bold result indicates any RCL exceedance. All results were reported below WI regulatory limits.
PID: Photoionization Detector
B: Less than 10x higher than method blank level
D: Result obtained from analysis of diluted sample
I: Interference present
J: Estimated value
NE: Not Established
RCL: Residual Contaminant Level
ug/kg: micrograms per kilogram

Abbreviations:

Dioxins	**Furans**
TCDD Tetrachlorodibenzo-p-dioxin	TCDF Tetrachlorodibenzofuran
PeCDD Pentachlorodibenzo-p-dioxin	PeCDF Pentachlorodibenzofuran
HxCDD Hexachlorodibenzo-p-dioxin	PeCDF Pentachlorodibenzofuran
HxCDD Hexachlorodibenzo-p-dioxin	HxCDF Hexachlorodibenzofuran
HxCDD Hexachlorodibenzo-p-dioxin	HxCDF Hexachlorodibenzofuran
HpCDD Heptachlorodibenzo-p-dioxin	HxCDF Hexachlorodibenzofuran
OCDD Octachlorodibenzo-p-dioxin	HxCDF Hexachlorodibenzofuran
	HpCDF Heptachlorodibenzofuran
	HpCDF Heptachlorodibenzofuran
	OCDF Octachlorodibenzofuran

Appendix C
SCC February 6, 2018 Letter

SAND CREEK CONSULTANTS, Inc.

Environmental and Geological
Scientists and Engineers

151 Mill St. • P.O. Box 218 • Amherst, WI 54406 • Tel. 715.824.5169

February 6, 2018

Citizens for an Environmentally Safe Thomas Street Neighborhood
c/o Ted Warpinski
Friebert, Finerty & St. John, S.C.
330 East Kilbourn Ave, Suite 1250
Milwaukee, WI 53202

Re: **Thomas Street Proposed Construction Corridor**
110 to 140 East Thomas Street
Wausau, Wisconsin

Subject: **Soil Sampling and Analysis Results**

Dear Mr. Warpinski:

The purpose of this letter is to present the methods and results of soil sampling performed along the referenced proposed construction corridor on January 9, 2018. The information is submitted for your review, consideration, and use.

Work Performed

The work was performed in accordance with the *Soil Sampling Plan*[1]. Samples were collected by Nichole Besyk and Pete Arntsen, both with Sand Creek Consultants, on January 9, 2018. Brian Petit/City of Wausau observed the work and surveyed the sample locations using global positioning system equipment.

Soil samples were collected by first using an electric hammer drill powered by a generator to drill through the frost layer, which was 4 to 5 inches thick. Once below the frost, the soil sample was collected by hand using hand tools and placed in a sample jar, which was then placed in a cooler. All samples were collected from depths of approximately 8 inches; near the base of the topsoil. New nitrile gloves were worn during sample collection and handling, and hand tools were washed with soapy water, rinsed with tap water, and final rinsed with distilled water between uses. Samples were stored on ice in a cooler pending shipment to Pace Analytical Services, LLC, on January 10, 2018.

Results

The physical characteristics of all samples were similar: the samples were moist and dark brown, with Munsell color ranging from 10YR 2/2 to 10YR 3/3 and soil texture ranging from loamy sand to sandy loam.

[1] Sand Creek Consultants, 2017, *Soil Sampling Plan Thomas Street Construction Project Wausau, Wisconsin* November 2017 (Revised November 28, 2017).

Sample locations are indicated on the enclosed **Figure**; the laboratory analysis results and their associated toxicity equivalent (TEQ) values are summarized on the enclosed **Table 1**; the **laboratory report**, and **a Photolog** are also enclosed.

Evaluation

The TEQ process is a method developed by the US Environmental Protection Agency (EPA) to relate all the dioxin/furan congeners to 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD), considered to be the most toxic congener. The total TEQ value of the sample can then be used for toxicity assessment purposes.

The data from the sample with the highest dioxin/furan concentrations (B-101) were entered into the Wisconsin Department of Natural Resources Residual Contaminant Levels (RCL) spreadsheet. The results are presented in **Table 2**. Four substances, hexachlorodibenzo-p-dioxin (Total HXCCD on Table 1); HpCDD, 2,3,7,8 (Total HpCDD); HxCDF, 2,3,7,8 (total HxCDF); and PeCDD, 2,3,7,8 (Total PeCDD) exceeded their Non-Industrial Direct-Contact RCL. Additionally, the Total PeCDD concentration in B-102 exceeded the Non-Industrial Direct-Contact RCL.

Combining the two evaluation techniques (TEQ and RCL), the TEQ value for B-101 (15 ng/kg) exceeds the Non-Industrial Direct-Contact Level for 2,3,7,8-TCDD (4.93 ng/kg).

If you have any questions or would like to discuss, please contact me at 715.824.5169 or by email at pete.arntsen@sand-creek.com.

Sincerely,

SAND CREEK CONSULTANTS, INC.

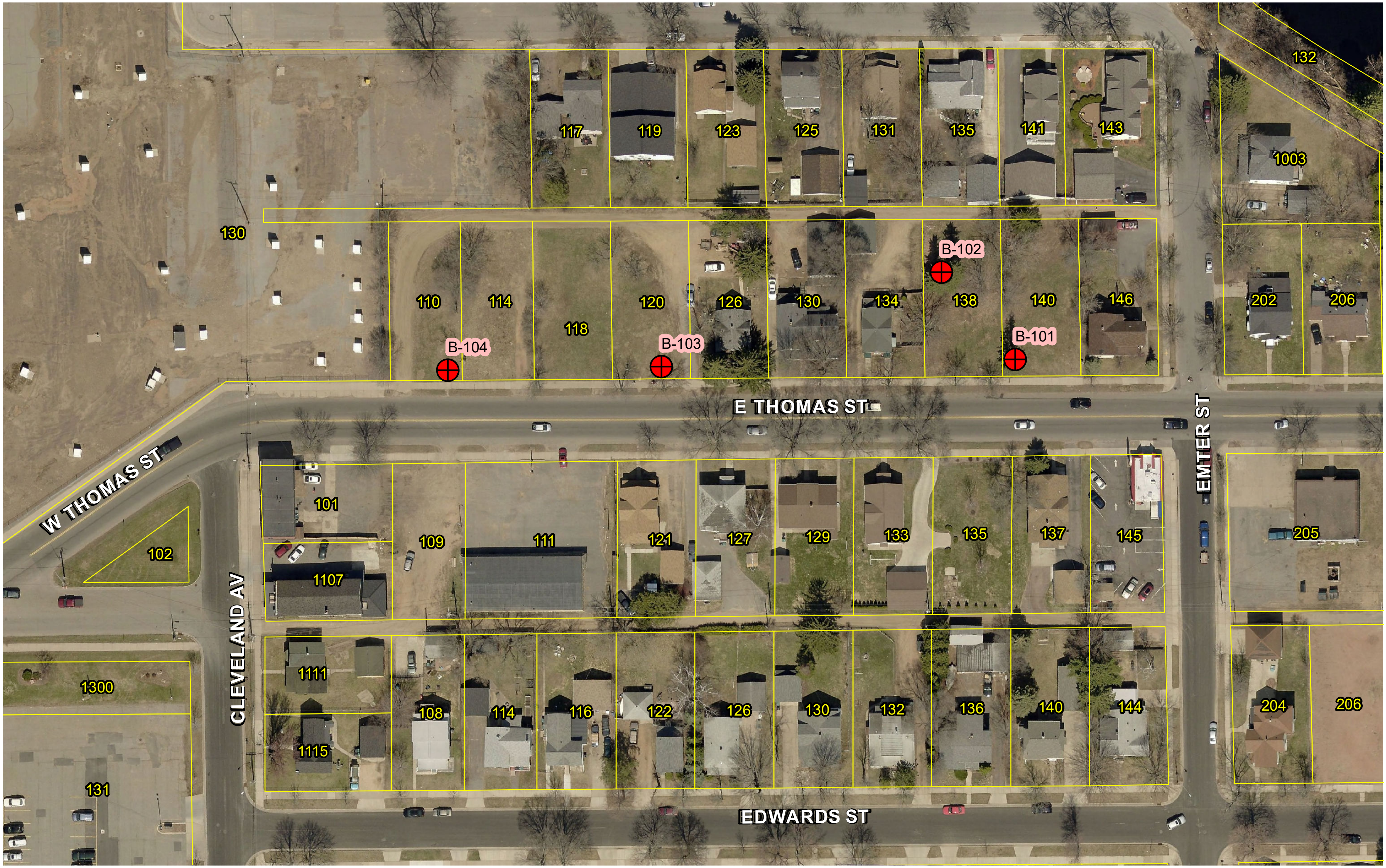
Pete Arntsen, MS, PH, PG
Senior Hydrogeologist

Enclosures: Figure 1
Tables 1 and 2
Laboratory Report
Photolog

Via email only

Figure 1

Soil Boring Locations



NOTES:

1. DUPLICATION OF THIS MAP IS PROHIBITED WITHOUT THE WRITTEN CONSENT OF THE CITY OF WAUSAU ENGINEERING DEPT.
2. THIS MAP WAS COMPILED AND DEVELOPED BY THE CITY OF WAUSAU AND MARATHON COUNTY GIS. THE CITY AND COUNTY ASSUME NO RESPONSIBILITY FOR THE ACCURACY OF THE INFORMATION CONTAINED HEREIN.
3. MAP FEATURES DEVELOPED FROM APRIL 2010 AERIAL PHOTOGRAPHY.
4. AERIAL PHOTO TAKEN APRIL, 2016.

Soil Boring Locations

CITY OF WAUSAU

Map Date: January 10, 2018

Soil Borings

Parcels

500 House Number

N W E S

0 25 50 100 150 Feet

Tables

Table 1: Analysis Results and TEQ Calculations of Soil Samples Collected from the Proposed Thomas Street Construction Corridor

		Direct-Contact Levels		Laboratory Results					2,3,7,8-TCDD Toxicity Equivalent Values			
		Non-Industrial	Industrial	B-101 8"	B-102 8"	B-103 8"	B-104 8"	WHO_{05} TEF	B-101 8"	B-102 8"	B-103 8"	B-104 8"
Dioxin Congeners												
2,3,7,8-TCDD	ng/kg	4.82	21.8	<0.28	<0.41	<0.23	<0.23	1.0	<0.28	<0.41	<0.23	<0.23
Total TCDD	ng/kg	--	--	10.0	2.5 B	1.7 B,J	1.1 B,J					
1,2,3,7,8-PeCDD	ng/kg	4.93	22.3	2.3 J	0.74 E,I,J	0.48 E,I,J	0.56 J	1.0	2.3	0.74	0.48	0.56
Total PeCDD	ng/kg	4.93	22.3	**23**	**7.1**	2.6 J	3.3 J					
1,2,3,4,7,8-HxCDD	ng/kg	49.3	223	3.1	1.1 J	0.55 E,I,J	0.69 J	0.1	0.31	0.11	0.055	0.069
1,2,3,6,7,8-HxCDD	ng/kg	49.3	223	15	4.2 J	2.2 J	3.6 J	0.1	1.5	0.42	0.22	0.36
1,2,3,7,8,9-HxCDD	ng/kg	49.3	223	7.6	2.4 J	1.4 J	1.9 J	0.1	0.76	0.24	0.14	0.99
Total HxCDD	ng/kg	49.3	223	**120**	39	19	24					
1,2,3,4,6,7,8-HpCDD	ng/kg	484	2,190	290	85	50	81	0.01	2.9	0.85	0.50	0.81
Total HpCDD	ng/kg	484	2,190	**560**	160	99	150					
1,2,3,4,6,7,8,9-OCDD	ng/kg	16,400	74,400	2,000	570	380	650	0.0003	0.60	0.17	0.11	0.20
Furan Congeners												
2,3,7,8-TCDF	ng/kg	48.4	219	2.9 V	0.87 J	<0.46	<0.26	0.1	0.29	0.09	<0.46	<0.26
Total TCDF	ng/kg	--	--	69	23.0	7.9	6.6					
1,2,3,7,8-PeCDF	ng/kg	164	744	2.0 J	0.70 J	<0.52	0.42 J	0.03	0.06	0.02	<0.52	0.42
2,3,4,7,8-PeCDF	ng/kg	16	74	9.8	2.0 J	1.1 J	1.2 J	0.3	2.94	0.60	0.33	0.36
Total PcCDF	ng/kg	--	--	120	36	18	18					
1,2,3,4,7,8-HxCDF	ng/kg	48.5	220	5.8	2.0 E,I,J	1.3 J	1.5 J	0.1	0.58	0.20	0.13	0.15
1,2,3,6,7,8-HxCDF	ng/kg	48.5	220	6.7	1.8 J	0.99 J	1.2 J	0.1	0.67	0.18	0.10	0.12
2,3,4,6,7,8-HxCDF	ng/kg	49.3	223	11 E,P	2.7 J	1.2 J	1.6 J	0.1	1.10	0.27	0.12	0.16
1,2,3,7,8,9-HxCDF	ng/kg	49.3	223	1.3 J	0.36 J	<0.12	<0.20	0.1	0.13	0.04	<0.12	<0.20
Total HxCDF	ng/kg	49.3	223	**150**	37	24	27					
1,2,3,4,6,7,8-HpCDF	ng/kg	490	2,220	120	30	17	26	0.01	1.20	0.30	0.17	0.26
1,2,3,4,7,8,9-HpCDF	ng/kg	490	2,220	4.0 J	0.96 E,I,J	0.81 J	1.0 J	0.01	0.040	0.0096	0.0081	0.010
Total HpCDF	ng/kg	490	2,220	140	46	34	59					
1,2,3,4,6,7,8,9-OCDF	ng/kg	16,400	74,400	190	36	19	42	0.0003	0.057	0.011	0.006	0.013
Total Dioxin/Furan	ng/kg			3,359	947	601	977		15	4.2	2.4	2.5

TCDD: Tetrachlorodibenzo-p-dioxin
PeCDD: Pentachlorodibenzo-p-dioxin
HxCDD: Hexachlorodibenzo-p-dioxin
HPCDD: Heptachlorodibenzo-p-dioxin
OCDD: Octachlorodibenzo-p-dioxin
TCDF: Tetrachlorodibenzofuran
PeCDF: Pentachlorodibenzofuran
HxCDF: Hexachlorodibenzofuran
HPCDF: Heptachlorodibenzofuran
OCDF: Octachlorodibenzofuran

WHO_{05} TEF = World Health Organization 2005 Toxicity Equivalence Factor
-- = Value not established
B = Less than 10x higher than the method blank level
E = Estimated maximum possible concentration
I = Interference present
J = Estimated value
P = PCDE interference
Bold values indicate concentration exceeds Non-Industrial Direct-Contact Residual Contamination level, calculated using the Wisconsin Department of Natural Resources Remediation and Redevelopment Program RCL spreadsheet (updated December 2017)

Table 2: NR 720 Direct-Contact ***Exceedance*** - ***Hazard*** - ***Risk*** Calculation Summary from Soil Data

BRRTS # : Type BRRTS No. Here (If Known)	# of Soil-Concentration Entries: 22	Number of Individual Exceedance	(Cumulative) Hazard Index	(Cumulative) Cancer Risk
		4	1.3699	1.5E-05

Bottom-Line: **NO! This NON-INDUSTRIAL site sampling location will need either further cleanup to lower contaminant levels or the construction of a cap/cover to address the direct-contact pathway.**

Date of Entry: 2/6/2018.
Date of Worksheet Used: 12/14/2017.

List below only has contaminants with data.

Contaminant	CAS Number	NC RCL (mg/kg)	C RCL (mg/kg)	Not-To-Exceed D-C RCL (mg/kg)	Basis	BTV (mg/kg)	INPUTTED Site Data (mg/kg)	Flag E = Individual Exceedance!	Hazard Quotient (HQ) from Data	Cancer Risk (CR) from Data
HCDD, 1,2,3,4,6,7,8,-	35822-46-9	0.073	4.84E-04	4.84E-04	ca		2.90E-04		0.004	6.0E-07
Heptachlorodibenzofuran, 1,2,3,4,6,7,8-	67562-39-4	0.005	4.90E-04	4.90E-04	ca		1.20E-04		0.0235	2.4E-07
Hexachlorodibenzofuran, 1,2,3,4,7,8-	70648-26-9	5.11E-04	4.85E-05	4.85E-05	ca		5.80E-06		0.0114	1.2E-07
Hexachlorodibenzo-p-dioxin	34465-46-8	5.11E-04	4.93E-05	4.93E-05	ca		1.20E-04	E	0.2348	2.4E-06
Hexachlorodibenzo-p-dioxin, 1,2,3,4,7,8-	39227-28-6	5.11E-04	4.93E-05	4.93E-05	ca		3.10E-06		0.0061	6.3E-08
HpCDD, 2,3,7,8-	37871-00-4	0.005	4.84E-04	4.84E-04	ca		5.60E-04	E	0.1096	1.2E-06
HpCDF, 1,2,3,4,7,8,9-	55673-89-7	0.005	4.90E-04	4.90E-04	ca		4.00E-06		0.0008	8.2E-09
HpCDF, 2,3,7,8-	38998-75-3	0.005	4.90E-04	4.90E-04	ca		1.40E-04		0.0274	2.9E-07
HxCDD, 1,2,3,6,7,8-	57653-85-7	5.11E-04	4.93E-05	4.93E-05	ca		1.50E-05		0.0294	3.0E-07
HxCDD, 1,2,3,7,8,9-	19408-74-3	5.11E-04	4.93E-05	4.93E-05	ca		7.60E-06		0.0149	1.5E-07
HxCDF, 1,2,3,6,7,8-	57117-44-9	5.11E-04	4.85E-05	4.85E-05	ca		6.70E-06		0.0131	1.4E-07
HxCDF, 1,2,3,7,8,9-	72918-21-9	5.11E-04	4.93E-05	4.93E-05	ca		1.30E-06		0.0025	2.6E-08
HxCDF, 2,3,4,6,7,8-	60851-34-5	5.11E-04	4.93E-05	4.93E-05	ca		1.10E-05		0.0215	2.2E-07
HxCDF, 2,3,7,8-	55684-94-1	5.11E-04	4.93E-05	4.93E-05	ca		1.50E-04	E	0.2935	3.0E-06
OCDD	3268-87-9	0.17	0.016	0.016	ca		0.002		0.0118	1.2E-07
OCDF	39001-02-0	0.17	0.016	0.016	ca		1.90E-04		0.0011	1.2E-08
PeCDD, 2,3,7,8-	36088-22-9	5.11E-05	4.93E-06	4.93E-06	ca		2.30E-05	E	0.4501	4.7E-06
PeCDF, 1,2,3,7,8-	57117-41-6	0.002	1.64E-04	1.64E-04	ca		2.00E-06		0.0012	1.2E-08
PeCDF, 2,3,4,7,8-	57117-31-4	1.70E-04	1.64E-05	1.64E-05	ca		9.80E-06		0.0576	6.0E-07

Laboratory Report

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

January 30, 2018

Pete Arntsen
SAND CREEK CONSULTANTS, INC.
151 Mill Street
Amherst, WI 54406

RE: Project: THOMAS STREET-WAUSAU
Pace Project No.: 40163368

Dear Pete Arntsen:

Enclosed are the analytical results for sample(s) received by the laboratory on January 11, 2018. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Dan Milewsky
dan.milewsky@pacelabs.com
(920)469-2436
Project Manager

Enclosures

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

CERTIFICATIONS

Project:	THOMAS STREET-WAUSAU
Pace Project No.:	40163368

Minnesota Certification IDs

1700 Elm Street SE, Suite 200, Minneapolis, MN 55414-2485
A2LA Certification #: 2926.01
Alabama Certification #: 40770
Alaska Contaminated Sites Certification #: 17-009
Alaska DW Certification #: MN00064
Arizona Certification #: AZ0014
Arkansas Certification #: 88-0680
California Certification #: 2929
CNMI Saipan Certification #:MP0003
Colorado Certification #: MN00064
Connecticut Certification #: PH-0256
EPA Region 8+Wyoming DW Certification #: via MN 027-053-137
Florida Certification #: E87605
Georgia Certification #: 959
Guam EPA Certification #: MN00064
Hawaii Certification #: MN00064
Idaho Certification #: MN00064
Illinois Certification #: 200011
Indiana Certification #: C-MN-01
Iowa Certification #: 368
Kansas Certification #: E-10167
Kentucky DW Certification #: 90062
Kentucky WW Certification #: 90062
Louisiana DEQ Certification #: 03086
Louisiana DW Certification #: MN00064
Maine Certification #: MN00064
Maryland Certification #: 322
Massachusetts Certification #: M-MN064
Michigan Certification #: 9909
Minnesota Certification #: 027-053-137
Mississippi Certification #: MN00064
Montana Certification #: CERT0092
Nebraska Certification #: NE-OS-18-06
Nevada Certification #: MN00064
New Hampshire Certification #: 2081
New Jersey Certification #: MN002
New York Certification #: 11647
North Carolina DW Certification #: 27700
North Carolina WW Certification #: 530
North Dakota Certification #: R-036
Ohio DW Certification #: 41244
Ohio VAP Certification #: CL101
Oklahoma Certification #: 9507
Oregon NwTPH Certification #: MN300001
Oregon Secondary Certification #: MN200001
Pennsylvania Certification #: 68-00563
Puerto Rico Certification #: MN00064
South Carolina Certification #:74003001
Tennessee Certification #: TN02818
Texas Certification #: T104704192
Utah Certification #: MN00064
Virginia Certification #: 460163
Washington Certification #: C486
West Virginia DW Certification #: 9952 C
West Virginia DEP Certification #: 382
Wisconsin Certification #: 999407970

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

SAMPLE SUMMARY

Project: THOMAS STREET-WAUSAU
Pace Project No.: 40163368

Lab ID	Sample ID	Matrix	Date Collected	Date Received
40163368001	**B-101, 8"**	Solid	01/09/18 12:35	01/11/18 08:30
40163368002	**B-102, 8"**	Solid	01/09/18 12:45	01/11/18 08:30
40163368003	**B-103, 8"**	Solid	01/09/18 12:25	01/11/18 08:30
40163368004	**B-104, 8"**	Solid	01/09/18 12:15	01/11/18 08:30

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

SAMPLE ANALYTE COUNT

Project: THOMAS STREET-WAUSAU
Pace Project No.: 40163368

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
40163368001	**B-101, 8"**	ASTM D2974	JDL	1	PASI-M
40163368002	**B-102, 8"**	ASTM D2974	JDL	1	PASI-M
40163368003	**B-103, 8"**	ASTM D2974	JDL	1	PASI-M
40163368004	**B-104, 8"**	ASTM D2974	JDL	1	PASI-M

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

SUMMARY OF DETECTION

Project: THOMAS STREET-WAUSAU
Pace Project No.: 40163368

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
40163368001	**B-101, 8"**					
ASTM D2974	Percent Moisture	12.0	%	0.10	01/16/18 14:40	
40163368002	**B-102, 8"**					
ASTM D2974	Percent Moisture	15.1	%	0.10	01/16/18 14:40	
40163368003	**B-103, 8"**					
ASTM D2974	Percent Moisture	16.8	%	0.10	01/16/18 14:40	
40163368004	**B-104, 8"**					
ASTM D2974	Percent Moisture	9.9	%	0.10	01/16/18 14:41	

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

ANALYTICAL RESULTS

Project: THOMAS STREET-WAUSAU
Pace Project No.: 40163368

Sample: B-101, 8" **Lab ID: 40163368001** Collected: 01/09/18 12:35 Received: 01/11/18 08:30 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**12.0**	%	0.10	0.10	1		01/16/18 14:40		

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

ANALYTICAL RESULTS

Project: THOMAS STREET-WAUSAU
Pace Project No.: 40163368

Sample: B-102, 8" **Lab ID: 40163368002** Collected: 01/09/18 12:45 Received: 01/11/18 08:30 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**15.1**	%	0.10	0.10	1		01/16/18 14:40		

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

ANALYTICAL RESULTS

Project: THOMAS STREET-WAUSAU
Pace Project No.: 40163368

Sample: B-103, 8" **Lab ID: 40163368003** Collected: 01/09/18 12:25 Received: 01/11/18 08:30 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**16.8**	%	0.10	0.10	1		01/16/18 14:40		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

ANALYTICAL RESULTS

Project: THOMAS STREET-WAUSAU
Pace Project No.: 40163368

Sample: B-104, 8'' **Lab ID: 40163368004** Collected: 01/09/18 12:15 Received: 01/11/18 08:30 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**9.9**	%	0.10	0.10	1		01/16/18 14:41		

Pace Analytical
www.pacelabs.com

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALITY CONTROL DATA

Project: THOMAS STREET-WAUSAU
Pace Project No.: 40163368

QC Batch: 518318 Analysis Method: ASTM D2974
QC Batch Method: ASTM D2974 Analysis Description: Dry Weight / %M by ASTM D2974
Associated Lab Samples: 40163368001, 40163368002, 40163368003, 40163368004

SAMPLE DUPLICATE: 2815081

Parameter	Units	10417245005 Result	Dup Result	RPD	Max RPD	Qualifiers
Percent Moisture	%	0.52	0.39	29	30	

SAMPLE DUPLICATE: 2815101

Parameter	Units	10417242003 Result	Dup Result	RPD	Max RPD	Qualifiers
Percent Moisture	%	2.0	2.2	9	30	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALIFIERS

Project: THOMAS STREET-WAUSAU
Pace Project No.: 40163368

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above LOD.

J - Estimated concentration at or above the LOD and below the LOQ.

LOD - Limit of Detection adjusted for dilution factor and percent moisture.

LOQ - Limit of Quantitation adjusted for dilution factor and percent moisture.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected at or above the adjusted LOD.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-M Pace Analytical Services - Minneapolis

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: THOMAS STREET-WAUSAU
Pace Project No.: 40163368

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
40163368001	**B-101, 8"**	ASTM D2974	518318		
40163368002	**B-102, 8"**	ASTM D2974	518318		
40163368003	**B-103, 8"**	ASTM D2974	518318		
40163368004	**B-104, 8"**	ASTM D2974	518318		

(Please Print Clearly)

Company Name:	Sand Creek
Branch/Location:	Amherst
Project Contact:	Pete Arntsen
Phone:	715-824-5969
Project Number:	
Project Name:	Thomas Street - Wausau
Project State:	WI
Sampled By (Print):	~~Pete A.~~ Nichole Besyk
Sampled By (Sign):	Nichole Besyk
PO #:	
Regulatory Program:	

Pace Analytical®
www.pacelabs.com

CHAIN OF CUSTODY

UPPER MIDWEST REGION
MN: 612-607-1700 WI: 920-469-2436

98M

40163368

*Preservation Codes
A=None B=HCL C=H2SO4 D=HNO3 E=DI Water F=Methanol G=NaOH
H=Sodium Bisulfate Solution I=Sodium Thiosulfate J=Other

Quote #:	
Mail To Contact:	Pete Arntsen
Mail To Company:	Sand Creek
Mail To Address:	PO Box 218 Amherst, WI 54406
Invoice To Contact:	~~Pete~~ Ted Warpinski
Invoice To Company:	~~Sand Creek~~ Friebert, Finerty, St. John
Invoice To Address:	330 East Kilbourn Ave Milwaukee, WI 53202
Invoice To Phone:	414-271-0130

Data Package Options (billable)
- ☐ EPA Level III
- ☐ EPA Level IV

MS/MSD
- ☐ On your sample (billable)
- ☐ NOT needed on your sample

Matrix Codes
A = Air, B = Biota, C = Charcoal, O = Oil, S = Soil, Sl = Sludge, W = Water, DW = Drinking Water, GW = Ground Water, SW = Surface Water, WW = Waste Water, WP = Wipe

FILTERED? (YES/NO) — Y/N: N
PRESERVATION (CODE)* — Pick Letter:

Analyses Requested: Dioxin/Furan EPA 1613

PACE LAB #	CLIENT FIELD ID	COLLECTION DATE	COLLECTION TIME	MATRIX	Dioxin/Furan EPA 1613	CLIENT COMMENTS	LAB COMMENTS (Lab Use Only)	Profile #
001	B-101, 8"	1/9	12:35	S	X		1-4ozag A	
002	B-102, 8"	|	12:45	|	X		|	
003	B-103, 8"	|	12:25	|	X		|	
004	B-104, 8"	|	12:15	|	X		↓	

Rush Turnaround Time Requested - Prelims
(Rush TAT subject to approval/surcharge)
Date Needed:

Transmit Prelim Rush Results by (complete what you want):

Email #1:	
Email #2:	
Telephone:	
Fax:	

Samples on HOLD are subject to special pricing and release of liability

Relinquished By:	Date/Time:	Received By:	Date/Time:
[signature]	1/9/2018, 4:10		
Waltco	1/11/18 0830	D Sems pace	1/11/18 0830

PACE Project No. 40163368

Receipt Temp = RO °C

Sample Receipt pH OK / Adjusted

Cooler Custody Seal
Present / Not Present
Intact / Not Intact

C019a(27Jun2006)

Version 6.0 06/14/06

ORIGINAL

Sample Condition Upon Receipt

Pace Analytical

Pace Analytical Services, LLC. - Green Bay WI
1241 Bellevue Street, Suite 9
Green Bay, WI 54302

Project #: WO# : 40163368

40163368

Client Name: Sand Creek

Courier: ☐ Fed Ex ☐ UPS ☐ Client ☐ Pace Other: Waltco

Tracking #: 1610937-1

Custody Seal on Cooler/Box Present: ☐ yes ☑ no   Seals intact: ☐ yes ☐ no

Custody Seal on Samples Present: ☐ yes ☑ no   Seals intact: ☐ yes ☐ no

Packing Material: ☑ Bubble Wrap ☑ Bubble Bags ☐ None ☐ Other

Thermometer Used N/A   **Type of Ice:** Wet Blue Dry None   ☑ Samples on ice, cooling process has begun

Cooler Temperature Uncorr: ROI /Corr: **Biological Tissue is Frozen:** ☐ yes ☐ no

Temp Blank Present: ☐ yes ☑ no

Temp should be above freezing to 6°C.
Biota Samples may be received at ≤ 0°C.

Person examining contents:
Date: 1/11/18
Initials: DS

				Comments:
Chain of Custody Present:	☑Yes	☐No	☐N/A	1.
Chain of Custody Filled Out:	☑Yes	☐No	☐N/A	2.
Chain of Custody Relinquished:	☑Yes	☐No	☐N/A	3.
Sampler Name & Signature on COC:	☑Yes	☐No	☐N/A	4.
Samples Arrived within Hold Time:	☑Yes	☐No	☐N/A	5.
- VOA Samples frozen upon receipt	☐Yes	☐No		Date/Time:
Short Hold Time Analysis (<72hr):	☐Yes	☑No	☐N/A	6.
Rush Turn Around Time Requested:	☐Yes	☑No	☐N/A	7.
Sufficient Volume:	☑Yes	☐No	☐N/A	8.
Correct Containers Used:	☑Yes	☐No	☐N/A	9.
-Pace Containers Used:	☑Yes	☐No	☐N/A	
-Pace IR Containers Used:	☐Yes	☐No	☑N/A	
Containers Intact:	☑Yes	☐No	☐N/A	10.
Filtered volume received for Dissolved tests	☐Yes	☐No	☑N/A	11.
Sample Labels match COC:	☑Yes	☐No	☐N/A	12.
-Includes date/time/ID/Analysis Matrix: S				
All containers needing preservation have been checked. (Non-Compliance noted in 13.)	☐Yes	☐No	☑N/A	13. ☐ HNO3 ☐ H2SO4 ☐ NaOH ☐ NaOH +ZnAct
All containers needing preservation are found to be in compliance with EPA recommendation. (HNO3, H2SO4 ≤2; NaOH+ZnAct ≥9, NaOH ≥12)	☐Yes	☐No	☑N/A	
exceptions: VOA, coliform, TOC, TOX, TOH, O&G, WIDROW, Phenolics, OTHER:	☐Yes	☑No		Initial when completed / Lab Std #ID of preservative / Date/ Time:
Headspace in VOA Vials (>6mm):	☐Yes	☐No	☑N/A	14.
Trip Blank Present:	☐Yes	☑No	☐N/A	15.
Trip Blank Custody Seals Present	☐Yes	☐No	☑N/A	
Pace Trip Blank Lot # (if purchased):				

Client Notification/ Resolution: If checked, see attached form for additional comments ☐

Person Contacted: ______   Date/Time: ______

Comments/ Resolution: ______

Project Manager Review: RnR for DM   **Date:** 1/11/18

F-GB-C-031-Rev.04 (12Dec2016) SCUR.xls
Pace Analytical Services LLC. - Green Bay WI

Pace Analytical Services, Inc.
1700 Elm Street
Minneapolis, MN 55414
Phone: 612.607.1700
Fax: 612.607.6444

www.pacelabs.com

Report Prepared for:

Dan Milewsky
PACE Wisconsin
1241 Bellevue Street
Suite 9
Green Bay WI 54302

REPORT OF LABORATORY ANALYSIS FOR PCDD/PCDF

Report Information:

Pace Project #: 10417092
Sample Receipt Date: 01/12/2018
Client Project #: 40163368
Client Sub PO #: N/A
State Cert #: 999407970

Invoicing & Reporting Options:

The report provided has been invoiced as a Level 2 PCDD/PCDF Report. If an upgrade of this report package is requested, an additional charge may be applied.

Please review the attached invoice for accuracy and forward any questions to Scott Unze, your Pace Project Manager.

This report has been reviewed by:

January 30, 2018
Scott Unze, Project Manager
(612) 607-6383
(612) 607-6444 (fax)
scott.unze@pacelabs.com

Report Prepared Date:

January 30, 2018

Report of Laboratory Analysis

The results relate only to the samples included in this report.

Pace Analytical Services, Inc.
1700 Elm Street
Minneapolis, MN 55414
Phone: 612.607.1700
Fax: 612.607.6444

DISCUSSION

This report presents the results from the analyses performed on four samples submitted by a representative of Pace Analytical Services, Inc. The samples were analyzed for the presence or absence of polychlorodibenzo-p-dioxins (PCDDs) and polychlorodibenzofurans (PCDFs) using USEPA Method 1613B. The reporting limits were based on signal-to-noise measurements. Estimated Maximum Possible Concentration (EMPC) values were treated as positives in the toxic equivalence calculations. Method blank and field sample results presented with reporting limits corresponding to the lowest calibration points and a nominal 10-gram sample amount were included in Appendix A.

The recoveries of the isotopically-labeled PCDD/PCDF internal standards in the sample extracts ranged from 60-111%. All of the labeled standard recoveries obtained for this project were within the target ranges specified in Method 1613B. Also, since the quantification of the native 2,3,7,8-substituted congeners was based on isotope dilution, the data were automatically corrected for variation in recovery and accurate values were obtained.

Values were flagged "I" where incorrect isotope ratios were obtained or "P" where polychlorinated diphenyl ethers were present. Concentrations below the calibration range were flagged "J" and should be regarded as estimates. The value reported for 2,3,7,8-TCDF in B-101, 8" was verified by a second column confirmation analysis and was flagged "V".

A laboratory method blank was prepared and analyzed with the sample batch as part of our routine quality control procedures. The results show the blank to contain trace levels of selected congeners. These levels were below the calibration range of the method. Sample levels similar to the corresponding blank level were flagged "B" on the results tables and may be, at least partially, attributed to the background. It should be noted that levels less than ten times the background are not generally considered to be statistically different from the background.

Laboratory spike samples were also prepared with the sample batch using clean reference matrix that had been fortified with native standard materials. The results show that the spiked native compounds were recovered at 89-116% with relative percent differences of 1.0-8.1%. These results were within the target ranges for the method. Matrix spikes were not prepared with the sample batch.

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Minnesota Laboratory Certifications

Authority	Certificate #	Authority	Certificate #
A2LA	2926.01	Mississippi	MN00064
Alabama	40770	Montana	CERT0092
Alaska	MN00064	Nebraska	NE-OS-18-06
Alaska	UST-078	Nevada	MN00064
Arizona	AZ0014	New Jersey (NE	MN002
Arkansas	88-0680	New York (NEL	11647
CNMI Saipan	MP0003	New hampshire	2081
California	MN00064	North Carolina	27700
Colorado	MN00064	North Carolina	530
Connecticut	PH-0256	North Dakota	R-036
EPA Region 8	8TMS-L	Ohio	41244
Florida (NELAP	E87605	Ohio VAP	CL101
Georgia (EDP)	959	Oklahoma	9507
Guam EPA	959	Oregon (ELAP)	MN200001
Hawaii	MN00064	Oregon (OREL	MN300001
Idaho	MN00064	Pennsylvania	68-00563
Illinois	200011	Puerto Rico	MN00064
Indiana	C-MN-01	South Carolina	74003001
Iowa	368	Tennessee	TN02818
Kansas	E-10167	Texas	T104704192
Kentucky	90062	Utah (NELAP)	MN00064
Louisiana	03086	Virginia	460163
Louisiana	MN00064	Washington	C486
Maine	MN00064	West Virginia #	9952C
Maryland	322	West Virginia D	382
Michigan	9909	Wisconsin	999407970
Minnesota	027-053-137	Wyoming	8TMS-L

Appendix A

Sample Management

10417092

Chain of Custody

Pace Analytical®
www.pacelabs.com

Workorder: 40163368 **Workorder Name:** THOMAS STREET-WAUSAU **Owner Received Date:** 1/11/2018 **Results Requested By:** 2/1/2018

Report To	Subcontract To
Dan Milewsky Pace Analytical Green Bay 1241 Bellevue Street Suite 9 Green Bay, WI 54302 Phone (920)469-2436	Pace Analytical Minnesota 1700 Elm Street SE Suite 200 Minneapolis, MN 55414 Phone (612)607-1700

Item	Sample ID	Sample Type	Collect Date/Time	Lab ID	Matrix	Preserved Containers: Unpreserved	Requested Analysis: EPA 1613 Dioxin	LAB USE ONLY
1	B-101, 8"	PS	1/9/2018 12:35	40163368001	Solid	1	X	001
2	B-102, 8"	PS	1/9/2018 12:45	40163368002	Solid	1	X	002
3	B-103, 8"	PS	1/9/2018 12:25	40163368003	Solid	1	X	003
4	B-104, 8"	PS	1/9/2018 12:15	40163368004	Solid	1	X	004
5								

Transfers	Released By	Date/Time	Received By	Date/Time
1	[signature]	1/11/18 1630	[signature] /Pace	1/12/18 1020
2				
3				

Comments: full list dioxin/furan

Cooler Temperature on Receipt 2.1 °C **Custody Seal** Y or N **Received on Ice** Y or N **Samples Intact** Y or N

***In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signature may not be provided on this COC document. This chain of custody is considered complete as is since this information is available in the owner laboratory.*

Pace Analytical	Document Name: Sample Condition Upon Receipt Form	Document Revised: 14Dec2017 Page 1 of 2
	Document No.: F-MN-L-213-rev.22	Issuing Authority: Pace Minnesota Quality Office

Sample Condition Upon Receipt

Client Name: Pasi - GB

Project #: WO# : 10417092

10417092

Courier: ☐ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace ☐ SpeeDee ☒ Other: Waltco

Tracking Number:

Custody Seal on Cooler/Box Present? ☒ Yes ☐ No **Seals Intact?** ☒ Yes ☐ No

Optional: Proj. Due Date: **Proj. Name:**

Packing Material: ☐ Bubble Wrap ☒ Bubble Bags ☐ None ☐ Other:

Temp Blank? ☒ Yes ☐ No

Thermometer Used: ☒ 151401163 ☐ G87A9155100842

Type of Ice: ☒ Wet ☐ Blue ☐ None ☐ Dry ☐ Melted

Cooler Temp Read (°C): 1.9 **Cooler Temp Corrected (°C):** 2.1 **Biological Tissue Frozen?** ☐ Yes ☐ No ☒ N/A

Temp should be above freezing to 6°C **Correction Factor:** +0.2 **Date and Initials of Person Examining Contents:** 1/12/18 SD

USDA Regulated Soil (☐ N/A, water sample)

Did samples originate in a quarantine zone within the United States: AL, AR, CA, FL, GA, ID, LA, MS, NC, NM, NY, OK, OR, SC, TN, TX or VA (check maps)? ☐ Yes ☒ No

Did samples originate from a foreign source (internationally, including Hawaii and Puerto Rico)? ☐ Yes ☒ No

If Yes to either question, fill out a Regulated Soil Checklist (F-MN-Q-338) and include with SCUR/COC paperwork.

				COMMENTS:
Chain of Custody Present?	☒ Yes	☐ No		1.
Chain of Custody Filled Out?	☒ Yes	☐ No		2.
Chain of Custody Relinquished?	☒ Yes	☐ No		3.
Sampler Name and/or Signature on COC?	☐ Yes	☐ No	☒ N/A	4.
Samples Arrived within Hold Time?	☒ Yes	☐ No		5.
Short Hold Time Analysis (<72 hr)?	☐ Yes	☒ No		6.
Rush Turn Around Time Requested?	☐ Yes	☒ No		7.
Sufficient Volume?	☒ Yes	☐ No		8.
Correct Containers Used?	☒ Yes	☐ No		9.
-Pace Containers Used?	☒ Yes	☐ No		
Containers Intact?	☒ Yes	☐ No		10.
Filtered Volume Received for Dissolved Tests?	☐ Yes	☐ No	☒ N/A	11. Note if sediment is visible in the dissolved container
Sample Labels Match COC? -Includes Date/Time/ID/Analysis Matrix: SL	☒ Yes	☐ No		12.
All containers needing acid/base preservation have been checked?	☐ Yes	☐ No	☒ N/A	13. ☐ HNO_3 ☐ H_2SO_4 ☐ NaOH Positive for Res. Chlorine? Y N Sample #
All containers needing preservation are found to be in compliance with EPA recommendation? (HNO_3, H_2SO_4, <2pH, NaOH >9 Sulfide, NaOH>12 Cyanide)	☐ Yes	☐ No	☒ N/A	
Exceptions: VOA, Coliform, TOC/DOC Oil and Grease, DRO/8015 (water) and Dioxin.	☐ Yes	☐ No	☒ N/A	Initial when completed: Lot # of added preservative:
Headspace in VOA Vials (>6mm)?	☐ Yes	☐ No	☒ N/A	14.
Trip Blank Present?	☐ Yes	☐ No	☒ N/A	15.
Trip Blank Custody Seals Present?	☐ Yes	☐ No	☒ N/A	
Pace Trip Blank Lot # (if purchased):				

CLIENT NOTIFICATION/RESOLUTION

Field Data Required? ☐ Yes ☐ No

Person Contacted: Date/Time:

Comments/Resolution:

Project Manager Review: [signature] **Date:** 01/12/18

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e out of hold, incorrect preservative, out of temp, incorrect containers).

Report No....10417092_1613FC_DFR

(Please Print Clearly)

Company Name:	Sand Creek
Branch/Location:	Amherst
Project Contact:	Pete Arntsen
Phone:	715-824-5969
Project Number:	
Project Name:	Thomas Street - Wausau
Project State:	WI
Sampled By (Print):	~~Pete A.~~ Nichole Besyk
Sampled By (Sign):	Nichole Besyk
PO #:	Regulatory Program:

Pace Analytical®
www.pacelabs.com

CHAIN OF CUSTODY

UPPER MIDWEST REGION
MN: 612-607-1700 WI: 920-469-2436

Page 1 of

U0163368

*Preservation Codes
A=None B=HCL C=H2SO4 D=HNO3 E=DI Water F=Methanol G=NaOH
H=Sodium Bisulfate Solution I=Sodium Thiosulfate J=Other

FILTERED? (YES/NO): N
PRESERVATION (CODE)*

Quote #:	
Mail To Contact:	Pete Arntsen
Mail To Company:	Sand Creek
Mail To Address:	PO Box 218 Amherst, WI 54406
Invoice To Contact:	~~S~~ Ted Warpinski
Invoice To Company:	~~Sand~~ Friebert, Finerty, St. John
Invoice To Address:	330 East Kilbourn Ave Milwaukee, WI 53202
Invoice To Phone:	414-271-0130

Data Package Options (billable)
☐ EPA Level III
☐ EPA Level IV

MS/MSD
☐ On your sample (billable)
☐ NOT needed on your sample

Matrix Codes
A = Air, B = Biota, C = Charcoal, O = Oil, S = Soil, Sl = Sludge
W = Water, DW = Drinking Water, GW = Ground Water, SW = Surface Water, WW = Waste Water, WP = Wipe

PACE LAB #	CLIENT FIELD ID	COLLECTION DATE	COLLECTION TIME	MATRIX	Dioxin/Furan EPA 1613	CLIENT COMMENTS	LAB COMMENTS (Lab Use Only)	Profile #
001	B-101, 8"	1/9	12:35	S	X		1-4ozag A	
002	B-102, 8"	|	12:45	|	X		|	
003	B-103, 8"	|	12:25	|	X		|	
004	B-104, 8"	|	12:15	|	X		↓	

Rush Turnaround Time Requested - Prelims
(Rush TAT subject to approval/surcharge)
Date Needed:

Transmit Prelim Rush Results by (complete what you want):

Email #1:	
Email #2:	
Telephone:	
Fax:	

Samples on HOLD are subject to special pricing and release of liability

Relinquished By:	Date/Time:	Received By:	Date/Time:
[signature]	1/9/2018, 4:10		
Waltco	1/11/18 0830	D Sams pace	1/11/18 0830

PACE Project No. U0163368
Receipt Temp = R8 °C
Sample Receipt pH OK / Adjusted
Cooler Custody Seal Present / Not Present
Intact / Not Intact

C019a(27Jun2006)
Version 6.0 06/14/06
ORIGINAL

Sample Condition Upon Receipt

Pace Analytical

Pace Analytical Services, LLC. - Green Bay WI
1241 Bellevue Street, Suite 9
Green Bay, WI 54302

Client Name: Sand Creek

Project #: 40163268

AFFIX WORKORDER LABEL HERE

Courier: ☐ Fed Ex ☐ UPS ☐ Client ☐ Pace Other: Waltco

Tracking #: 1610937-1

Custody Seal on Cooler/Box Present: ☐ yes ☑ no Seals intact: ☐ yes ☐ no

Custody Seal on Samples Present: ☐ yes ☑ no Seals intact: ☐ yes ☐ no

Packing Material: ☑ Bubble Wrap ☐ Bubble Bags ☐ None ☐ Other

Thermometer Used N/A **Type of Ice:** ~~Wet~~ Blue Dry None ☑ Samples on ice, cooling process has begun

Cooler Temperature Uncorr: ROI /Corr: **Biological Tissue is Frozen:** ☐ yes ☐ no

Temp Blank Present: ☐ yes ☑ no

Temp should be above freezing to 6°C.
Biota Samples may be received at ≤ 0°C.

Person examining contents:
Date: 1/11/18
Initials: DS

				Comments:
Chain of Custody Present:	☑Yes	☐No	☐N/A	1.
Chain of Custody Filled Out:	☑Yes	☐No	☐N/A	2.
Chain of Custody Relinquished:	☑Yes	☐No	☐N/A	3.
Sampler Name & Signature on COC:	☑Yes	☐No	☐N/A	4.
Samples Arrived within Hold Time:	☑Yes	☐No	☐N/A	5.
- VOA Samples frozen upon receipt	☐Yes	☐No		Date/Time:
Short Hold Time Analysis (<72hr):	☐Yes	☑No	☐N/A	6.
Rush Turn Around Time Requested:	☐Yes	☑No	☐N/A	7.
Sufficient Volume:	☑Yes	☐No	☐N/A	8.
Correct Containers Used:	☑Yes	☐No	☐N/A	9.
-Pace Containers Used:	☑Yes	☐No	☐N/A	
-Pace IR Containers Used:	☐Yes	☐No	☑N/A	
Containers Intact:	☑Yes	☐No	☐N/A	10.
Filtered volume received for Dissolved tests	☐Yes	☐No	☑N/A	11.
Sample Labels match COC:	☑Yes	☐No	☐N/A	12.
-Includes date/time/ID/Analysis Matrix: S				
All containers needing preservation have been checked. (Non-Compliance noted in 13.)	☐Yes	☐No	☑N/A	13. ☐ HNO3 ☐ H2SO4 ☐ NaOH ☐ NaOH +ZnAct
All containers needing preservation are found to be in compliance with EPA recommendation. (HNO3, H2SO4 ≤2; NaOH+ZnAct ≥9, NaOH ≥12)	☐Yes	☐No	☑N/A	
exceptions: VOA, coliform, TOC, TOX, TOH, O&G, WIDROW, Phenolics, OTHER:	☐Yes	☑No		Initial when completed / Lab Std #ID of preservative / Date/ Time:
Headspace in VOA Vials (>6mm):	☐Yes	☐No	☑N/A	14.
Trip Blank Present:	☐Yes	☑No	☐N/A	15.
Trip Blank Custody Seals Present	☐Yes	☐No	☑N/A	
Pace Trip Blank Lot # (if purchased):				

Client Notification/ Resolution: If checked, see attached form for additional comments ☐

Person Contacted: Date/Time:

Comments/ Resolution:

Project Manager Review: RnR for DM **Date:** 1/11/18

F-GB-C-031-Rev.04 (12Dec2016) SCUR.xls
Pace Analytical Services LLC. - Green Bay WI

Pace Analytical™

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Method 1613B Blank Analysis Results

Lab Sample ID	BLANK-59704	Matrix	Solid
Filename	U180118A_04	Dilution	NA
Total Amount Extracted	10.2 g	Extracted	01/15/2018 14:50
ICAL ID	U171222	Analyzed	01/18/2018 03:49
CCal Filename(s)	U180117B_18	Injected By	SMT

Native Isomers	Conc ng/Kg	EMPC ng/Kg	RL ng/Kg	Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	ND	-----	1.0	2,3,7,8-TCDF-13C	2.00	65
Total TCDF	ND	-----	1.0	2,3,7,8-TCDD-13C	2.00	63
				1,2,3,7,8-PeCDF-13C	2.00	73
2,3,7,8-TCDD	ND	-----	1.0	2,3,4,7,8-PeCDF-13C	2.00	77
Total TCDD	ND	-----	1.0	1,2,3,7,8-PeCDD-13C	2.00	87
				1,2,3,4,7,8-HxCDF-13C	2.00	76
1,2,3,7,8-PeCDF	ND	-----	5.0	1,2,3,6,7,8-HxCDF-13C	2.00	77
2,3,4,7,8-PeCDF	ND	-----	5.0	2,3,4,6,7,8-HxCDF-13C	2.00	83
Total PeCDF	ND	-----	5.0	1,2,3,7,8,9-HxCDF-13C	2.00	76
				1,2,3,4,7,8-HxCDD-13C	2.00	78
1,2,3,7,8-PeCDD	ND	-----	5.0	1,2,3,6,7,8-HxCDD-13C	2.00	78
Total PeCDD	ND	-----	5.0	1,2,3,4,6,7,8-HpCDF-13C	2.00	72
				1,2,3,4,7,8,9-HpCDF-13C	2.00	78
1,2,3,4,7,8-HxCDF	ND	-----	5.0	1,2,3,4,6,7,8-HpCDD-13C	2.00	84
1,2,3,6,7,8-HxCDF	ND	-----	5.0	OCDD-13C	4.00	79
2,3,4,6,7,8-HxCDF	ND	-----	5.0			
1,2,3,7,8,9-HxCDF	ND	-----	5.0	1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	ND	-----	5.0	1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	ND	-----	5.0	2,3,7,8-TCDD-37Cl4	0.20	65
1,2,3,6,7,8-HxCDD	ND	-----	5.0			
1,2,3,7,8,9-HxCDD	ND	-----	5.0			
Total HxCDD	ND	-----	5.0			
1,2,3,4,6,7,8-HpCDF	ND	-----	5.0	Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	ND	-----	5.0	Equivalence: 0.00 ng/Kg		
Total HpCDF	ND	-----	5.0	(Lower-bound - Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	ND	-----	5.0			
Total HpCDD	ND	-----	5.0			
OCDF	ND	-----	10			
OCDD	ND	-----	10			

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
RL = Reporting Limit

Results reported on a total weight basis and are valid to no more than 2 significant figures.

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Method 1613B Sample Analysis Results

Client - PACE Wisconsin

Client's Sample ID	B-101, 8"		
Lab Sample ID	40163368001		
Filename	F180119B_09		
Injected By	BAL		
Total Amount Extracted	13.0 g	Matrix	Solid
% Moisture	12.0	Dilution	NA
Dry Weight Extracted	11.4 g	Collected	01/09/2018 12:35
ICAL ID	F180103	Received	01/12/2018 10:20
CCal Filename(s)	F180119A_21	Extracted	01/15/2018 14:50
Method Blank ID	BLANK-59704	Analyzed	01/20/2018 10:40

Native Isomers	Conc ng/Kg	EMPC ng/Kg	RL ng/Kg		Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	2.9	-----	1.0	V	2,3,7,8-TCDF-13C	2.00	72
Total TCDF	69	-----	1.0		2,3,7,8-TCDD-13C	2.00	65
					1,2,3,7,8-PeCDF-13C	2.00	81
2,3,7,8-TCDD	ND	-----	1.0		2,3,4,7,8-PeCDF-13C	2.00	85
Total TCDD	7.8	-----	1.0		1,2,3,7,8-PeCDD-13C	2.00	82
					1,2,3,4,7,8-HxCDF-13C	2.00	77
1,2,3,7,8-PeCDF	ND	-----	5.0		1,2,3,6,7,8-HxCDF-13C	2.00	71
2,3,4,7,8-PeCDF	9.8	-----	5.0		2,3,4,6,7,8-HxCDF-13C	2.00	74
Total PeCDF	120	-----	5.0		1,2,3,7,8,9-HxCDF-13C	2.00	73
					1,2,3,4,7,8-HxCDD-13C	2.00	71
1,2,3,7,8-PeCDD	ND	-----	5.0		1,2,3,6,7,8-HxCDD-13C	2.00	63
Total PeCDD	6.9	-----	5.0		1,2,3,4,6,7,8-HpCDF-13C	2.00	60
					1,2,3,4,7,8,9-HpCDF-13C	2.00	74
1,2,3,4,7,8-HxCDF	5.8	-----	5.0		1,2,3,4,6,7,8-HpCDD-13C	2.00	73
1,2,3,6,7,8-HxCDF	6.7	-----	5.0		OCDD-13C	4.00	87
2,3,4,6,7,8-HxCDF	-----	11	5.0	P			
1,2,3,7,8,9-HxCDF	ND	-----	5.0		1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	150	-----	5.0		1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	ND	-----	5.0		2,3,7,8-TCDD-37Cl4	0.20	61
1,2,3,6,7,8-HxCDD	15	-----	5.0				
1,2,3,7,8,9-HxCDD	7.6	-----	5.0				
Total HxCDD	120	-----	5.0				
1,2,3,4,6,7,8-HpCDF	120	-----	5.0		Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	ND	-----	5.0		Equivalence: 16 ng/Kg		
Total HpCDF	140	-----	5.0		(Lower-bound - Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	290	-----	5.0				
Total HpCDD	560	-----	5.0				
OCDF	190	-----	10				
OCDD	2000	-----	10				

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
RL = Reporting Limit

ND = Not Detected
NA = Not Applicable
NC = Not Calculated

Results reported on a dry weight basis and are valid to no more than 2 significant figures.
P = PCDE Interference
V = Result verified by confirmation analysis

REPORT OF LABORATORY ANALYSIS

Pace Analytical™
Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Method 1613B Sample Analysis Results

Client - PACE Wisconsin

Client's Sample ID	B-102, 8"		
Lab Sample ID	40163368002		
Filename	F180119B_10		
Injected By	BAL		
Total Amount Extracted	13.0 g	Matrix	Solid
% Moisture	15.1	Dilution	NA
Dry Weight Extracted	11.0 g	Collected	01/09/2018 12:45
ICAL ID	F180103	Received	01/12/2018 10:20
CCal Filename(s)	F180119A_21	Extracted	01/15/2018 14:50
Method Blank ID	BLANK-59704	Analyzed	01/20/2018 11:22

Native Isomers	Conc ng/Kg	EMPC ng/Kg	RL ng/Kg	Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	ND	-----	1.0	2,3,7,8-TCDF-13C	2.00	92
Total TCDF	23	-----	1.0	2,3,7,8-TCDD-13C	2.00	83
				1,2,3,7,8-PeCDF-13C	2.00	103
2,3,7,8-TCDD	ND	-----	1.0	2,3,4,7,8-PeCDF-13C	2.00	111
Total TCDD	1.8	-----	1.0	1,2,3,7,8-PeCDD-13C	2.00	107
				1,2,3,4,7,8-HxCDF-13C	2.00	92
1,2,3,7,8-PeCDF	ND	-----	5.0	1,2,3,6,7,8-HxCDF-13C	2.00	99
2,3,4,7,8-PeCDF	ND	-----	5.0	2,3,4,6,7,8-HxCDF-13C	2.00	100
Total PeCDF	29	-----	5.0	1,2,3,7,8,9-HxCDF-13C	2.00	99
				1,2,3,4,7,8-HxCDD-13C	2.00	87
1,2,3,7,8-PeCDD	ND	-----	5.0	1,2,3,6,7,8-HxCDD-13C	2.00	86
Total PeCDD	ND	-----	5.0	1,2,3,4,6,7,8-HpCDF-13C	2.00	81
				1,2,3,4,7,8,9-HpCDF-13C	2.00	93
1,2,3,4,7,8-HxCDF	ND	-----	5.0	1,2,3,4,6,7,8-HpCDD-13C	2.00	91
1,2,3,6,7,8-HxCDF	ND	-----	5.0	OCDD-13C	4.00	104
2,3,4,6,7,8-HxCDF	ND	-----	5.0			
1,2,3,7,8,9-HxCDF	ND	-----	5.0	1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	27	-----	5.0	1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	ND	-----	5.0	2,3,7,8-TCDD-37Cl4	0.20	79
1,2,3,6,7,8-HxCDD	ND	-----	5.0			
1,2,3,7,8,9-HxCDD	ND	-----	5.0			
Total HxCDD	28	-----	5.0			
1,2,3,4,6,7,8-HpCDF	30	-----	5.0	Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	ND	-----	5.0	Equivalence: 1.8 ng/Kg		
Total HpCDF	46	-----	5.0	(Lower-bound - Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	85	-----	5.0			
Total HpCDD	160	-----	5.0			
OCDF	36	-----	10			
OCDD	570	-----	10			

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
RL = Reporting Limit

ND = Not Detected
NA = Not Applicable
NC = Not Calculated

Results reported on a dry weight basis and are valid to no more than 2 significant figures.

REPORT OF LABORATORY ANALYSIS

Pace Analytical™

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Method 1613B Sample Analysis Results

Client - PACE Wisconsin

Client's Sample ID	B-103, 8"		
Lab Sample ID	40163368003		
Filename	F180119B_11		
Injected By	BAL		
Total Amount Extracted	13.6 g	Matrix	Solid
% Moisture	16.8	Dilution	NA
Dry Weight Extracted	11.3 g	Collected	01/09/2018 12:25
ICAL ID	F180103	Received	01/12/2018 10:20
CCal Filename(s)	F180119A_21	Extracted	01/15/2018 14:50
Method Blank ID	BLANK-59704	Analyzed	01/20/2018 12:06

Native Isomers	Conc ng/Kg	EMPC ng/Kg	RL ng/Kg	Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	ND	-----	1.0	2,3,7,8-TCDF-13C	2.00	75
Total TCDF	6.8	-----	1.0	2,3,7,8-TCDD-13C	2.00	67
				1,2,3,7,8-PeCDF-13C	2.00	80
2,3,7,8-TCDD	ND	-----	1.0	2,3,4,7,8-PeCDF-13C	2.00	87
Total TCDD	ND	-----	1.0	1,2,3,7,8-PeCDD-13C	2.00	83
				1,2,3,4,7,8-HxCDF-13C	2.00	76
1,2,3,7,8-PeCDF	ND	-----	5.0	1,2,3,6,7,8-HxCDF-13C	2.00	80
2,3,4,7,8-PeCDF	ND	-----	5.0	2,3,4,6,7,8-HxCDF-13C	2.00	81
Total PeCDF	11	-----	5.0	1,2,3,7,8,9-HxCDF-13C	2.00	85
				1,2,3,4,7,8-HxCDD-13C	2.00	67
1,2,3,7,8-PeCDD	ND	-----	5.0	1,2,3,6,7,8-HxCDD-13C	2.00	78
Total PeCDD	ND	-----	5.0	1,2,3,4,6,7,8-HpCDF-13C	2.00	70
				1,2,3,4,7,8,9-HpCDF-13C	2.00	78
1,2,3,4,7,8-HxCDF	ND	-----	5.0	1,2,3,4,6,7,8-HpCDD-13C	2.00	77
1,2,3,6,7,8-HxCDF	ND	-----	5.0	OCDD-13C	4.00	85
2,3,4,6,7,8-HxCDF	ND	-----	5.0			
1,2,3,7,8,9-HxCDF	ND	-----	5.0	1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	13	-----	5.0	1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	ND	-----	5.0	2,3,7,8-TCDD-37Cl4	0.20	62
1,2,3,6,7,8-HxCDD	ND	-----	5.0			
1,2,3,7,8,9-HxCDD	ND	-----	5.0			
Total HxCDD	14	-----	5.0			
1,2,3,4,6,7,8-HpCDF	17	-----	5.0	Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	ND	-----	5.0	Equivalence: 1.1 ng/Kg		
Total HpCDF	33	-----	5.0	(Lower-bound - Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	50	-----	5.0			
Total HpCDD	99	-----	5.0			
OCDF	19	-----	10			
OCDD	380	-----	10			

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
RL = Reporting Limit

ND = Not Detected
NA = Not Applicable
NC = Not Calculated

Results reported on a dry weight basis and are valid to no more than 2 significant figures.

REPORT OF LABORATORY ANALYSIS

Pace Analytical™

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Method 1613B Sample Analysis Results

Client - PACE Wisconsin

Client's Sample ID	B-104, 8"		
Lab Sample ID	40163368004		
Filename	F180119B_12		
Injected By	BAL		
Total Amount Extracted	13.1 g	Matrix	Solid
% Moisture	9.9	Dilution	NA
Dry Weight Extracted	11.8 g	Collected	01/09/2018 12:15
ICAL ID	F180103	Received	01/12/2018 10:20
CCal Filename(s)	F180119A_21	Extracted	01/15/2018 14:50
Method Blank ID	BLANK-59704	Analyzed	01/20/2018 12:49

Native Isomers	Conc ng/Kg	EMPC ng/Kg	RL ng/Kg	Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	ND	-----	1.0	2,3,7,8-TCDF-13C	2.00	75
Total TCDF	3.0	-----	1.0	2,3,7,8-TCDD-13C	2.00	70
				1,2,3,7,8-PeCDF-13C	2.00	82
2,3,7,8-TCDD	ND	-----	1.0	2,3,4,7,8-PeCDF-13C	2.00	90
Total TCDD	ND	-----	1.0	1,2,3,7,8-PeCDD-13C	2.00	86
				1,2,3,4,7,8-HxCDF-13C	2.00	73
1,2,3,7,8-PeCDF	ND	-----	5.0	1,2,3,6,7,8-HxCDF-13C	2.00	82
2,3,4,7,8-PeCDF	ND	-----	5.0	2,3,4,6,7,8-HxCDF-13C	2.00	79
Total PeCDF	11	-----	5.0	1,2,3,7,8,9-HxCDF-13C	2.00	82
				1,2,3,4,7,8-HxCDD-13C	2.00	75
1,2,3,7,8-PeCDD	ND	-----	5.0	1,2,3,6,7,8-HxCDD-13C	2.00	65
Total PeCDD	ND	-----	5.0	1,2,3,4,6,7,8-HpCDF-13C	2.00	68
				1,2,3,4,7,8,9-HpCDF-13C	2.00	80
1,2,3,4,7,8-HxCDF	ND	-----	5.0	1,2,3,4,6,7,8-HpCDD-13C	2.00	77
1,2,3,6,7,8-HxCDF	ND	-----	5.0	OCDD-13C	4.00	93
2,3,4,6,7,8-HxCDF	ND	-----	5.0			
1,2,3,7,8,9-HxCDF	ND	-----	5.0	1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	14	-----	5.0	1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	ND	-----	5.0	2,3,7,8-TCDD-37Cl4	0.20	66
1,2,3,6,7,8-HxCDD	ND	-----	5.0			
1,2,3,7,8,9-HxCDD	ND	-----	5.0			
Total HxCDD	17	-----	5.0			
1,2,3,4,6,7,8-HpCDF	26	-----	5.0	Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	ND	-----	5.0	Equivalence: 1.8 ng/Kg		
Total HpCDF	58	-----	5.0	(Lower-bound - Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	81	-----	5.0			
Total HpCDD	150	-----	5.0			
OCDF	42	-----	10			
OCDD	650	-----	10			

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
RL = Reporting Limit

ND = Not Detected
NA = Not Applicable
NC = Not Calculated

Results reported on a dry weight basis and are valid to no more than 2 significant figures.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Reporting Flags

A = Reporting Limit based on signal to noise

B = Less than 10x higher than method blank level

C = Result obtained from confirmation analysis

D = Result obtained from analysis of diluted sample

E = Exceeds calibration range

I = Interference present

J = Estimated value

Nn = Value obtained from additional analysis

P = PCDE Interference

R = Recovery outside target range

S = Peak saturated

U = Analyte not detected

V = Result verified by confirmation analysis

X = %D Exceeds limits

Y = Calculated using average of daily RFs

* = See Discussion

Appendix B

Sample Analysis Summary

Pace Analytical™

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Method 1613B Sample Analysis Results

Client - PACE Wisconsin

Client's Sample ID	B-101, 8"			
Lab Sample ID	40163368001			
Filename	F180119B_09			
Injected By	BAL			
Total Amount Extracted	13.0 g		Matrix	Solid
% Moisture	12.0		Dilution	NA
Dry Weight Extracted	11.4 g		Collected	01/09/2018 12:35
ICAL ID	F180103		Received	01/12/2018 10:20
CCal Filename(s)	F180119A_21		Extracted	01/15/2018 14:50
Method Blank ID	BLANK-59704		Analyzed	01/20/2018 10:40

Native Isomers	Conc ng/Kg	EMPC ng/Kg	EDL ng/Kg		Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	2.9	-----	0.82	V	2,3,7,8-TCDF-13C	2.00	72
Total TCDF	69	-----	0.82		2,3,7,8-TCDD-13C	2.00	65
					1,2,3,7,8-PeCDF-13C	2.00	81
2,3,7,8-TCDD	ND	-----	0.28		2,3,4,7,8-PeCDF-13C	2.00	85
Total TCDD	10	-----	0.28		1,2,3,7,8-PeCDD-13C	2.00	82
					1,2,3,4,7,8-HxCDF-13C	2.00	77
1,2,3,7,8-PeCDF	2.0	-----	0.26	J	1,2,3,6,7,8-HxCDF-13C	2.00	71
2,3,4,7,8-PeCDF	9.8	-----	0.10		2,3,4,6,7,8-HxCDF-13C	2.00	74
Total PeCDF	120	-----	0.18		1,2,3,7,8,9-HxCDF-13C	2.00	73
					1,2,3,4,7,8-HxCDD-13C	2.00	71
1,2,3,7,8-PeCDD	2.3	-----	0.22	J	1,2,3,6,7,8-HxCDD-13C	2.00	63
Total PeCDD	23	-----	0.22		1,2,3,4,6,7,8-HpCDF-13C	2.00	60
					1,2,3,4,7,8,9-HpCDF-13C	2.00	74
1,2,3,4,7,8-HxCDF	5.8	-----	0.14		1,2,3,4,6,7,8-HpCDD-13C	2.00	73
1,2,3,6,7,8-HxCDF	6.7	-----	0.12		OCDD-13C	4.00	87
2,3,4,6,7,8-HxCDF	-----	11	0.12	P			
1,2,3,7,8,9-HxCDF	1.3	-----	0.14	J	1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	150	-----	0.13		1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	3.1	-----	0.31	J	2,3,7,8-TCDD-37Cl4	0.20	61
1,2,3,6,7,8-HxCDD	15	-----	0.11				
1,2,3,7,8,9-HxCDD	7.6	-----	0.13				
Total HxCDD	120	-----	0.18				
1,2,3,4,6,7,8-HpCDF	120	-----	0.26		Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	4.0	-----	0.15	J	Equivalence: 18 ng/Kg		
Total HpCDF	140	-----	0.20		(Lower-bound - Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	290	-----	0.50				
Total HpCDD	560	-----	0.50				
OCDF	190	-----	0.79				
OCDD	2000	-----	0.36				

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
EDL = Estimated Detection Limit

ND = Not Detected
NA = Not Applicable
NC = Not Calculated

Results reported on a dry weight basis and are valid to no more than 2 significant figures.
J = Estimated value
P = PCDE Interference
V = Result verified by confirmation analysis

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Method 1613B Sample Analysis Results

Client - PACE Wisconsin

Client's Sample ID	B-102, 8"		
Lab Sample ID	40163368002		
Filename	F180119B_10		
Injected By	BAL		
Total Amount Extracted	13.0 g	Matrix	Solid
% Moisture	15.1	Dilution	NA
Dry Weight Extracted	11.0 g	Collected	01/09/2018 12:45
ICAL ID	F180103	Received	01/12/2018 10:20
CCal Filename(s)	F180119A_21	Extracted	01/15/2018 14:50
Method Blank ID	BLANK-59704	Analyzed	01/20/2018 11:22

Native Isomers	Conc ng/Kg	EMPC ng/Kg	EDL ng/Kg		Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	0.87	-----	0.77	J	2,3,7,8-TCDF-13C	2.00	92
Total TCDF	23	-----	0.77		2,3,7,8-TCDD-13C	2.00	83
					1,2,3,7,8-PeCDF-13C	2.00	103
2,3,7,8-TCDD	ND	-----	0.41		2,3,4,7,8-PeCDF-13C	2.00	111
Total TCDD	2.5	-----	0.41	B	1,2,3,7,8-PeCDD-13C	2.00	107
					1,2,3,4,7,8-HxCDF-13C	2.00	92
1,2,3,7,8-PeCDF	0.70	-----	0.15	J	1,2,3,6,7,8-HxCDF-13C	2.00	99
2,3,4,7,8-PeCDF	2.0	-----	0.12	J	2,3,4,6,7,8-HxCDF-13C	2.00	100
Total PeCDF	36	-----	0.13		1,2,3,7,8,9-HxCDF-13C	2.00	99
					1,2,3,4,7,8-HxCDD-13C	2.00	87
1,2,3,7,8-PeCDD	-----	0.74	0.14	IJ	1,2,3,6,7,8-HxCDD-13C	2.00	86
Total PeCDD	7.1	-----	0.14		1,2,3,4,6,7,8-HpCDF-13C	2.00	81
					1,2,3,4,7,8,9-HpCDF-13C	2.00	93
1,2,3,4,7,8-HxCDF	-----	2.0	0.18	IJ	1,2,3,4,6,7,8-HpCDD-13C	2.00	91
1,2,3,6,7,8-HxCDF	1.8	-----	0.14	J	OCDD-13C	4.00	104
2,3,4,6,7,8-HxCDF	2.7	-----	0.14	J			
1,2,3,7,8,9-HxCDF	0.36	-----	0.11	J	1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	37	-----	0.14		1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	1.1	-----	0.14	J	2,3,7,8-TCDD-37Cl4	0.20	79
1,2,3,6,7,8-HxCDD	4.2	-----	0.18	J			
1,2,3,7,8,9-HxCDD	2.4	-----	0.22	J			
Total HxCDD	39	-----	0.18				
1,2,3,4,6,7,8-HpCDF	30	-----	0.28		Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	-----	0.96	0.12	IJ	Equivalence: 4.7 ng/Kg		
Total HpCDF	46	-----	0.20		(Lower-bound - Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	85	-----	0.35				
Total HpCDD	160	-----	0.35				
OCDF	36	-----	0.12				
OCDD	570	-----	0.28				

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
EDL = Estimated Detection Limit

ND = Not Detected
NA = Not Applicable
NC = Not Calculated

Results reported on a dry weight basis and are valid to no more than 2 significant figures.
J = Estimated value
B = Less than 10x higher than method blank level
I = Interference present

REPORT OF LABORATORY ANALYSIS

Pace Analytical™

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Method 1613B Sample Analysis Results

Client - PACE Wisconsin

Client's Sample ID	B-103, 8"		
Lab Sample ID	40163368003		
Filename	F180119B_11		
Injected By	BAL		
Total Amount Extracted	13.6 g	Matrix	Solid
% Moisture	16.8	Dilution	NA
Dry Weight Extracted	11.3 g	Collected	01/09/2018 12:25
ICAL ID	F180103	Received	01/12/2018 10:20
CCal Filename(s)	F180119A_21	Extracted	01/15/2018 14:50
Method Blank ID	BLANK-59704	Analyzed	01/20/2018 12:06

Native Isomers	**Conc** ng/Kg	**EMPC** ng/Kg	**EDL** ng/Kg		**Internal Standards**	**ng's Added**	**Percent Recovery**
2,3,7,8-TCDF	ND	-----	0.46		2,3,7,8-TCDF-13C	2.00	75
Total TCDF	7.9	-----	0.46		2,3,7,8-TCDD-13C	2.00	67
					1,2,3,7,8-PeCDF-13C	2.00	80
2,3,7,8-TCDD	ND	-----	0.23		2,3,4,7,8-PeCDF-13C	2.00	87
Total TCDD	1.7	-----	0.23	BJ	1,2,3,7,8-PeCDD-13C	2.00	83
					1,2,3,4,7,8-HxCDF-13C	2.00	76
1,2,3,7,8-PeCDF	ND	-----	0.52		1,2,3,6,7,8-HxCDF-13C	2.00	80
2,3,4,7,8-PeCDF	1.1	-----	0.24	J	2,3,4,6,7,8-HxCDF-13C	2.00	81
Total PeCDF	18	-----	0.38		1,2,3,7,8,9-HxCDF-13C	2.00	85
					1,2,3,4,7,8-HxCDD-13C	2.00	67
1,2,3,7,8-PeCDD	-----	0.48	0.32	IJ	1,2,3,6,7,8-HxCDD-13C	2.00	78
Total PeCDD	2.6	-----	0.32	J	1,2,3,4,6,7,8-HpCDF-13C	2.00	70
					1,2,3,4,7,8,9-HpCDF-13C	2.00	78
1,2,3,4,7,8-HxCDF	1.3	-----	0.40	J	1,2,3,4,6,7,8-HpCDD-13C	2.00	77
1,2,3,6,7,8-HxCDF	0.99	-----	0.22	J	OCDD-13C	4.00	85
2,3,4,6,7,8-HxCDF	1.2	-----	0.31	J			
1,2,3,7,8,9-HxCDF	ND	-----	0.12		1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	24	-----	0.26		1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	-----	0.55	0.13	IJ	2,3,7,8-TCDD-37Cl4	0.20	62
1,2,3,6,7,8-HxCDD	2.2	-----	0.13	J			
1,2,3,7,8,9-HxCDD	1.4	-----	0.14	J			
Total HxCDD	19	-----	0.13				
1,2,3,4,6,7,8-HpCDF	17	-----	0.17		Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	0.81	-----	0.10	J	Equivalence: 2.6 ng/Kg		
Total HpCDF	34	-----	0.14		(Lower-bound - Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	50	-----	0.38				
Total HpCDD	99	-----	0.38				
OCDF	19	-----	0.24				
OCDD	380	-----	0.18				

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
EDL = Estimated Detection Limit

ND = Not Detected
NA = Not Applicable
NC = Not Calculated

Results reported on a dry weight basis and are valid to no more than 2 significant figures.
J = Estimated value
B = Less than 10x higher than method blank level
I = Interference present

REPORT OF LABORATORY ANALYSIS

Pace Analytical™

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Method 1613B Sample Analysis Results

Client - PACE Wisconsin

Client's Sample ID	B-104, 8"			
Lab Sample ID	40163368004			
Filename	F180119B_12			
Injected By	BAL			
Total Amount Extracted	13.1 g		Matrix	Solid
% Moisture	9.9		Dilution	NA
Dry Weight Extracted	11.8 g		Collected	01/09/2018 12:15
ICAL ID	F180103		Received	01/12/2018 10:20
CCal Filename(s)	F180119A_21		Extracted	01/15/2018 14:50
Method Blank ID	BLANK-59704		Analyzed	01/20/2018 12:49

Native Isomers	Conc ng/Kg	EMPC ng/Kg	EDL ng/Kg		Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	ND	-----	0.26		2,3,7,8-TCDF-13C	2.00	75
Total TCDF	6.6	-----	0.26		2,3,7,8-TCDD-13C	2.00	70
					1,2,3,7,8-PeCDF-13C	2.00	82
2,3,7,8-TCDD	ND	-----	0.23		2,3,4,7,8-PeCDF-13C	2.00	90
Total TCDD	1.1	-----	0.23	BJ	1,2,3,7,8-PeCDD-13C	2.00	86
					1,2,3,4,7,8-HxCDF-13C	2.00	73
1,2,3,7,8-PeCDF	0.42	-----	0.32	J	1,2,3,6,7,8-HxCDF-13C	2.00	82
2,3,4,7,8-PeCDF	1.2	-----	0.17	J	2,3,4,6,7,8-HxCDF-13C	2.00	79
Total PeCDF	18	-----	0.25		1,2,3,7,8,9-HxCDF-13C	2.00	82
					1,2,3,4,7,8-HxCDD-13C	2.00	75
1,2,3,7,8-PeCDD	0.56	-----	0.37	J	1,2,3,6,7,8-HxCDD-13C	2.00	65
Total PeCDD	3.3	-----	0.37	J	1,2,3,4,6,7,8-HpCDF-13C	2.00	68
					1,2,3,4,7,8,9-HpCDF-13C	2.00	80
1,2,3,4,7,8-HxCDF	1.5	-----	0.90	J	1,2,3,4,6,7,8-HpCDD-13C	2.00	77
1,2,3,6,7,8-HxCDF	1.2	-----	0.38	J	OCDD-13C	4.00	93
2,3,4,6,7,8-HxCDF	1.6	-----	0.22	J			
1,2,3,7,8,9-HxCDF	ND	-----	0.20		1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	27	-----	0.42		1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	0.69	-----	0.25	J	2,3,7,8-TCDD-37Cl4	0.20	66
1,2,3,6,7,8-HxCDD	3.6	-----	0.22	J			
1,2,3,7,8,9-HxCDD	1.9	-----	0.25	J			
Total HxCDD	24	-----	0.24				
1,2,3,4,6,7,8-HpCDF	26	-----	0.096		Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	1.0	-----	0.079	J	Equivalence: 3.7 ng/Kg		
Total HpCDF	59	-----	0.087		(Lower-bound - Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	81	-----	0.066				
Total HpCDD	150	-----	0.066				
OCDF	42	-----	0.097				
OCDD	650	-----	0.14				

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
EDL = Estimated Detection Limit

ND = Not Detected
NA = Not Applicable
NC = Not Calculated

Results reported on a dry weight basis and are valid to no more than 2 significant figures.
J = Estimated value
B = Less than 10x higher than method blank level

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Pace Analytical™

Method 1613B Blank Analysis Results

Lab Sample ID	BLANK-59704	Matrix	Solid
Filename	U180118A_04	Dilution	NA
Total Amount Extracted	10.2 g	Extracted	01/15/2018 14:50
ICAL ID	U171222	Analyzed	01/18/2018 03:49
CCal Filename(s)	U180117B_18	Injected By	SMT

Native Isomers	Conc ng/Kg	EMPC ng/Kg	EDL ng/Kg		Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	ND	-----	0.10		2,3,7,8-TCDF-13C	2.00	65
Total TCDF	ND	-----	0.10		2,3,7,8-TCDD-13C	2.00	63
					1,2,3,7,8-PeCDF-13C	2.00	73
2,3,7,8-TCDD	ND	-----	0.14		2,3,4,7,8-PeCDF-13C	2.00	77
Total TCDD	0.39	-----	0.14	J	1,2,3,7,8-PeCDD-13C	2.00	87
					1,2,3,4,7,8-HxCDF-13C	2.00	76
1,2,3,7,8-PeCDF	ND	-----	0.15		1,2,3,6,7,8-HxCDF-13C	2.00	77
2,3,4,7,8-PeCDF	ND	-----	0.10		2,3,4,6,7,8-HxCDF-13C	2.00	83
Total PeCDF	ND	-----	0.12		1,2,3,7,8,9-HxCDF-13C	2.00	76
					1,2,3,4,7,8-HxCDD-13C	2.00	78
1,2,3,7,8-PeCDD	ND	-----	0.33		1,2,3,6,7,8-HxCDD-13C	2.00	78
Total PeCDD	ND	-----	0.33		1,2,3,4,6,7,8-HpCDF-13C	2.00	72
					1,2,3,4,7,8,9-HpCDF-13C	2.00	78
1,2,3,4,7,8-HxCDF	ND	-----	0.075		1,2,3,4,6,7,8-HpCDD-13C	2.00	84
1,2,3,6,7,8-HxCDF	ND	-----	0.080		OCDD-13C	4.00	79
2,3,4,6,7,8-HxCDF	ND	-----	0.067				
1,2,3,7,8,9-HxCDF	ND	-----	0.071		1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	ND	-----	0.073		1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	ND	-----	0.090		2,3,7,8-TCDD-37Cl4	0.20	65
1,2,3,6,7,8-HxCDD	ND	-----	0.087				
1,2,3,7,8,9-HxCDD	ND	-----	0.085				
Total HxCDD	ND	-----	0.087				
1,2,3,4,6,7,8-HpCDF	ND	-----	0.068		Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	ND	-----	0.095		Equivalence: 0.0013 ng/Kg		
Total HpCDF	0.087	-----	0.081	J	(Lower-bound - Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	ND	-----	0.089				
Total HpCDD	ND	-----	0.089				
OCDF	-----	0.14	0.13	IJ			
OCDD	1.2	-----	0.24	J			

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
EDL = Estimated Detection Limit

Results reported on a total weight basis and are valid to no more than 2 significant figures.
J = Estimated value
I = Interference present

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Method 1613B Laboratory Control Spike Results

Lab Sample ID	LCS-59705		
Filename	U180118A_01	Matrix	Solid
Total Amount Extracted	10.9 g	Dilution	NA
ICAL ID	U171222	Extracted	01/15/2018 14:50
CCal Filename	U180117B_18	Analyzed	01/18/2018 01:38
Method Blank ID	BLANK-59704	Injected By	SMT

Compound	Cs	Cr	Lower Limit	Upper Limit	% Rec.
2,3,7,8-TCDF	10	9.9	7.5	15.8	99
2,3,7,8-TCDD	10	11	6.7	15.8	114
1,2,3,7,8-PeCDF	50	52	40.0	67.0	104
2,3,4,7,8-PeCDF	50	47	34.0	80.0	95
1,2,3,7,8-PeCDD	50	49	35.0	71.0	98
1,2,3,4,7,8-HxCDF	50	50	36.0	67.0	101
1,2,3,6,7,8-HxCDF	50	49	42.0	65.0	97
2,3,4,6,7,8-HxCDF	50	45	35.0	78.0	89
1,2,3,7,8,9-HxCDF	50	48	39.0	65.0	95
1,2,3,4,7,8-HxCDD	50	52	35.0	82.0	103
1,2,3,6,7,8-HxCDD	50	54	38.0	67.0	107
1,2,3,7,8,9-HxCDD	50	53	32.0	81.0	106
1,2,3,4,6,7,8-HpCDF	50	52	41.0	61.0	104
1,2,3,4,7,8,9-HpCDF	50	47	39.0	69.0	95
1,2,3,4,6,7,8-HpCDD	50	48	35.0	70.0	96
OCDF	100	100	63.0	170.0	105
OCDD	100	100	78.0	144.0	104
2,3,7,8-TCDD-37Cl4	10	6.8	3.1	19.1	68
2,3,7,8-TCDF-13C	100	73	22.0	152.0	73
2,3,7,8-TCDD-13C	100	69	20.0	175.0	69
1,2,3,7,8-PeCDF-13C	100	78	21.0	192.0	78
2,3,4,7,8-PeCDF-13C	100	83	13.0	328.0	83
1,2,3,7,8-PeCDD-13C	100	95	21.0	227.0	95
1,2,3,4,7,8-HxCDF-13C	100	82	19.0	202.0	82
1,2,3,6,7,8-HxCDF-13C	100	83	21.0	159.0	83
2,3,4,6,7,8-HxCDF-13C	100	89	22.0	176.0	89
1,2,3,7,8,9-HxCDF-13C	100	84	17.0	205.0	84
1,2,3,4,7,8-HxCDD-13C	100	85	21.0	193.0	85
1,2,3,6,7,8-HxCDD-13C	100	82	25.0	163.0	82
1,2,3,4,6,7,8-HpCDF-13C	100	79	21.0	158.0	79
1,2,3,4,7,8,9-HpCDF-13C	100	84	20.0	186.0	84
1,2,3,4,6,7,8-HpCDD-13C	100	89	26.0	166.0	89
OCDD-13C	200	160	26.0	397.0	80

Cs = Concentration Spiked (ng/mL)
Cr = Concentration Recovered (ng/mL)
Rec. = Recovery (Expressed as Percent)
Control Limit Reference: Method 1613, Table 6, 10/94 Revision
R = Recovery outside of control limits
Nn = Value obtained from additional analysis
* = See Discussion

REPORT OF LABORATORY ANALYSIS

Pace Analytical™

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Method 1613B Laboratory Control Spike Results

Lab Sample ID	LCSD-59714		
Filename	U180118A_02	Matrix	Solid
Total Amount Extracted	10.2 g	Dilution	NA
ICAL ID	U171222	Extracted	01/15/2018 14:50
CCal Filename	U180117B_18	Analyzed	01/18/2018 02:21
Method Blank ID	BLANK-59704	Injected By	SMT

Compound	Cs	Cr	Lower Limit	Upper Limit	% Rec.
2,3,7,8-TCDF	10	10	7.5	15.8	105
2,3,7,8-TCDD	10	12	6.7	15.8	116
1,2,3,7,8-PeCDF	50	55	40.0	67.0	109
2,3,4,7,8-PeCDF	50	49	34.0	80.0	98
1,2,3,7,8-PeCDD	50	52	35.0	71.0	103
1,2,3,4,7,8-HxCDF	50	52	36.0	67.0	103
1,2,3,6,7,8-HxCDF	50	50	42.0	65.0	100
2,3,4,6,7,8-HxCDF	50	46	35.0	78.0	92
1,2,3,7,8,9-HxCDF	50	50	39.0	65.0	100
1,2,3,4,7,8-HxCDD	50	53	35.0	82.0	107
1,2,3,6,7,8-HxCDD	50	56	38.0	67.0	112
1,2,3,7,8,9-HxCDD	50	55	32.0	81.0	111
1,2,3,4,6,7,8-HpCDF	50	54	41.0	61.0	108
1,2,3,4,7,8,9-HpCDF	50	51	39.0	69.0	103
1,2,3,4,6,7,8-HpCDD	50	49	35.0	70.0	99
OCDF	100	100	63.0	170.0	104
OCDD	100	110	78.0	144.0	105
2,3,7,8-TCDD-37Cl4	10	7.1	3.1	19.1	71
2,3,7,8-TCDF-13C	100	73	22.0	152.0	73
2,3,7,8-TCDD-13C	100	71	20.0	175.0	71
1,2,3,7,8-PeCDF-13C	100	78	21.0	192.0	78
2,3,4,7,8-PeCDF-13C	100	82	13.0	328.0	82
1,2,3,7,8-PeCDD-13C	100	94	21.0	227.0	94
1,2,3,4,7,8-HxCDF-13C	100	85	19.0	202.0	85
1,2,3,6,7,8-HxCDF-13C	100	88	21.0	159.0	88
2,3,4,6,7,8-HxCDF-13C	100	93	22.0	176.0	93
1,2,3,7,8,9-HxCDF-13C	100	84	17.0	205.0	84
1,2,3,4,7,8-HxCDD-13C	100	90	21.0	193.0	90
1,2,3,6,7,8-HxCDD-13C	100	83	25.0	163.0	83
1,2,3,4,6,7,8-HpCDF-13C	100	80	21.0	158.0	80
1,2,3,4,7,8,9-HpCDF-13C	100	84	20.0	186.0	84
1,2,3,4,6,7,8-HpCDD-13C	100	92	26.0	166.0	92
OCDD-13C	200	170	26.0	397.0	84

Cs = Concentration Spiked (ng/mL)
Cr = Concentration Recovered (ng/mL)
Rec. = Recovery (Expressed as Percent)
Control Limit Reference: Method 1613, Table 6, 10/94 Revision
R = Recovery outside of control limits
Nn = Value obtained from additional analysis
* = See Discussion

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Method 1613B

Spike Recovery Relative Percent Difference (RPD) Results

Client PACE Wisconsin

Spike 1 ID LCS-59705 Spike 2 ID LCSD-59714
Spike 1 Filename U180118A_01 Spike 2 Filename U180118A_02

Compound	Spike 1 %REC	Spike 2 %REC	%RPD
2,3,7,8-TCDF	99	105	5.9
2,3,7,8-TCDD	114	116	1.7
1,2,3,7,8-PeCDF	104	109	4.7
2,3,4,7,8-PeCDF	95	98	3.1
1,2,3,7,8-PeCDD	98	103	5.0
1,2,3,4,7,8-HxCDF	101	103	2.0
1,2,3,6,7,8-HxCDF	97	100	3.0
2,3,4,6,7,8-HxCDF	89	92	3.3
1,2,3,7,8,9-HxCDF	95	100	5.1
1,2,3,4,7,8-HxCDD	103	107	3.8
1,2,3,6,7,8-HxCDD	107	112	4.6
1,2,3,7,8,9-HxCDD	106	111	4.6
1,2,3,4,6,7,8-HpCDF	104	108	3.8
1,2,3,4,7,8,9-HpCDF	95	103	8.1
1,2,3,4,6,7,8-HpCDD	96	99	3.1
OCDF	105	104	1.0
OCDD	104	105	1.0

%REC = Percent Recovered
RPD = The difference between the two values divided by the mean value

Photolog

Soil Sampling Photolog
Thomas Street Construction Corridor
Wausau, Wisconsin

Photo No. 1 B-101 location and sampling equipment

Photo No. 2 B-101 location

Photo No. 3 B-102 location and sample collection

Photo No. 4 B-102 location

Photo No. 5 B-103 using hammer drill

Photo No. 6 B-103 location

Photo No. 7 B-104 location and sample collection

Photo No. 8 B-104 location

Appendix D
Department of Health Services
August 20, 2018 Letter

Scott Walker
Governor

Linda Seemeyer
Secretary

State of Wisconsin
Department of Health Services

DIVISION OF PUBLIC HEALTH

1 WEST WILSON STREET
PO BOX 2659
MADISON WI 53701-2659

Telephone: 608-266-1251
Fax: 608-267-2832
TTY: 711 or 800-947-3529

August 20, 2018

The Honorable Patrick Peckham
City Council Alderman, District 1, Wausau
1618 Emerson St
Wausau, WI 54403

Subject: Wausau Riverside Park Dioxin Contamination

Dear Mr. Peckham,

The Wisconsin Department of Health Services (DHS) appreciates the opportunity to review and comment on the soil testing reports from the Thomas Street neighborhood. On March 7, 2018, you asked if there is a safety risk due to dioxin contamination in the soil near the culvert area close to the Riverside Park. We reviewed reports from previous soil sampling conducted by the city and the citizen groups within the concerned area. We also visited the site on April 17, 2018 to assess possible dioxin exposure pathways for people living in the neighborhood on and near Thomas Street. After our data review and exposure assessment, DHS concludes that there is **no apparent health hazard** for people using the Riverside park and residents living in the Thomas Street neighborhood due to dioxin soil contamination.

Figure 1. Site Overview. Site includes Riverside Park and Thomas/River Street neighborhood

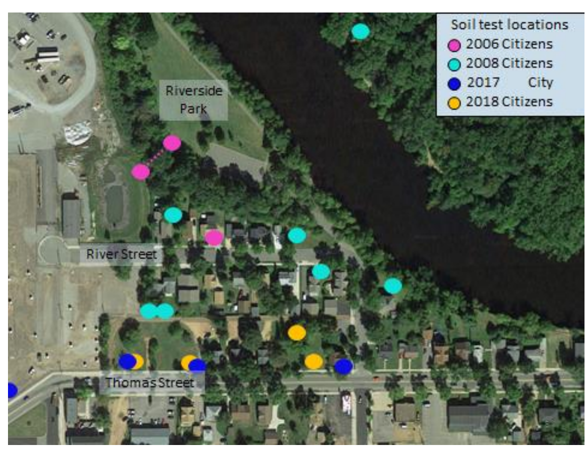


Figure 2. Soil sampling locations

Despite this conclusion, dioxin levels above the screening level were detected in the culvert inlet and outfall area adjacent to the Riverside Park (Figure 1 and Figure 2) and in five sampling locations in the Thomas Street neighborhood. In both park and residential areas, incidental ingestion of small amounts of soil is the most plausible pathway for dioxin exposure. However, most areas are well-covered with grass or pavement. Caps or ground cover such as these minimize the chance of exposure to soil that might contain contaminants. In addition, access to the culvert where dioxin was detected is limited. Therefore, actual exposure to dioxin during daily activities in the Riverside Park area and Thomas Street neighborhood is unlikely. We estimated the possible maximum daily intakes of dioxin through contact with contaminated soil for both park users and residents and concluded that the predicted exposures are too small to be harmful.

BACKGROUND AND STATEMENT OF ISSUES

The City of Wausau is planning a road reconstruction project in the Thomas Street neighborhood, which is also adjacent to the property of Wauleco, a former window manufacturer. Wauleco used the wood preservative pentachlorophenol (PCP) in their manufacturing process. The chemical synthesis of PCP also produces small amounts of dioxin, which can be present as an impurity in the wood preservative. Due to a history of PCP releases to the environment, the property is now undergoing remediation under the authority of the Wisconsin Department of Natural Resources (DNR) (BRRTS No. 02-37-000006).[1] During the Thomas Street reconstruction planning, the public expressed concerns about possible off-site soil contamination in the area due to known PCP and dioxin problems on the Wauleco property.

In 2017, the City of Wausau performed a Phase II analysis within the Thomas Street construction limit and found residual dioxin below the screening levels in soils.[2] In 2018, a private citizen group performed their own testing of the surface soils (6-8 inches deep) on Thomas Street. The sampling locations included residential backyards and public areas. Of these, the dioxin level in one sample within the construction boundary was above the U.S. Environmental Protection Agency's (EPA) Regional Screening Level (RSL) for residential soils.[3] Surface soil tests at a culvert near the Riverside Park in 2006[4] also showed dioxin levels exceeding the EPA industrial RSL.

The main concern raised by the community is uncertainty whether there is a risk of health effects in the Thomas Street neighborhood due to dioxin levels found in soil. We assessed this risk based on an independent review of available environmental data and by visiting the area to assess pathways of dioxin exposure. This information was used to calculate estimates of exposure, based on people's daily activity in the area. Separate calculations were performed for park users and for the adjacent Thomas Street neighborhood.

INVESTIGATION

Data Review

[1] Wisconsin Dept. of Natural Resources. Bureau of Remediation and Redevelopment Tracking System. https://dnr.wi.gov/botw/GetActivityDetail.do?siteId=644000&adn=0237000006
[2] AECOM, September, 2017, *Results for Phase 2 Environmental Sampling Investigation, Thomas Street Phase II*.
[3] Sand Creek Consultants, February 2018, *Soil Sampling and Analysis Results for the Thomas Street Construction Corridor*.
[4] Pace Analytical, 2006, *Determination of PCDD/PCDF LEVELS*. (prepared for: Friebert, Finnerty. & St. John, S.C.

Four soil sampling reports were reviewed, and the sampling locations and results are summarized in Table 1. The 2006 report (Pace Analytical)[4] was contracted by the Citizens for an Environmentally Safe Thomas Street Neighborhood. Sampling locations included the culvert area (inlet and outfall) and one residential area at 122 River Street. Soil samples for this assessment were collected from about 8 inches below the surface. Dioxin levels in the culvert inlet, culvert outfall, and River Street were 105.6, 87.7, and 11.6 ng/kg, which exceed the EPA residential RSL of 4.8 ng/kg. Two culvert results were higher than the industrial RSL of 22 ng/kg.

An additional report from 2008 (Pace Analytical) was provided by the Citizens for an Environmentally Safe Thomas Street Neighborhood for our review.[5] In this report, nine samples were collected from various area including River Street neighborhood, Fern Island, Oak Island, and Weston Woods. All soil samples were collected from shallow topsoil (6-8 inches below the surface). Among nine samples, one sample collected from 1003 Emter Street (47 ng/kg) and two samples collected from 117 River Street (40 and 42 ng/kg) exceeded the industrial RSL.

In 2017, the city of Wausau performed a Phase II analysis (AECOM) of 12 sub-surface soil samples within the Thomas Street construction limits.[2] The soil samples were taken at 6 locations with intervals of 1-4, 4-6, 6-8, and 10-12 feet below the surface. No dioxin was detected from this assessment.

In 2018, the Citizens for an Environmentally Safe Thomas Street Neighborhood conducted an additional assessment (Sand Creek Consultants, 2018) of the surface soil.[3] Four soil samples were collected from about 4-5 inches below the surface within the Thomas Street neighborhood construction boundary. Dioxin was detected in all four samples. Of these, one sample (B-101:15 ng/kg) exceeded the residential RSL.

Site Visit

On April 17, 2018, DHS and DNR staff visited the site to understand potential exposure routes for people that visit Riverside Park and the Thomas Street/River Street residential area. Exposure to dioxin contamination can occur if people have direct contact with the soil (i.e. when gardening or playing in the dirt) or accidentally inhale or ingest soil. Our focus was to determine access to open soil areas and to estimate the average time people spend in the area.

Figure 3. Culvert location at Riverside Park

The culvert is located on a small embankment that is a former railroad at the border between the Wauleco fence line and Riverside Park (Figure 3).

[5] Pace Analytical, December, 2008, *Report of Laboratory Analysis for PCDD/PCDF* (Pace Project No: 1085806)

The culvert area is steep and covered with trees and branches making it difficult to access. On the opposite side of the hill (close to the Wisconsin River), soils are well covered with grass and there is an asphalt path preventing direct exposure to contaminated soil (Figure 4). Along Thomas Street and River Street, most ground areas were well-covered with either grass or pavement (Figure 5). However, residents may come in contact with soil through common activities such as gardening or digging.

Figure 4. View of the Wisconsin River from near the culvert in Riverside Park

Figure 5. Street view of River Street Area. The Wauleco Property is in the background at the end of the street.

DISCUSSION

Dioxin Toxicity

Dioxin is a group of 75 compounds that share similar chemical structures. It is a byproduct of certain chemical syntheses, and is also produced when people burn wood or waste such as home burn barrels, fireplaces, and wood stoves. Exhaust from diesel also contains dioxin. Dioxin is not intentionally manufactured by industries except for research purposes. Dioxin may be formed during the chlorine bleaching process at pulp and paper mills or during chlorination by waste and drinking water treatment plants.

Dioxins are persistent in the environment, and do not break down easily. They are also lipophilic ("fat loving"). Due to these properties, dioxins tend to stay in the soil instead of migrating far away through water. Dioxins also are present in the food chain. Everyone is exposed to dioxin because they are in many foods and present throughout our environment. More than 90% of dioxin exposure comes from consumption of food contaminated with dioxin, especially through meat, dairy products, and fatty fish.

Dioxins vary in toxicity, with 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) considered most toxic of the dioxin group. The dioxins can cause a variety of effects to the body that are related to regulation of the cell cycle in particular tissues. These include effects to the skin, immune and hormone systems, weight loss, liver effects, and reproductive effects. Although everyone carries some dioxin in their bodies, these severe effects are seen primarily in test animals, and more rarely in people that have received heavy exposures to TCDD. Several studies suggest that TCDD-exposure increases the risk of cancer in people and animals. The World Health Organization (WHO) has determined that TCDD is a human carcinogen.

Risk Assessment

Based on our observation during the site visit, accidental ingestion (swallowing) of soil contaminated with dioxin through skin contact (hand-to-mouth activity) is the most likely source of exposure to dioxin by Riverside Park users and Thomas Street residents. Thus, we conducted conservative, reasonable scenarios to calculate the possible maximum dioxin exposure per day for the Riverside Park users and Thomas Street residents.

For the park users, we assumed that an individual visits the park near the culvert outfall 3 times per week, 35 weeks per year (considering vacation weeks and winter season when people do not go out to the park). We also assumed that the soil is uncovered and an individual accidentally ingests soil, since it is normal for people to ingest tiny amounts of soil from their hands or dust in the air each day. The dioxin level from the culvert outfall was used for the calculation. For the Thomas and River Street residents, we assumed that an individual works or plays in their backyard 5 times per week, 35 weeks per year (considering vacation weeks and winter season when people do not spend time in their backyard). We assumed that soil contained 47 ng/kg of dioxin for our assessment - the highest level of dioxin detected in the residential area.

For the Riverside Park users, we estimated an average daily intake of **0.036 pg dioxin/kg/day** (picograms of dioxin per kilogram of body weight per day) for adults and **0.5 pg dioxin/kg/day** for children. For the Thomas and River Street residents, we estimated an average daily intake of **0.032 pg dioxin/kg/day** for adults and **0.45 pg dioxin/kg/day** for children (see Appendix for exposure calculations). These estimates were compared to exposures that are considered acceptable to the public.

The EPA Integrated Risk Information System (IRIS) program provides a daily acceptable reference dose (also called as oral reference dose), which is an estimate of a daily oral exposure to the human population (including sensitive subgroups) that is likely to have no adverse health effects during a lifetime. The oral reference dose for dioxin is 0.7 pg/kg.day. **The conservative exposure scenarios we calculated are all below 0.7 pg/kg/day.**

Limitations of this assessment

For the risk assessment for the Riverside Park users, our data was limited to the two analyses from culvert samples taken in 2006 because those were the only samples collected within the Riverside Park area. The culvert samples are likely "worst case" for the park; however, dioxin levels elsewhere in the park are unknown. Based on the park's topography, it is possible that culvert outfall water could have carried sediment and dioxins downhill. However, the chance of dioxin migrating into Wisconsin River is low due to its insolubility in water and tight adhesion to soil.

ADDITIONAL CONSIDERATIONS

During the City of Wausau Capital Improvements and Street Maintenance Committee Meeting on May 17, 2018, questions were raised about uptake of dioxin from soil into plants, such as garden vegetables, and livestock, such as backyard chickens. In general, urban soils may contain contaminants such as heavy metals, petroleum products, and asbestos since urban soils are often closer to pollution sources, such as industrial areas, busy roads, and waste dumps. As a result, many soil contaminants are present at higher concentrations in urban areas. Contaminants may also be released into the environment by individual activities, such as burning coal in the backyard. Thus, it is important to minimize contact with potential contaminants in soil by following general best practices.

Garden Plants

Research indicates that very little of our exposure to dioxin comes from vegetables. The chemical properties of dioxin are such that they tend not to be taken up through the roots and sap of plants, but instead stick to soil particles and to the waxy exterior of plant roots. The best way to avoid dioxin, and other potential contaminants that may be transferred to plants from the soil, is to make sure food plants, particularly root crops, are properly washed and peeled before eating. Creating raised beds supplemented with cleaner soils is a common practice to avoid various soil contaminants for people that garden in urban areas.

Backyard Chickens

The detailed pathway of how dioxin from the environment transfers into chicken eggs is not well understood. However, research indicates that chickens ingesting feed or soil particles contaminated with certain chemicals may result in increased levels of contaminants in eggs. Free-range chicken eggs have a higher risk of being contaminated with increased levels of dioxins than barn or cage eggs. Thus, contamination levels in soil should be kept low and should be controlled in areas with backyard chickens. We recommend that individuals with backyard chickens restrict outdoor runs or keep the chickens in a confined area that has been covered with clean soils. This would likely reduce exposure to potential contaminants in backyard soils and decrease contaminant levels in eggs from backyard chickens.

CONCLUSIONS

Based on our risk assessment of dioxin soil testing results in the park and residential area, we conclude the following:

- **DHS concludes that there is no apparent public health hazard for the park users at the Riverside Park from dioxin contamination.** Although dioxins are present in soils around the culvert outfall at concentrations above screening values for soil, the estimated exposure to dioxin from contact with these soils is not enough to cause harm to people visiting the park.

- **DHS concludes that there is no apparent public health hazard for the residents at the Thomas Street and the River Street neighborhoods from dioxin contamination.** Although dioxins are present in soils at five residences at concentrations above screening values for soil, the estimated exposure to dioxin from contact with these soils is not enough to cause harm for these residents.

RECOMMENDATIONS

- Although the risk of exposure to dioxin around the culvert outfall area is low, DHS recommends that the City of Wausau explore short-term and long-term options to further reduce the possibility of exposure to soils around the culvert outfall area.

- Although the risk of exposure to dioxin from residential soils in the Thomas Street neighborhood is low, DHS recommends that even small amounts of exposure be avoided by following normal hygiene practices. These include maintaining grass and other vegetative ground cover and washing hands after working in garden soils and before eating.

- Although the risk of exposure to dioxin from residential soils in the Thomas Street neighborhood is low, DHS recommends that urban gardeners follow common practices to avoid unnecessary exposure to substances widely found in residential soils. Root crops should be washed and peeled. We also recommend that individuals with backyard chickens restrict outdoor runs or keep the chickens in a confined area that has been covered with clean soils.

I hope that this assessment will provide a better understanding of the dioxin situation in the Thomas Street and Riverside Park areas in Wausau for you and your constituents. Please feel free to contact me with any additional questions at 608-267-2949.

Sincerely,

Clara Jeong, PhD
Toxicologist
Bureau of Environmental and Occupational Health
Wisconsin Department of Health Services

Cc:
Eric Lindman, City of Wausau
Robert Mielke, City of Wausau
Gary Gisselman, City of Wausau
Dale Grosskurth, Marathon County Health Department
Matt Thompson, DNR
Robert Thiboldeaux, DHS

TABLE 1. Summary of the soil sample results from available reports

Report Year	Locations	Sample Depth (inch/feet)	TEF-adjusted Total 2,3,7,8-TCDD (ng/kg)	2,3,7,8-TCDD in Original Soil (ng/kg)
2006[6]	Culvert Inlet	4-6 inches	**105.6**[7]	2.1
2006	Culvert Outfall	4-6 inches	**87.7** [7]	0
2006	122 River street	4-6 inches	**11.6**[11]	0
2008[8]	1003 Emter street	6-8 inches	**47**[7]	ND (not detected)
2008	130 River street	6-8 inches	2.8	ND
2008	141 River street	6-8 inches	1.3	ND
2008	120 River street	6-8 inches	1.9	ND
2008	117 River street	6-8 inches	**40**[7]	ND
2008	Fern Island	6-8 inches	3.7	ND
2008	117 River street #2	6-8 inches	**42**[11]	ND
2008	Oak Island	6-8 inches	0.59	ND
2008	Weston Woods	6-8 inches	0.0073	ND
2017[9]	B-1	1-4 feet	NA	<0.63
2017	B-1	4-6 feet	NA	<0.15
2017	B-2	1-4 feet	NA	<2.6 (Diluted sample)
2017	B-2	6-8 feet	NA	<0.1
2017	B-3	1-2 feet	NA	<0.064
2017	B-3	10-12 feet	NA	<0.1
2017	B-4	1-2 feet	NA	<0.094
2017	B-4	10-12 feet	NA	<0.094
2017	B-5	1-4 feet	NA	<0.079
2017	B-5	10-12 feet	NA	<0.079
2017	B-6	1-4 feet	NA	<0.011
2017	B-6	8-10 feet	NA	<0.071
2018[10]	B-101	4-5 inches	**15** [11]	<0.28
2018	B-102	4-5 inches	4.2	<0.41
2018	B-103	4-5 inches	2.4	<0.23
2018	B-104	4-5 inches	2.5	<0.23
EPA Residential Regional Screening Level (ng/kg)			4.8	
EPA Industrial Regional Screening Level (ng/kg)			22	

[6] Pace Analytical, 2006, *Determination of PCDD/PCDF LEVELS*. (prepared for: Friebert, Finnerty. & St. John, S.C.
[7] Levels exceeding both EPA residential regional screening level and EPA industrial regional screening levels.
[8] Pace Analytical, December, 2008, *Report of Laboratory Analysis for PCDD/PCDF* (Pace Project No: 1085806)
[9] AECOM, September, 2017, Results for Phase 2 Environmental Sampling Investigation, Thomas Street Phase II.
[10] Pace Analytical, 2006, *Determination of PCDD/PCDF LEVELS*. (prepared for: Friebert, Finnerty. & St. John, S.C.
[11] Levels exceeding EPA industrial regional screening levels.

APPENDIX

Exposure Calculation:
Average Daily Intake of Dioxin for Riverside Park Users and Thomas/River Street Residents

Park Users

- Conservative scenario for Park Users:
  - An individual visits the park near the culvert outfall 3 times per week, 35 weeks per year (considering vacation weeks and winter season when people don't go out to the park).
  - The soil is uncovered and an individual accidentally ingests soil, since it is normal for people to ingest tiny amounts of soil on hands or dust in the air each day.
  - During each visit, an individual accidentally ingest soil through hand-to-mouth activity (0.1g for an adult, and 0.2g for a child).

a. Dioxin concentration in culvert outfall soil = 87.7 ng/kg

b. Average dioxin intake per park visit:

b-1. <u>adult</u>

$$87.7 \frac{ng\ dioxin}{kg\ soil} \times 0.1\ g\ soil\ \times\ 1000 \frac{pg}{ng} \times \frac{1kg}{1000g} = \text{ 8.77 pg dioxin per visit}$$

b-2. <u>child</u>

$$87.7 \frac{ng\ dioxin}{kg\ soil} \times 0.2\ g\ soil\ \times\ 1000 \frac{pg}{ng} \times \frac{1kg}{1000g} = \text{ 17.54 pg dioxin per visit}$$

c. Number of park visits per year:

$$3 \frac{\text{visit}}{\text{week}} \times 35 \text{ weeks } = \text{ 105 visits}$$

d. Average daily intake of dioxin from spending time at the park:

b-1. <u>adult</u> (average body weight: 70kg)

$$8.77\ pg \frac{dioxin}{visit} \times 105 \frac{visit}{year} \div\ 365 \frac{day}{year} \div\ 70\ kg =\ 0.036 \text{ pg} \frac{\text{dioxin}}{\text{kg} \cdot \text{day}}$$

b-2. <u>child</u> (average body weight: 10kg)

$$17.54\ pg \frac{dioxin}{visit} \times 105 \frac{visit}{year} \div\ 365 \frac{day}{year} \div\ 10\ kg =\ 0.50 \text{ pg} \frac{\text{dioxin}}{\text{kg} \cdot \text{day}}$$

e. For the River Park users, the conservative exposure scenarios calculated above are all below the daily acceptable reference dose of 0.7 pg/kg.day.

Thomas and River Street Residents

- Conservative scenario for Thomas and River Street Residents:
    - An individual works/plays in their backyard 5 times per week, 35 weeks per year (considering vacation weeks and winter season when people don't spend time at their backyard).
    - The soil is uncovered and an individual accidentally ingests soil, since it is normal for people to ingest tiny amounts of soil on hands or dust in the air each day.
    - During each visit, an individual accidentally ingest soil through hand-to-mouth activity (0.1g for an adult, and 0.2g for a child).

a. The highest dioxin level detected at residential area = 47 ng/kg in soil

b. Average dioxin intake per backyard visit:

b-1. adult

$$47 \frac{ng\ dioxin}{kg\ soil} \times 0.1\ g\ soil\ \times\ 1000 \frac{pg}{ng} \times \frac{1kg}{1000g} =\ 4.7\ \text{pg dioxin per visit}$$

b-2. child

$$47 \frac{ng\ dioxin}{kg\ soil} \times 0.2\ g\ soil\ \times\ 1000 \frac{pg}{ng} \times \frac{1kg}{1000g} =\ 9.4\ \text{pg dioxin per visit}$$

c. Number of park visits per year:

$$5 \frac{\text{visit}}{\text{week}} \times 35\ \text{weeks}\ =\ 175\ \text{visits}$$

d. Average daily intake of dioxin from spending time at the park:

b-1. adult (average body weight: 70kg)

$$4.7\ pg \frac{dioxin}{visit} \times 175 \frac{visit}{year} \div\ 365 \frac{day}{year} \div\ 70\ kg =\ 0.032\ \text{pg} \frac{\text{dioxin}}{\text{kg} \cdot \text{day}}$$

b-2. child (average body weight: 10kg)

$$9.4\ pg \frac{dioxin}{visit} \times 175 \frac{visit}{year} \div\ 365 \frac{day}{year} \div\ 10\ kg =\ 0.45\ \text{pg} \frac{\text{dioxin}}{\text{kg} \cdot \text{day}}$$

e. For the Thomas/River Street Residents, the conservative exposure scenarios calculated above are all below the daily acceptable reference dose of 0.7 pg/kg.day.

Appendix E
Department of Health Services
February 7, 2019 Letter

Tony Evers
Governor

Andrea Palm
Secretary

State of Wisconsin
Department of Health Services

DIVISION OF PUBLIC HEALTH

1 WEST WILSON STREET
PO BOX 2659
MADISON WI 53701-2659

Telephone: 608-266-1251
Fax: 608-267-2832
TTY: 711 or 800-947-3529

February, 7, 2019

The Honorable Patrick Peckham

City Council Alderman, District 1, Wausau
1618 Emerson St
Wausau, WI 54403

Subject: Response to Comments on the Wisconsin Department of Health Service's Letter on Dioxin Contamination

Dear Mr. Peckham,

At your request, the Wisconsin Department of Health Services (DHS) reviewed comments prepared by Mr. Stephen Lester, Science Director of the Center for Health, Environment & Justice, on our letter regarding dioxin contamination. We would like to provide clarifying statements and additional information on our risk assessment.

On March 7, 2018, the City of Wausau asked if there is a health risk due to dioxin contamination in the surface soil near the culvert area close to the Riverside Park. DHS received additional soil testing reports from the Thomas Street area for review. Thus, we conducted a human health risk assessment of dioxin in the surface soil with all available data.

Based on the analysis of available data, DHS concludes that exposure to dioxin in surface soil at the Riverside Park and at the Thomas Street area are unlikely to be harmful to people. We conducted both cancer risk and non-cancer risk assessments using the limited soil sampling data available for the area. The addition of the cancer risk assessment does not change our initial conclusion that the level of dioxins found in the soil is unlikely to cause harm to residents in the area. DHS first considered a non-cancer assessment to identify the immediate health effects from dioxin exposure in soil. Please find the enclosed document for the details on human health risk assessment.

DHS recommends further investigation of dioxin contamination to better understand the potential health impact in the community. The current assessment was made with the reasonable assumption that the worst-case exposure scenarios have been identified. However, there are unanswered questions about the degree and extent of soil contamination, particularly in Riverside Park, and the question of whether soil dioxin in the Thomas Street area is solely due to background or due to an identifiable source. Thus, DHS recommends investigating the degree and extent of dioxin contamination in soil to better characterize the area. DHS is willing to re-evaluate the public health risk for the community once additional information is available.

I hope this letter will provide a better understanding of the DHS interpretation of the dioxin situation in the Riverside Park and Thomas Street areas in Wausau for you and your constituents. Please feel free to contact me with any additional questions at 608-267-2949.

Sincerely,

Clara Jeong, PhD

Toxicologist

Bureau of Environmental and Occupational Health

Wisconsin Department of Health Services

Cc:

Robert Mielke, City of Wausau

Gary Gisselman, City of Wausau

Eric Lindman, City of Wausau

Matt Thompson, Department of Natural Resources

Dale Grosskurth, Marathon County Health Department

Robert Thiboldeaux, Department of Health Services

Background information is available in DHS' letter to the City of Wausau on August 20, 2018, subject line: Wausau Riverside Park Dioxin Contamination.[1]

HUMAN HEALTH RISK ASSESSMENT

A. Data Review

We first obtained all available environmental sampling data for the Riverside Park and Thomas Street locations. As described in our previous letter, DHS reviewed four soil sampling reports. The sampling locations and results are summarized in Appendix A and Appendix B. We found data from 28 samples and included 12 samples in our evaluation. We excluded 12 samples from the phase II analysis results performed by the city of Wausau (AECOM) in 2017 because no dioxin was detected.[2] We also excluded three samples that were collected in public recreational area other than Riverside Park (Fern Island, Oak Island, and Weston Woods) where all dioxin levels were below the Environmental Protection Agency's (EPA's) screening level.[3] Lastly, we excluded the data from the culvert inlet because the area connecting the park and Wauleco property is fenced and no public access is available to the other side.[4] The data used for this screening process are summarized in Table 1.

Table 1. Comparison of dioxin levels detected in surface soils from Riverside Park and Thomas Street Area with EPA screening levels.

Location	Number of Samples	Data Type	Result (ng/kg)	EPA RSL[a] (ng/kg)	Exceedance?
Riverside Park	1	Culvert Outfall	105.6	4.8	**Yes**
Thomas Street	11	Median	4.2		No
		Maximum	47		**Yes**

a. EPA's regional screening level (RSL) for residential soil, ng/kg

We then compared the environmental sampling data to the appropriate screening levels to decide if further evaluation was needed. Screening levels are not thresholds of toxicity. When a contaminant concentration is above these values, it does not mean that health effects are expected but it does represent a point at which further evaluation is warranted.

EPA's regional screening level for dioxin in residential soils is 4.8 ng/kg. The surface soil sample collected from the Thomas Street neighborhood from 2006 to 2018 showed dioxin levels ranging from 1.3 to 47 ng/kg and the median was 4.2 ng/kg (SD = ± 18.2). A total of 6 out of 12 samples, including the culvert outfall sample, exceeded EPA's regional screening level for residential soils. Based on the screening level results, we decided to perform further evaluation.

B. Determination of exposure pathways

The next step of the assessment process is to evaluate the potential for complete exposure pathways, given the specific exposure situations at this site. This step involves considering the environmental media of concern, understanding the chemical and physical properties of the contaminant in the media, and identifying possible routes of human exposures and opportunities for people to have contact with the contaminant.

There are several routes through which people may come into contact with a contaminant from the environment: ingestion, dermal exposure, and inhalation. The major dioxin exposure pathway for both Riverside Park users and residents in the Thomas Street area is ingestion of dioxin-containing soil through normal hand-to-mouth activities. While exposure through skin contact is also possible during such activities, it is considered a minor source because dioxin does not move through the skin easily. Inhalation was not evaluated because the chance of exposure to dioxin through breathing air is very low due to dioxin's chemical properties.

C. Evaluation of health effects

The final step of the risk assessment process is to characterize the risk posed to receptors, in this case, the park users and residents. In this step, we estimate how much of the chemical of concern may get into a person's body. The calculations rely on the environmental sample data and assumptions that determine how much, how often, and how long a person may come into contact with a chemical. Estimated exposure doses are expressed as the amount of contaminant that a person takes in daily per unit of body weight. The unit is expressed as milligram chemical per kilogram body weight per day (mg/kg/day). In this case, we estimated how much dioxin people are exposed to from accidentally ingesting dioxin-containing soil particles and from absorbing dioxin through skin by touching the contaminated soil.

Total estimated dose (mg/kg/day) = Ingestion dose + Dermal absorption dose

We calculated the total estimated doses for children and adults for the Riverside Park users and for the residents at the Thomas Street neighborhood. Conservative assumptions and parameters were included in our analysis; the assumptions and parameters used for the calculations are presented in detail in Appendix C. Calculation formulas are described in Appendix D. The health effects of the estimated doses were then evaluated by comparing them to established guidelines from EPA and the Agency for the Toxic Substances and Disease Registry (ATSDR) for both non-cancer risk and cancer risk.

<u>C-2. Evaluation of non-cancer risk</u>

For non-cancer risk assessment, we compared the total estimated dioxin dose to the oral reference dose (RfD) established by EPA. We calculated the hazard quotient by dividing the total estimated dose by the oral RfD. The hazard quotient is the ratio of the potential exposure to a substance to the level at which no harmful effect is expected. If the hazard quotient value is greater than 1, the substance may represent a risk to human health.

We assessed the estimated dose for a child (age 0 to less than 6) and for an adult for each site. All calculated results showed hazard quotient values below 1. The results of non-cancer risk assessments are summarized in Table 2. Thus, we concluded that exposure to dioxins in surface soil at Riverside Park of park users during occasional recreational activities is not expected to harm their health. We also concluded that exposure to dioxin in surface soil of Thomas Street residents in their yards is not expected to harm their health.

Table 2. Non-cancer hazard calculations resulting from exposure to dioxins in surface soils from Riverside Park and Thomas Street Area, Wausau, WI.

Location	Concentration (ng/kg)	Scenarios	Estimated Dose (mg/kg/day)			RfD (mg/kg/day)	Hazard Quotient
			Ingestion	Skin	Total		
Riverside Park	87.7	Child	$3.4x10^{-10}$	$2.9x10^{-11}$	$3.7x10^{-10}$	$7.0x10^{-10}$	0.52
		Adult	$3.6x10^{-11}$	$4.3x10^{-12}$	$4.0\ x10^{-11}$		0.06
Thomas Street	47	Child	$3.0x10^{-10}$	$2.6x10^{-11}$	$3.3x10^{-10}$		0.47
		Adult	$3.2x10^{-11}$	$3.9x10^{-12}$	$3.6x10^{-11}$		0.05

C-3. Evaluation of excess cancer risk

Current toxicological practice assumes there is no “safe dose” of a carcinogen (chemical that can cause cancer). In other words, exposure to any amount of a carcinogen causes some additional cancer risk. Because of this, EPA and ATSDR use a theoretical cancer risk approach to evaluate potential health risk from exposure to carcinogens.[5]This approach does not provide a yes or no answer to cancer risk but shows the chance of additional risk. An excess cancer risk that is below 1 in 1,000,000 is considered negligible and some regulatory agencies use this to establish the clean-up goal for contaminated sites.[6] A risk that is above 1 in 10,000 is considered high enough that some sort of remediation is needed.[7] For Superfund site removal process, EPA considers an excess cancer risk between 1 in 10,000 and 1 in 1,000,000 to be acceptable and states that risks slightly greater than 1 in 10,000 may be considered to be acceptable if justified based on site-specific conditions.[7,8]

Theoretical excess cancer risk is calculated by multiplying a total estimated dose of a substance by its cancer slope factor, also known as the cancer potency factor (CPF). We used the oral CPF value for both ingestion exposure pathway and dermal exposure pathway to estimate the total excess cancer risk.

Using the conservative exposure scenarios (Appendix C), we evaluated the excess cancer risk for a 30-year exposure and a 70-year exposure. The results of the cancer risk assessment are summarized in Table 3.

For park users, the calculated excess cancer risks are $6.1x10^{-6}$ for a 30-year exposure assessment and $9.5x10^{-6}$ for a 70-year exposure assessment. Stated another way, if one million people are exposed to the same level of dioxin over the same amount of time (30 or 70 years), we estimate that 6 to 9 additional cases of cancer might occur.

For the residential area, the calculated excess cancer risks are 5.6×10^{-6} for a 30-year exposure assessment and 9.1×10^{-6} for a 70-year exposure assessment. Stated another way, if one million people are exposed to the same level of dioxin over the same amount of time (30 or 70 years), we estimate that 5 to 9 additional cases of cancer might occur.

Table 3. Cancer hazard calculations resulting from exposure to dioxins in surface soils from Riverside Park and Thomas Street Area, Wausau, WI.

Location	Concentration (ng/kg)	Scenarios	Duration	Excess Cancer Risk (per 1,000,000) Ingestion	Skin Contact	Total
Riverside Park	87.7	Child	5 years	3.6	0.31	3.9
		Lifetime	30 years	5.5	0.55	6.1
		Lifetime	70 years	8.6	0.91	9.5
Thomas Street	47	Child	5 years	3.2	0.28	3.5
		Lifetime	30 years	5.2	0.49	5.6
		Lifetime	70 years	8.2	0.82	9.1

Several conservative exposure assumptions were applied for the risk calculation. First, we assumed that dioxin is present in surface soil across the entire Riverside Park and nearby residential area. We also assumed that during each visit, people will always get exposed to contaminated soils by disturbing the covered area (grass or snow) and touching the underneath soil. In addition, we assumed that the exposure frequency would be consistent for either 30 or 70 consecutive years. It is unlikely to see people's activity fulfilling all of these assumptions in a realistic scenario. Thus, the calculations result in very conservative dose estimates and we expect actual exposures and corresponding risk to be lower than the calculated results.

Based on the calculation and the site-specific evaluation, we concluded that exposure to dioxins in surface soil at Riverside Park of park users through occasional recreational activities is not expected to cause harm (does not cause an unacceptable increased risk of cancer). We also concluded that exposure to dioxin in surface residential soil of Thomas Street residents in their yards is not expected to cause an excessive cancer risk of concern.

LIMITATIONS OF THIS ASSESSMENT

The main limitation of this assessment is the lack of data within the area of concern. In contrast to prior investigations which have focused on pentachlorophenol (PCP), the extent and concentrations of dioxin levels in the site are not fully characterized. For the Riverside Park assessment, our data was limited to the culvert samples taken in 2006 as those were the only samples collected within the area. Dioxin levels at other more accessible areas of the park have not been characterized. Based on the park's topography, it is possible that water from the culvert outfall could have carried sediment and dioxins downhill, although the chance of dioxin migrating into Wisconsin River through groundwater is low due to dioxin's tight adhesion to soil. In this assessment, we assumed the dioxin levels at the culvert area represent the "worst case (highest concentration)" for the whole park.

CONCLUSIONS

- DHS concludes that exposure to dioxin in surface soil at the Riverside Park is unlikely to cause adverse health effects to the park users.
- DHS concludes that exposure to dioxin in surface soil at the Thomas Street residential area is unlikely to cause adverse health effects to the residents.

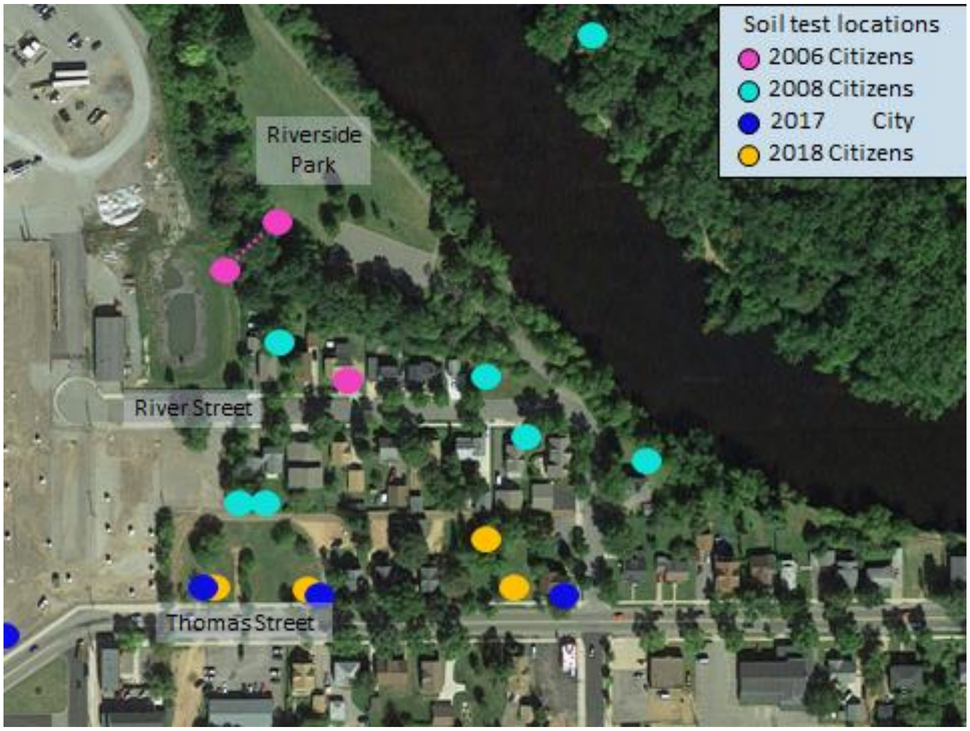
RECOMMENDATIONS

- **DHS recommends further assessment of dioxin levels, location, and other characterizations to fully understand the potential health impact in the community.** Although the exposure to dioxin in surface soil at the Riverside Park is unlikely to cause adverse health effects to the park users, this community is located adjacent to a former wood treatment facility that has used PCP for over 20 years. PCP products contain dioxin as impurities. Considering the amount and length of PCP use during the operation, it is important to assess the levels and extent of dioxin on-site as well as the potential of dioxin migration to off-site locations.
- **As a general practice, DHS recommends awareness of the major environmental sources of dioxin exposure, and steps to limit exposure.** Because dioxin is ubiquitous in the environment and tends to accumulate in the body, it is important to reduce unnecessary exposure to dioxins. Dioxin accumulates in the food chain; meat and dairy products tend to be our greatest sources of exposure compared to fruit and vegetables. People working or playing in soil should wash their hands before eating. Children should be advised not eat dirt or put toys in their mouth while playing outside.

APPENDICES

Appendix A:	**Scope of the Site Including Sampling locations**
Appendix B:	**Summary of all available environmental sampling data**
Appendix C:	**Exposure assumptions and parameters used for risk assessments for Riverside Park users and Thomas Street neighborhood residents**
Appendix D:	**Estimated Dose Calculations**

APPENDIX A. Scope of the Site Including Sampling locations



APPENDIX B. Summary of all available environmental sampling data

Report Year	Locations	Sample Depth (inches)	TEF-adjusted Total dioxin (ng/kg)	Exceeding EPA Value[a]?
2006	Culvert Inlet	4-6	**105.6**	**Yes**
	Culvert Outfall	4-6	**87.7**	**Yes**
	122 River street	4-6	**11.6**	**Yes**
2008	1003 Emter street	8-10	**47**	**Yes**
	130 River street	4-6	2.8	
	141 River street	6-8	1.3	
	120 River street	4-6	1.9	
	117 River street	4-6	**40**	**Yes**
	Fern Island	4-6	3.7	
	117 River street #2	4-6	**42**	**Yes**
	Oak Island	4-6	0.59	
	Weston	4-6	0.0073	
2018	140 E Thomas street	4-5	**15**	**Yes**
	138 E Thomas street	4-5	4.2	
	120 E Thomas street	4-5	2.4	
	110 E Thomas street	4-5	2.5	

a. EPA Residential Regional Screening Level is 4.8 ng/kg.

Data sources:

- Pace Analytical, 2006, Determination of PCDD/PCDF LEVELS (prepared for: Friebert, Finnerty & St. John, S.C).
- Pace Analytical, December, 2008, Report of Laboratory Analysis for PCDD/PCDF (Pace Project No: 1085806)
- Sand Creek Consultants, 2018, Soil Sampling and Analysis Results for the Thomas Street Construction Corridor (Prepared for Citizens for an Environmentally Safe Thomas Street Neighborhood).
- Data from AECOM (September, 2017, Results for Phase 2 Environmental Sampling

- Investigation) AECOM report is not included in the table because dioxin was not detected at any locations.

Appendix C. Exposure assumptions and parameters used for risk assessments for Riverside Park users and Thomas Street neighborhood residents.

Parameter	Symbol	Value		Unit	Source	Notes
maximum dioxin concentration	C	Riverside Park	87.7	ng/kg		
		Thomas Street	47			
conversion factor	CF	$1.00x10^{-12}$		kg/ng		Converts contaminant concentration from ng to kg
ingestion rate	IR	Child	200	mg/day	EPA	Child age 0 to <6
		Adult	100			
exposure frequency	EF	Riverside Park	105	days/year		3 visits per week, 35 weeks per year
		Thomas Street	175			5 visits per week, 35 weeks per year
exposure duration	ED	Childhood	5	years		Age 0 to <6
		25-year as adult	25			assume total 30 year exposure
		65-year as adult	65			assume total 70 year exposure
body weight	BW	Child	15	kg	ATSDR	Child age 0 to <6
		Adult	70			
average time (non-cancer)	$AT_{non\text{-}cancer}$	Child	1825	days		Child: 5 years
		Adult	9125			Adult: 25 years

average time (cancer)	AT_{cancer}	25550		days	EPA	Lifetime: 70 years
cancer potency factor	CPF	$1.5x10^{5}$		$(mg/kg/day)^{-1}$	EPA	
skin area available for contact	SA	Child	2900	cm^2	ATSDR	
		Adult	5700			
soil-to-skin adherence factor	AF	Child	0.2	mg/cm^2		
		Adult	0.07			
absorption factor	ABS	0.03		N/A	EPA	
adherence duration	AD	1		days	EPA	
oral route adjustment factor	ORAF	1		N/A		

Appendix D. Estimated Dose Calculations

Total estimated dose (non-cancer) = Ingestion dose + Dermal absorption dose

Ingestion Route

$$Ingestion\ Dose_{(non-cancer\ (mg/kg/day))} = \frac{C \times CF \times IR \times EF \times ED}{BW \times AT_{non-cancer}}$$

$$Cacner\ Risk = \frac{C \times CF \times IR \times EF \times ED \times CPF}{BW \times AT_{cancer}}$$

Dermal Route

$$Dermal\ Transfer\ (DT) = \frac{C \times AF \times ABS \times AD \times CF}{ORAF}$$

$$Dermal\ absorption\ Dose_{(non-cancer\ (mg/kg/day))} = \frac{DT \times SA \times EF \times ED}{BW \times AT_{non-cancer}}$$

$$Cacner\ Risk = \frac{DT \times SA \times EF \times ED \times CPF}{BW \times AT_{cancer}}$$

Evaluation of non-cancer health Risk:

$$Hazard\ Quotient\ (HQ) = \frac{Estimated\ Dose\ (mg/kg\ /day)}{RfD\ (mg/kg/day)}$$

* The hazard quotient (HQ) is the ratio of the potential exposure to a substance to the level of which no harmful effects is expected. If the hazard quotient is greater than one, the substance may pose a health risk.

Excess cancer risk = Ingestion excess cancer risk + Dermal excess cancer risk

REFERENCES

1. WDHS. Letter Subject: Wausau Riverside Park Dioxin Contamination, Prepared for the City of Wausau. *Wisconsin Department of Health Services*, 2018
2. AECOM. *Results for Phase 2 Environmental Sampling Investigation, Thomas Street Phase II.* 2017. URL: http://www.ci.wausau.wi.us/Portals/0/Departments/Mayor/Documents/PR_Soil_Testing_Packet.pdf
3. Pace Analytical. *Report of Laboratory Analysis for PCDD/PCDF (Pace Project No: 1085806).* 2008.
4. Pace Analytical. Determination of PCDD/PCDF Levelsm, prepared for: Friebert, Finnerty & St. John, S.C. 2006.
5. USEPA. Guidelines for Carcinogen Risk Assessment In. Washington, DC Risk Assessment Forum, *U.S. Environmental Protection Agency*, 2005.
6. USEPA. Review of State Soil Cleanup Levels for Dioxin. In: National Center for Environmental Assessment OoRaD, ed: U.S. Environmental Protection Agency; 2009.
7. USEPA. US EPA Risk Assessment: Regional Removal Management Levels (RMLs). 2018. URL: https://www.epa.gov/risk/regional-removal-management-levels-rmls-frequently-asked-questions#FAQ5.
8. USEPA. 1991. Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions. Office of Solid Waste and Emergency Response, Washington, DC. OSWER Directive 9355.0-30

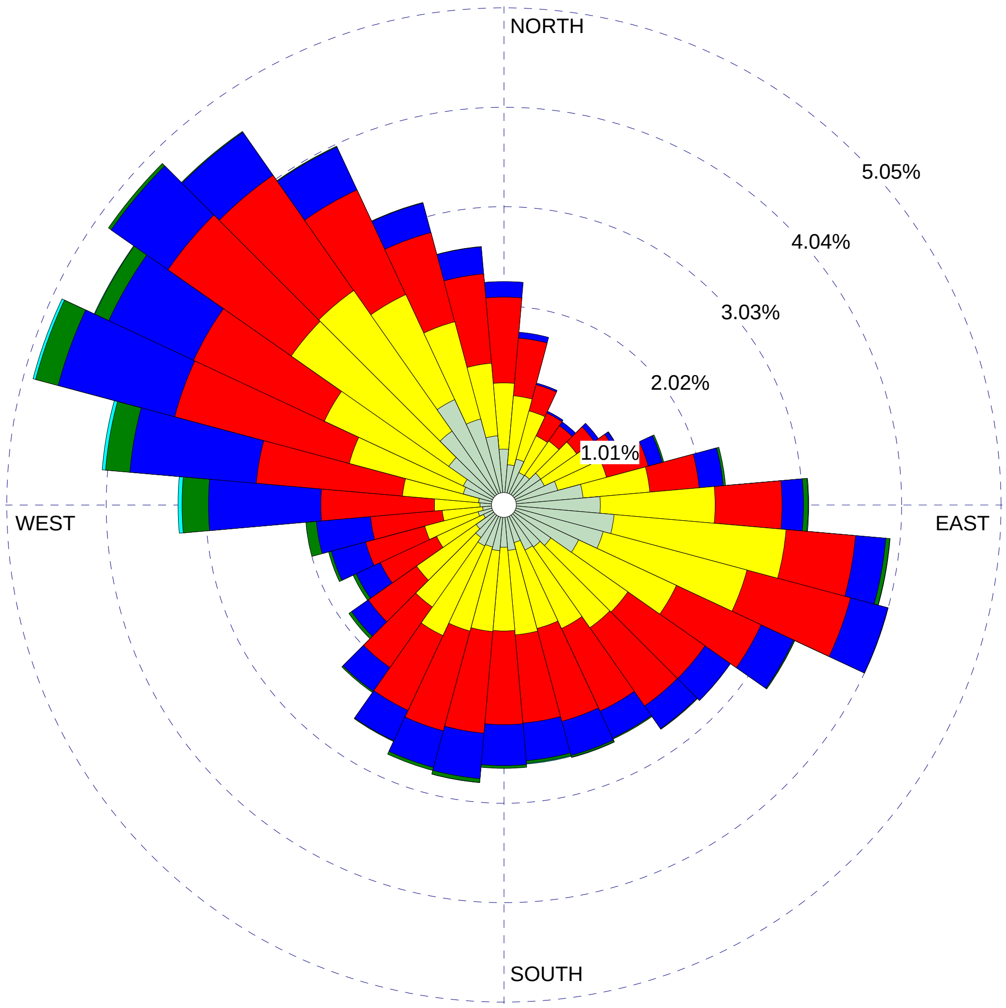
Appendix F
Wind Rose Data

WIND ROSE PLOT:

Wausau Airport 2011-2015

DISPLAY:

Wind Speed
Direction (blowing from)



WIND SPEED
(Knots)

- >= 21.58
- 17.11 - 21.58
- 11.08 - 17.11
- 7.00 - 11.08
- 4.08 - 7.00
- 0.97 - 4.08

Calms: 1.32%

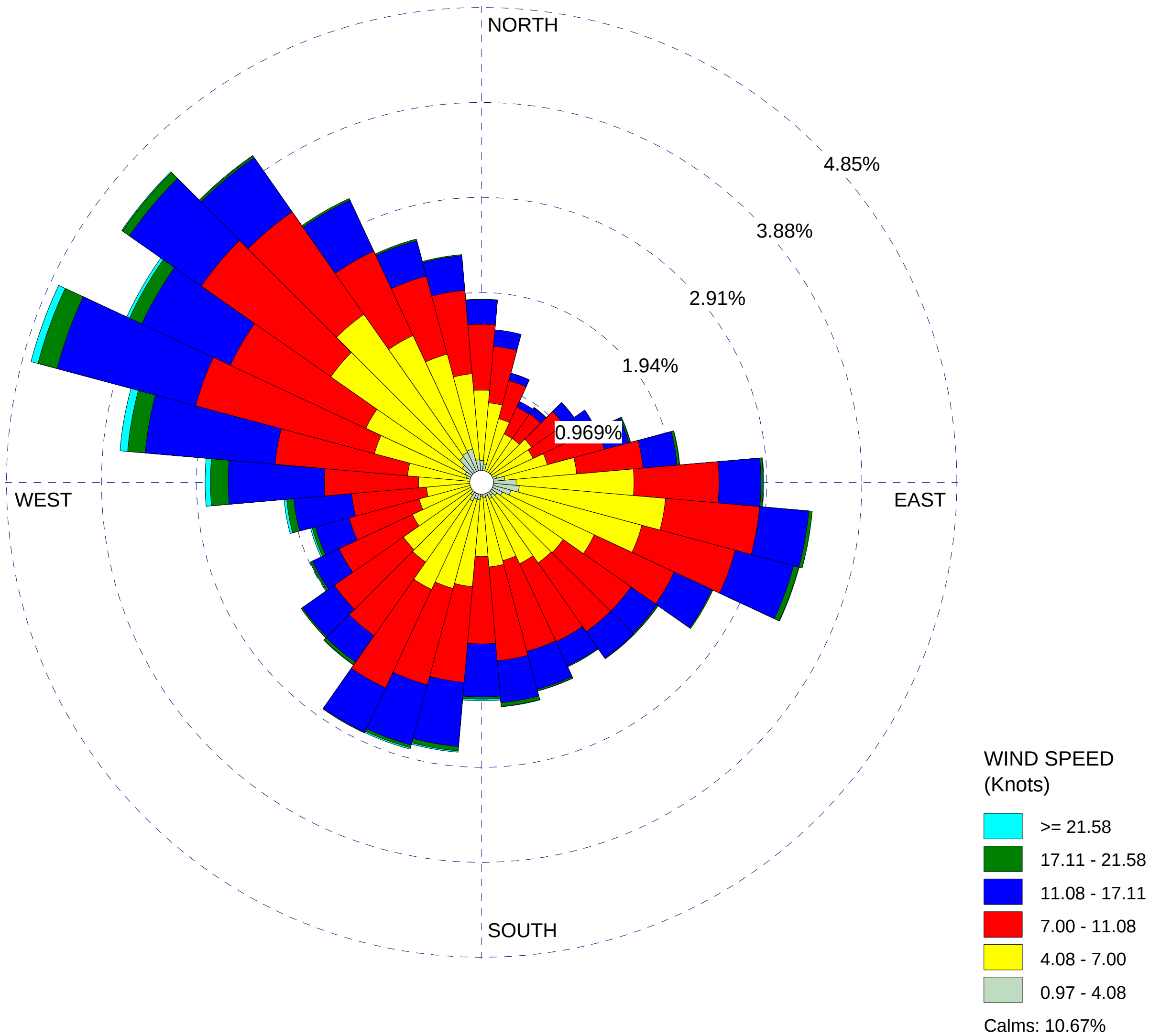
COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 1/1/2011 - 00:00 **End Date: 12/31/2015 - 23:59**	MODELER:	Figure 1 Wind Rose Data 2011-2015
	CALM WINDS: **1.32%**	TOTAL COUNT: **43752 hrs.**	
	AVG. WIND SPEED: **7.22 Knots**	DATE: **3/8/2019**	PROJECT NO.:

WIND ROSE PLOT:

Wausau Airport 1998-2002

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 1/1/1998 - 00:00 **End Date: 12/31/2002 - 23:59**	MODELER:	Figure 2 Wind Rose Data 1998-2002
	CALM WINDS: **10.67%**	TOTAL COUNT: **43371 hrs.**	
	AVG. WIND SPEED: **7.02 Knots**	DATE: **3/8/2019**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

Appendix G
Laboratory Dioxin/Furan Method Detection Limits

Pace Analytical Services, LLC
Method Detection Limit and Reporting Limit
for Dioxins and Furans by USEPA Method 1613B

Analyte		Solids by SW3540		Control limits		
	CAS#	MDL (ng/Kg)	PRL (ng/Kg)	Lower	Upper	RPD
2,3,7,8-TCDF	51207-31-9	0.140	1.0	70	130	20
2,3,7,8-TCDD	1746-01-6	0.311	1.0	70	130	20
1,2,3,7,8-PeCDF	57117-41-6	0.190	5.0	70	130	20
2,3,4,7,8-PeCDF	57117-31-4	0.145	5.0	70	130	20
1,2,3,7,8-PeCDD	40321-76-4	0.156	5.0	70	130	20
1,2,3,4,7,8-HxCDF	70648-26-9	0.198	5.0	70	130	20
1,2,3,6,7,8-HxCDF	57117-44-9	0.209	5.0	70	130	20
2,3,4,6,7,8-HxCDF	60851-34-5	0.273	5.0	70	130	20
1,2,3,7,8,9-HxCDF	72918-21-9	0.261	5.0	70	130	20
1,2,3,4,7,8-HxCDD	39227-28-6	0.356	5.0	70	130	20
1,2,3,6,7,8-HxCDD	57653-85-7	0.226	5.0	70	130	20
1,2,3,7,8,9-HxCDD	19408-74-3	0.472	5.0	70	130	20
1,2,3,4,6,7,8-HpCDF	67562-39-4	0.336	5.0	70	130	20
1,2,3,4,7,8,9-HpCDF	55673-89-7	0.442	5.0	70	130	20
1,2,3,4,6,7,8-HpCDD	35822-46-9	0.457	5.0	70	130	20
OCDF	39001-02-0	1.14	10.0	70	130	20
OCDD	3268-87-9	0.730	10.0	70	130	20
Total TCDF	55722-27-5	0.140	1.0	70	130	20
Total TCDD	41903-57-5	0.311	1.0	70	130	20
Total PeCDF	30402-15-4	0.335	10.0	70	130	20
Total PeCDD	36088-22-9	0.156	5.0	70	130	20
Total HxCDF	55684-94-1	0.94	20.0	70	130	20
Total HxCDD	34465-46-8	1.05	15.0	70	130	20
Total HpCDF	38998-75-3	0.78	10.0	70	130	20
Total HpCDD	37871-00-4	0.457	5.0	70	130	20

Labeled Analyte		Control limits	
		Lower	Upper
$^{13}C_{12}$-2,3,7,8-TCDF		24	169
$^{13}C_{12}$-2,3,7,8-TCDD		25	164
$^{13}C_{12}$-1,2,3,7,8-PeCDF		24	185
$^{13}C_{12}$-2,3,4,7,8-PeCDF		21	178
$^{13}C_{12}$-1,2,3,7,8-PeCDD		25	181
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF		26	152
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF		26	123
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF		28	136
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF		29	147
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD		32	141
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD		28	130
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF		28	143
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF		26	138
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD		23	140
$^{13}C_{12}$-OCDD		17	157
$^{37}Cl_4$-2,3,7,8-TCDD		35	197

Pace Analytical Services, LLC
1700 Elm Street SE, Suite 200 Minneapolis, MN 55414
612-607-1700
www.pacelabs.com