ARCADIS Design & Consultancy for natural and built assets

# BIOSOLIDS LANDSPREADING – PHASE I INVESTIGATION WORK PLAN

BRRTS No. 02-38-583856

November 2019

# BIOSOLIDS LANDSPREADING – PHASE I INVESTIGATION WORK PLAN

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# CONTENTS



# APPENDICES

# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| Arcadis | Arcadis US, Inc. |
| BRRTS | Bureau for Remediation and Redevelopment Tracking System |
| CFR | Code of Federal Regulation |
| GIS | Geographic Information System |
| ITRC | Interstate Technology Regulatory Council |
| MS | matrix spike |
| MSD | matrix spike duplicate |
| NR | Natural Resources |
| NCSS | National Cooperative Soil Survey |
| NRCS | Natural Resources Conservation Service |
| QA/QC | quality assurance/quality control |
| PFAS | per- and polyfluoroalkyl substances |
| USDA | United States Department of Agriculture |
| USEPA | United States Environmental Protection Agency |
| USGS | United States Geological Survey |
| WAC | Wisconsin Administrative Code |
| WDHS | Wisconsin Department of Health Services |
| WDNR | Wisconsin Department of Natural Resources |
| WGNHS | Wisconsin Geological and Natural History Survey |
| Work Plan | Biosolids Landspreading – Phase I Investigation Work Plan |
| WWTP | Wastewater Treatment Plant |

# 1 INTRODUCTION

Arcadis US, Inc. (Arcadis) has prepared this Biosolids Landspreading – Phase I Investigation Work Plan (Work Plan) in response to the Wisconsin Department of Natural Resources (WDNR) letter dated October 16, 2019 (BRRTS No. 02-38-583856, WDNR 2019a), presented in Appendix A. As per Wisconsin Administrative Code (WAC), Department of Natural Resources (NR), Chapter NR 749, a check to cover the review fee for this Work Plan will be provided to WDNR.

An industry-standard process for data gathering, evaluation, and planning in advance of any potential future interim action or remedial activity includes investigation and assessment of background information as a first step, followed by planning for subsequent steps (e.g., collection of field data, evaluation of same, planning for follow-on activities, etc.) (USEPA 1988, ASTM 2016; WAC Chapter NR 716.01). In general, interim or final remedial action should only be taken after investigation and assessment. Following such a data-driven Investigate-Assess-Take Action process ensures thorough and appropriate collection of foundational information prior to determining an appropriate course of additional action. This process also leads to a more holistic understanding of issues and better outcomes over the long term. The steps outlined in this Work Plan follow this kind of prudent approach, and are consistent with the thought process used for site investigation and assessment for various constituents of concern in Wisconsin and elsewhere in the United States under a variety of environmental regulatory programs. For example, this kind of Investigate-Assess-Take Action approach has been used in the Marinette County area in Wisconsin for per- and polyfluoroalkyl substances (PFAS), with WDNR concurrence.

Evaluation of PFAS in land-applied biosolids is a relatively new issue in the United States in general, and in Wisconsin in particular. Given the emerging nature of this issue, and the fact that WDNR has not issued final regulatory standards for PFAS in various environmental media, execution of the Phase I work described in this Work Plan will be an important and necessary first step for understanding subsequent investigation and evaluation activities. New information and insight gained from other information sources may become important and will be considered as appropriate. The lack of precedent within Wisconsin for evaluation of PFAS in land-applied biosolids may lead to consideration of other information sources in the future, as issues associated with PFAS in land-applied biosolids continues to evolve.

This Work Plan identifies the initial non-intrusive investigation and location assessment Phase I actions that need to be conducted in order to prepare and conduct a sound Phase II Work Plan for the 16 fields identified and develop an appropriate sampling protocol that meets the requirements of WAC Chapter NR 716.07, and constitutes Phase I of the Work Plan required by those provisions. This Work Plan also includes the preparation of a Phase II Work Plan that will detail the sampling protocol, locations, and methodologies to be performed, based on the results of the Phase I investigation. The Phase I investigation and preparation of the Phase II Work Plan would be completed within 3 to 4 months of WDNR authorization to proceed, assuming access to the fields has been granted. Upon completion and WDNR concurrence with the Phase I, a Phase II Work Plan will be developed based on the data received in the Phase I process and submitted to WDNR. The Phase II Work Plan would be implemented after WDNR concurrence with the Phase II Work Plan and access has been granted to the 16 private fields.

# 2 BACKGROUND

## 2.1 Biosolids Description

During wastewater treatment, organic material is produced and consolidated. This organic material is referred to as "biosolids". Biosolids can be beneficially used, meaning rather than treating the biosolids as waste and placing them in a landfill, they can be recycled to provide a benefit. Biosolids are often applied to soil as a source of nutrients and to replenish soil organic matter. This is referred to as land application or landspreading. Biosolids can be applied to any type of soil. A common use is to apply biosolids to agricultural fields to increase field productivity (USEPA 2000).

Land application of biosolids can reduce the need for chemical fertilizers. Biosolids improve soil properties, including texture and water holding capacity. Some of the nutrients included in biosolids are nitrogen and phosphorus. The nutrients in biosolids have a number of advantages to inorganic fertilizers. The biosolid nutrients are organic and release slowly to plants. The biosolid nutrients are less water soluble than inorganic fertilizers. Both of these properties result in a lower potential for biosolids nutrients to run off into surface waters and leach into groundwater than inorganic fertilizers (USEPA 2000).

Untreated biosolids are examined for four primary categories: metals, disease causing organisms (called pathogens), attracting disease causing organisms (e.g., rodents, mosquitoes, etc., these are called vector attractants), and odor. To protect from this, land application of biosolids are regulated by the United States 40 Code of Federal Regulation (CFR) Part 503. These regulations describe the sampling and analysis requirements to confirm the biosolids meet the applicable criteria and operational standards. Criteria are set for metals. Operational standards are set for pathogens and vector attractants. The regulations also describe management practices for how biosolids can be land applied. The regulations include record keeping and reporting requirements for where biosolids are applied, how much are applied, and when they were applied.

The United States Environmental Protection Agency (USEPA) oversees the implementation of 40 CFR Part 503. Under 40 CFR Part 501, USEPA can delegate the authority for this regulation to states. USEPA has delegated authority for the biosolids land application to the WDNR. Wisconsin regulates biosolids land application under WAC Chapter NR 214. This regulation describes how biosolids can be land applied, vehicle requirements for land application, and monitoring requirements.

## 2.2 Biosolids Landspreading Background

The city of Marinette Wastewater Treatment Plant (WWTP) has historically landspread biosolids on privately owned farm fields. Biosolids landspreading activities conducted by the city of Marinette are permitted by the WDNR in accordance with WAC Chapter NR 214.

In June 2018, the city of Marinette notified the WDNR of elevated PFAS concentrations present in influent wastewater received by the WWTP. In July 2018, the city of Marinette identified elevated PFAS concentrations in biosolids generated by the WWTP from 2017 and 2018. In July 2018, the city of Marinette tested lines from five wastewater zones that discharge into its WWTP, and identified levels of PFAS in all five lines. In addition, the Marinette area contains numerous different industrial sites, that are

likely contributing sources of PFAS contamination. As a result, there are potentially multiple sources of PFAS that may have been present in the biosolids historically spread by the city of Marinette WWTP.

If PFAS are present in the privately-owned farm fields, there are also potentially other environmental sources of PFAS that may have contributed to the presence of PFAS in the fields. There are multiple sources of PFAS in the environment. The United States Environmental Protection Agency (USEPA) and the Interstate Technology Regulatory Council (ITRC) describe sources contributing PFAS to the environment (USEPA 2019, ITRC 2018). Identification of sources is a process recommended by WDNR and USEPA (WDNR 2019b, USEPA 1988). Source evaluation is performed to identify where constituents are coming from and is necessary to evaluate which sources need to be controlled and to identify appropriate methods for control. In the absence of source identification, a given source may be controlled but other unidentified sources may be ongoing and result in recontamination (USEPA 2005).

The WDNR has identified 16 private fields to be investigated for the presence of PFAS (Appendix A).

# 3 SCOPE OF WORK: PHASE I INVESTIGATION

The following is a summary of Phase I investigation activities, prepared in accordance with WAC Chapter NR 716.07.

## 3.1 Evaluation of Existing Data

In order to develop a Phase II Work Plan for each of the 16 fields identified, the following information will be evaluated. This information is critical to support the locations, sample depths, and sampling parameters for any samples. The following information was developed in accordance with the WDNR Site Investigation Work Plan Preparation Checklist Form 4400-316, provided as Attachment 2 in Appendix A.

Specific actions associated with these WDNR requirements are presented below. As noted in Section 1 above, execution of these Phase I steps will be important for subsequent Phase II work because of the emerging nature of the potential issues associated with PFAS in biosolids.

- Per WAC Chapter NR 716.09(2)(e), United States Geological Survey (USGS) topographic maps to evaluate drainage directions in the fields. USGS is the primary civilian mapping agency of the United States and the current topographic map series is derived from Geographic Information System (GIS) data, modeled on legacy 7.5-minute quadrangle maps.
- Per WAC Chapter NR 716.09(2)(e), USGS – Natural Resources Conservation Service (NRCS) soil survey maps to assess surface soil conditions, and to determine drainage and infiltration patterns. The NRCS provides soil data and information produced by the National Cooperative Soil Survey (NCSS), a nationwide public-private partnership that collaborates to provide information about soils.
- Per WAC Chapter NR 716.09(2)(e), United States Department of Agriculture (USDA) Soil Conservation Service soil survey maps for Marinette County to assess texture and classification of surface soils. The USDA Soil Conservation Service has leadership for the federal part of the NCSS.
    - USDA Soil Conservation Service – Soil Survey of Marinette County, Wisconsin: https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/wisconsin/WI075/0/marinette.pdf
- Per WAC Chapter NR 716.07(5), Marinette County tax maps to assess property boundaries and field ownership. The Land Information Department GIS integrates all land records within Marinette County.
- Per WAC Chapter NR 716.09(2)(a), Marinette County Register of Deeds records to confirm the required Section, Township, and Range for each parcel. The Register of Deeds office provides comprehensive records of Marinette County real estate documents.
- Per WAC Chapter NR 716.07(7), Wisconsin Department of Health Services (WDHS) records to locate potable water wells and review well construction and water quality data. The WDHS – Well Water Quality Viewer summarizes private well water quality data from the state and local sources:
    - WDHS – Well Water Quality Viewer: https://www.uwsp.edu/cnr-ap/watershed/pages/wellwaterviewer.aspx
- Per WAC Chapter NR 716.07(8)(a),(b),(c),(d); wetland and surface water maps, including United States Fish and Wildlife Service – National Wetlands Inventory Wetlands Mapper website and the WDNR – Surface Water Data Viewer to identify locations, extents, and characteristics of wetlands;

chemistry (water, sediment), physical, and biological (macroinvertebrate and fish) data; This information will be used to evaluate water drainage directions and water infiltration patterns:
  - United States Fish and Wildlife Service – National Wetlands Inventory Wetlands Mapper: https://www.fws.gov/wetlands/data/mapper.html
  - WDNR – Surface Water Data Viewer: https://dnrmaps.wi.gov/H5/?Viewer=SWDV&runWorkflow=Wetland

- Per WAC Chapter NR 716.07(1), historic and current aerial photographs to assess extents of the fields, past land usage, surface water body locations, whether there are developments (i.e., buildings) on the parcels.
- Per WAC Chapter NR 716.07(3), WDNR Bureau for Remediation and Redevelopment Tracking System (BRRTS) records for each parcel, to evaluate any history of spills or releases.
- Per WAC Chapter NR 716.09(2), previously published WDNR information on groundwater in the area of interest, including groundwater elevation measurements and groundwater quality data to evaluate the presence of aquifers and groundwater flow directions.
- Per WAC Chapter NR 716.07(7), water well logs in the Wisconsin Geological and Natural History Survey (WGNHS) and WDNR databases to evaluate where wells are present, what geologic unit the wells are screened in, what the water elevation was at time of drilling, and whether the well is a potable water well; This information could be used to identify wells for sampling in a subsequent investigation phase:
  - WGNHS – Historic Well Construction Reports (1930 – 1989): https://data.wgnhs.wisc.edu/well-viewer/
  - WDNR – Well Construction Reports (1987 – Present): https://prodoasext.dnr.wi.gov/inter1/watr$.startup

These records will also be used to evaluate precipitation, infiltration, and runoff zone pathways.

## 3.2 Evaluation of Potential Sources

As required by WAC Chapter NR 716.07(5), an evaluation of potential sources of PFAS will include:

- Submit Freedom of Information Act requests to the city of Marinette and city of Peshtigo for copies of indirect discharge permits to the cities' respective WWTPs, and others as may be identified.
- Identify industry types and commercial entity types in the area of interest.
- Evaluate PFAS analyte profiles to determine potential relative amounts of different PFAS compounds.
- Review municipal and industrial landspreading permits for fields in the area of interest.
- Review land application permits for other municipalities.
- Review waste hauling records in the area of interest.
- Identify other potential sites with known or potential PFAS issues in the area of interest.
- Identify other potential deposition activities (fill, etc.).

- Review well construction report information:
    - WDNR – Well Driller Viewer: https://dnrmaps.wi.gov/H5/?viewer=Well_Driller_Viewer
- Interview local officials, WDNR regional staff, and local residents who have lived or worked in the area of interest.

## 3.3 Assessment of Field Usage

In order to determine appropriate sampling methodology, including sampling locations and depth of samples, the following activities will be conducted in accordance with WAC Chapter NR 716.07(1):

- Interviews regarding details of land application and tilling practices in the 16 fields identified.
- Potential interviewees include:
    - Landowners, tenants, and ranchers
    - Wisconsin Department of Agriculture, Trade, and Consumer Protection
    - city of Marinette WWTP and city of Peshtigo WWTP municipal officials
    - Officials from any other municipal WWTP identified as having landspread in the area of interest
    - Biosolids spreading companies and subcontractors
    - Any other personnel identified with direct involvement in landspreading biosolids in the area of interest.
- Obtain laboratory analytical results and related documentation from any previous related investigations conducted in the identified fields.
- Determine farm field crop type, crop rotations, tilling activities, other field uses (e.g., grazing cattle), and typical crop management practices, to the extent practicable.
- Identify and confirm potable water wells and residences at the identified fields and on any parcel within an approximate 1,200-foot buffer zone surrounding each of the fields.
- Identify residences and any other structures present, to evaluate the potential for PFAS vapor intrusion. While PFAS vapor intrusion is not expected to be a significant concern due to the characteristics of PFAS in soil and groundwater, the potential for vapor intrusion will be evaluated in accordance with WAC Chapter NR 716.
- Per WAC Chapter NR 716.07(6), obtain access agreements from each landowner, as needed.
- Conduct site walks with landowners and farmers and inspect areas of reported landspreading.

# 4 PREPARATION OF PHASE II WORK PLAN

The Phase I investigation work described above will be used to prepare a Phase II Work Plan to conduct sampling on the 16 identified fields, consistent with the requirements of WAC Chapters NR 716.07 and 716.09. The Phase II Work Plan will be prepared based on the data derived in the Phase I investigation. The Phase II Work Plan will include soil, potable well, and surface water sampling on each of the 16 fields and on any parcel within an approximately 1,200-foot buffer zone surrounding each of the fields, as applicable.

## 4.1 Soil Sampling

The soil sampling program will be developed based on information collected during Phase I. The information will be used to determine sample locations and sample depth. Once sample location and sample depths are selected, then the sampling method will be determined. There are some activities for soil sampling that are considered very likely and include:

- Prior to mobilization, permission for access to investigation locations will be obtained from the applicable landowners.
- Prior to mobilization, Wisconsin One Call (i.e., Diggers Hotline) will be contacted and a private utility locating service will be contracted to complete utility location.
- Continuous soil cores will be collected and logged by a qualified field professional.
- Soil samples collected at each boring will be analyzed up to 36 PFAS compounds that are reportable using a modified version of USEPA Method 537.
- As part of the field quality assurance/quality control (QA/QC), one matrix spike (MS) sample and one matrix spike duplicate (MSD) sample will be collected for every 20 field samples collected and one field duplicate will be collected for every ten field samples.
- Internal laboratory QA/QC will consist of one laboratory blank and one laboratory control sample (or blank spike) per batch of samples, and additional QA/QC as indicated by the laboratory QA/QC procedures.
- Purge water, soil, and drilling fluid generated while completing the proposed activities will be containerized (e.g., 55-gallon steel drums) and staged in a centralized and secured location.
- All investigation locations will be documented with field GIS units or surveyed.

## 4.2 Potable Well Sampling

The potable well sampling program will be developed based on information collected during Phase I. It is anticipated that the sampling methods will be similar to the methods described in the Revised Long-Term Potable Well Sampling Plan (Arcadis 2018a). There are some activities for potable well sampling that are considered very likely and include:

- Prior to mobilization, permission for access to investigation locations will be obtained from the applicable landowners.

- Coordinate a sample date and time with the contact person for each well.
- Initiate flow from the water source and allow the system to flush for at least 3 minutes.
- Collect the sample into the high-density polyethylene bottle until the sample bottle is full (leaving slight headspace in the bottle is acceptable).
- Well water samples collected will be analyzed for all 36 PFAS compounds that are reportable using a modified version of USEPA Method 537.
- As part of the field QA/QC, one MS sample and one MSD sample will be collected for every 20 field samples collected and one field duplicate will be collected for every ten field samples.
- Internal laboratory QA/QC will consist of one laboratory blank and one laboratory control sample (or blank spike) per batch of samples, and additional QA/QC as indicated by the laboratory QA/QC procedures.
- Purge water generated while completing the proposed activities will be containerized (e.g., 55-gallon steel drums) and staged in a centralized and secured location.
- All investigation locations will be documented with field GIS units or surveyed.

## 4.3 Surface Water Sampling

The surface water sampling program will be developed based on information collected during Phase I. The information will be used to determine sample locations and sample depth. Once sample location and sample depth are selected, then sampling method will be determined. It is anticipated that the sampling methods will be similar to the surface water sampling methods described in the Revised Site Investigation Work Plan (Arcadis 2018b) and Supplement Site Investigation Work Plan (Arcadis 2019). There are some activities for surface water sampling that are considered very likely and include:

- Prior to mobilization, permission for access to investigation locations will be obtained from the applicable landowners.
- Surface water samples collected will be analyzed for Total Suspended Solids and up to 36 PFAS compounds that are reportable using a modified version of USEPA Method 537.
- As part of the field QA/QC, one MS sample and one MSD sample will be collected for every 20 field samples collected and one field duplicate will be collected for every ten field samples.
- Internal laboratory QA/QC will consist of one laboratory blank and one laboratory control sample (or blank spike) per batch of samples, and additional QA/QC as indicated by the laboratory QA/QC procedures.
- All investigation locations will be documented with field GIS units or surveyed.

# 5 REPORTING

Once the Phase I scope of work is complete, a summary letter report will be prepared. This report will include text with applicable figures, tables, and appendices. Upon submittal of the report and WDNR concurrence, subsequent Phase II investigation steps can be evaluated by WDNR.

# 6 ANTICIPATED SCHEDULE

The anticipated schedule for investigation and reporting is as follows:

- Phase I Work Plan – We believe that the activities detailed in this Work Plan can reasonably be completed within 3 to 4 months of WDNR authorization to proceed, assuming access to the fields has been granted. Upon completion and WDNR concurrence with the Phase I investigation, a Phase II Work Plan will be developed based on the data received in the Phase I process and submitted to WDNR.
- Phase II Work Plan – We believe that the sampling activities outlined in the Phase II Work Plan can be initiated after WDNR concurrence with the Phase II Work Plan and access has been granted to the 16 private fields.

In the event the schedule is affected by weather, access, or other factors; WDNR will be provided an updated schedule for the activities.

# 7 REFERENCES

Arcadis. 2019. Supplemental Site Investigation Work Plan. Ansul Fire Technology Center Site. 2700 Industrial Parkway, Marinette, Wisconsin. BRRTS No. 02-38-580694. February 5, 2019.

Arcadis. 2018a. Revised Long-Term Potable Well Sampling Plan. Ansul Fire Technology Center Site. 2700 Industrial Parkway, Marinette, Wisconsin. BRRTS No. 02-38-580694. April 20, 2018.

Arcadis. 2018b. Revised Site Investigation Work Plan. Ansul Fire Technology Center Site. 2700 Industrial Parkway, Marinette, Wisconsin. BRRTS No. 02-38-580694. April 20, 2018.

ASTM. 2016. E2247-16. Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process for Forestland or Rural Property.

ITRC. 2018. History and Use of Per- and Polyfluorylalkyl Substances (PFAS). March.

WDNR. 2019a. Notice of Noncompliance for the Reported Contamination at the City of Marinette Waste Water Treatment Facility and Associated Fields Utilized for Landspreading of Biosolids Sludge. Marinette County, Wisconsin. BRRTS No. 02-38-583856. October 16, 2019.

WDNR. 2019b. Site Investigation Scoping: Identifying Contaminants of Concern. RR-19-0101-D. September 16.

USEPA. 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. EPA/540/G-89/004. OSWER Directive 9355.3-01. October.

USEPA. 2000. Biosolids Technology Fact Sheet Land Application of Biosolids. EPA 832-F-00-064. September.

USEPA. 2005. Contaminated Sediment Remediation Guidance for Hazardous Waste Sites. EPA-540-R-05-012, OSWER 9355.0-85. December.

USEPA. 2019. Basic Information on PFAS. https://www.epa.gov/pfas/basic-information-pfas. Accessed November 12, 2019.

# 8 NR 712.09 CERTIFICATION

I, Ben Verburg, hereby certify that I am a registered professional engineer in the State of Wisconsin, registered in accordance with the requirements of ch. A-E 4, Wis. Adm. Code; that this document has been prepared in accordance with the Rules of Professional Conduct in ch. A-E 8, Wis. Adm. Code; and that, to the best of my knowledge, all 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.

Ben Verburg, Principal Engineer, 31794-006

Signature, title and P.E. number

P.E. stamp

I, Chris Peters, hereby certify that I am a geologist 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.

C. Peters VP 1054-013

Signature and title and P.G. number

WISCONSIN
Christopher S. Peters
1054-013
Professional Geologist
Michigan
PROFESSIONAL GEOLOGIST

# APPENDIX A

October 16, 2019 Letter from WDNR

**State of Wisconsin**
**DEPARTMENT OF NATURAL RESOURCES**
**101 S. Webster Street**
**Box 7921**
**Madison WI 53707-7921**

**Tony Evers, Governor**
**Preston D. Cole, Secretary**
Telephone 608-266-2621
Toll Free 1-888-936-7463
TTY Access via relay - 711

October 16, 2019

Mr. Jeffery Danko
Johnson Controls, Inc.
5757 North Green Bay Avenue
Milwaukee, WI 53209

Mr. Scott Wahl
Tyco Fire Products, LP
One Stanton Street
Marinette, WI 54143

**Subject: Notice of Noncompliance for the Reported Contamination at the City of Marinette Waste Water Treatment Facility and Associated Fields Utilized for Landspreading of Biosolids Sludge; Marinette County, WI**
DNR BRRTS Activity # 02-38-583856

Dear Mr. Danko and Mr. Wahl:

On July 3, 2019 the Department of Natural Resources (DNR) sent a Responsible Party (RP) letter requiring a site investigation (SI) workplan to address the fields associated with the land spreading of biosolids (the fields) from the City of Marinette Waste Water Treatment Plant. As you know, we have received correspondence from you and recently met with your representatives to discuss our request.

Our letter requested an SI workplan by September 3, 2019, as required by Wis. Admin. Code NR 716.09(1). As of October 15, 2019, the DNR has not received an SI workplan. Given the need to complete an SI, the DNR has developed an outline for a preliminary SI workplan to address the fields, private wells and surface water. Please note that this preliminary SI workplan does not constitute a full SI for the fields and wells but serves as a reasonable starting point for you to initiate the investigation that is already past due. Please be aware that additional site investigation activities may be required to determine to full degree and extent of contamination.

We are hopeful that we can continue a dialog with you and your consultant to commence the work outlined below. Our technical staff is available to meet with you and your consultant to discuss what may be needed to finalize the SI workplan. The DNR expects JCI and Tyco to submit an SI workplan to address the fields by **Friday, November 15, 2019**. If you do not submit an adequate SI workplan to address the fields by this date, the DNR will take direct action under Wis. Stat. §§ 292.31(1)(b) and 292.31(3)(b)1. to implement a SI workplan and evaluate further environmental enforcement actions and cost recovery under Wis. Stat. § 292.31(8).

**Preliminary Biosolids SI Workplan Components**

- Develop an SI workplan that complies with the requirements in Wis. Admin. Code, chs. NR 700 through NR 754. See the attached SI Workplan Checklist (form 4400-316) for assistance in developing the SI workplan.

- The SI workplan must address sampling and investigation plans for a minimum of 15 fields; this includes the fields upon which biosolids were most frequently and recently landspread, according to available records (see Attachment – Fields to be Evaluated in Initial Site Investigation Workplan).

- In accordance with Wis. Admin. Code ch. NR 716, include detailed information for each field investigated. Also include information regarding crop type, crop rotations, and typical crop management practices.

- A plan to sample potable wells and residences on each of the 15 fields and on any parcel within a 1200-ft buffer of each of the fields.

- The SI work plan must include a plan for surface water sampling which may be collected from any standing water in fields, nearby drainage ditches, or intermittent streams within the designated fields.

- For all sampling conducted, provide detailed information regarding the density of sampling for a given field. For example, soil samples were collected at from 0-25 cm depth and 25-50 cm depth; the final SI report will need to include detailed maps and/or graphics illustrating sample locations.

- For all proposed sampling to be conducted, provide a detailed explanation of the procedures and methodology utilized in developing a sampling strategy for determining the degree and extent of PFAS contamination associated with landspreading of PFAS contaminated biosolids. This includes substantiation of the total depth profile selected for all soil sampling to be conducted, substantiation of the total depth profile selected for all groundwater samples to be collected, the lab methods that will be utilized in analysis, and the list of PFAS analytes that will be tested.

This outline is an effort to move this process forward. We expect JCI and Tyco to complete this work and, as noted above, we request you submit an SI workplan to the DNR by November 15, 2019 with associated Wis. Admin. Code NR 749 review fee. Please understand that if you fail to take the actions required by Wis. Stat. § 292.11 to address this contamination, the DNR will move forward under Wis. Stat. § 292.31 to implement the SI workplan and evaluate further environmental enforcement actions and cost recovery under Wis. Stat. § 292.31(8). If you have questions concerning the SI workplan, please do not hesitate to write or call David Neste at 920-424-0399. Thank you for your prompt attention to this matter.

Sincerely,

Roxanne N. Chronert
Team Supervisor, Northeast Region
Remediation and Redevelopment Program

Attachments:
1. Fields to be Evaluated in Initial Site Investigation Workplan
2. Site Investigation Work Plan Preparation Checklist Form 4400-316

ec: Darsi Foss, DNR
William J. Nelson, DNR
David Neste, DNR
Linda Benfield, Foley & Lardner

Fields to be Evaluated in Initial Site Investigation Workplan

| DNR # | Site # | Field # | Owner | Latitude | Longitude | Municipality |
|---|---|---|---|---|---|---|
| 32302 | GW | 119 | A | 45.1429389 | -87.8609861 | LAKE |
| 32712 | GW | 123 | A | 45.1373765 | -87.8661669 | LAKE |
| 38724 | MN1 | 2 | B | 45.1082152 | -87.7883596 | PORTERFIELD |
| 38727 | NN | 5 | C | 45.175575 | -87.8340028 | GROVER |
| 38728 | NN | 3 | C | 45.175575 | -87.8340028 | LAKE |
| 46051 | MN1 | 1 | B | 45.1064861 | -87.7913556 | GROVER |
| 51051 | GW | 124 | A | 45.1394528 | -87.87125 | LAKE |
| 62081 | NN | 1 | C | 45.1447064 | -87.8403047 | LAKE |
| 77299 | SP | 1 | D | 45.1081767 | -87.7832009 | PORTERFIELD |
| 77300 | SP | 2 | D | 45.119033 | -87.7931973 | PORTERFIELD |
| 77302 | SP | 5 | D | 45.1191643 | -87.813617 | PORTERFIELD |
| 81386 | GW | 121 | A | 45.1410128 | -87.8558495 | PORTERFIELD |
| 81402 | GW | 120 | A | 45.1410128 | -87.8558495 | LAKE |
| 81403 | GW | 122 | A | 45.1375 | -87.8712608 | LAKE |
| 81404 | SP | 3 | D | 45.1227443 | -87.8084148 | PORTERFIELD |
| 89662 | NN | 2 | C | 45.1410223 | -87.8296914 | LAKE |

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

# Site Investigation Work Plan Preparation Checklist Wis. Admin. Code § NR 716.07

Form 4400-316 (R 07/19)



## Wisconsin DNR – NR 700 Process

**Remediation and Redevelopment Program** **April 2019**

### Purpose

This guidance is offered as an optional tool to help develop and review site investigation work plans for compliance with Wis. Admin. Code ch. NR 716 Site Investigation requirements. Consultants may choose to use this checklist as an outline for preparation of the site investigation work plan. Use of this checklist is not required. Rule citations are added for clarity. The checklist is meant for use with Wis. Admin. Code § NR 716.09 and other site investigation related guidance. For more comprehensive site investigation related information, visit our web page at dnr.wi.gov and search: "site investigation."

| **Receipt of Site Investigation Work Plan** NR 716.09 (1) | | **Comments** |
|---|---|---|
| ☐ NR 716.09 (1) | Within 60 days of receipt of RP letter, or other notification that a site investigation is required | |
| ☐ NR 716.09 (1), NR 700.11 (3g) | One paper copy | |
| ☐ NR 716.09 (1), NR 700.11 (3g) | One electronic copy | |
| ☐ NR 749 | Review fee, if review by DNR is requested | |
| **Purpose** NR 716.01 | | **Comments** |
| ☐ NR 716.01 | Proposed investigation will define the nature, degree and extent of contamination | |
| ☐ NR 716.01 | Proposed investigation will define the source or sources of contamination | |
| ☐ NR 716.01 | Proposed investigation will determine the need for an interim and/or remedial action | |
| ☐ NR 716.01 | Proposed investigation will provide information needed to select an interim and/or remedial action | |
| **Contents** NR 716.09 (2) | | **Comments** |
| ☐ NR 716.09 (2) (a) | Site name and address | |
| ☐ NR 716.09 (2) (a) | Site location – ¼ ¼ section, Township, Range, County | |
| ☐ NR 716.09 (2) (a) | WTM coordinates | |
| ☐ NR 716.09 (2) (b) | RP's name and address (May be more than one RP – current property owner, lessee, operator, other RP.) | |
| ☐ NR 716.09 (2) (b) | Consultant or contractor's name and address | |
| ☐ NR 716.09 (2) (c) | Site location on a USGS topo map | |
| ☐ NR 716.09 (2) (c) | Site layout map(s) with: buildings, roads, discharge location & other relevant site features | |
| ☐ NR 716.09 (2) (d) | Scoping of the Investigation: | |
| ☐ NR 716.07 (1) | • History of the site or facility, including land uses that may have one or more associated hazardous substance discharges or environmental pollution, including emerging contaminants such as PFAS | |
| ☐ NR 716.07 (2) | • Type and amount of contamination, if known | |

| **Contents** (continue) NR 716.09 (2) | | **Comments** |
|---|---|---|
| ☐ NR 716.07 (3) | • History of previous hazardous substance discharges or environmental pollution | |
| ☐ NR 716.07 (4) | • Environmental media affected or potentially affected by contamination | |
| ☐ NR 716.07 (5) | • Location of the site or facility and its proximity to other sources of contamination | |
| ☐ NR 716.07 (6) | • Need for permission from property owners to allow access to the site or facility and to adjacent or nearby properties | |
| ☐ NR 716.07 (7) | • Potential or known impacts to receptors, including buildings, utilities or other subsurface improvements, and water supply wells within 1,200 feet of outermost edge of contamination | |
| ☐ NR 716.07 (8) (a), (b), (c), (d) | • Potential for impacts to sensitive species, habitats or ecosystems, wetlands, resource waters, sites of historical/archaeological significance | |
| ☐ NR 716.07 (9) | • Potential interim and remedial actions applicable to the contamination | |
| ☐ NR 716.07 (10) | • Immediate or interim actions taken or in progress, including any evaluations made of whether an interim action is necessary | |
| ☐ NR 716.07 (11) | • Any other items, including climatological conditions and background water or soil quality info that may affect the scope or conduct of the investigation | |
| ☐ NR 716.07 (12) | • Need to gather data to determine the hydraulic conductivity of materials where contaminated groundwater is found | |
| ☐ NR 716.09 (2) (e) | Physiographical and geological setting of the site necessary to choose sampling methods and locations, including: | |
| ☐ NR 716.09 (2) (e) 1. | • Existing topography, including prominent topographic features | |
| ☐ NR 716.09 (2) (e) 2. | • Surface water drainage patterns and significant hydrologic features, such as surface waters, springs, drainage basins, divides, wetlands, floodplain or floodway | |
| ☐ NR 716.09 (2) (e) 3. | • Texture and classification of surficial soils | |
| ☐ NR 716.09 (2) (e) 4. | • Nature and distribution of geologic materials, including the thickness and type of unconsolidated materials and type and nature of bedrock | |
| ☐ NR 716.09 (2) (e) 5. | • General hydrogeologic information | |
| ☐ NR 716.09 (2) (e) 6. | • Potential hazardous substance migration pathways | |
| ☐ NR 716.09 (2) (f) | Sampling and analysis strategy to be used during the field investigation, including: | |
| ☐ NR 716.09 (2) (f) 1. | • Description of the investigative techniques to be used to characterize the site or facility | |
| ☐ NR 716.09 (2) (f) 2. | • Site layout map(s), in planimetric and vertical views, with locations from which samples of environmental media will be obtained or a description of the strategy to be used for determining sample locations | |

| **Contents** (continue)<br>NR 716.09 (2) | | **Comments** |
|---|---|---|
| ☐ NR 716.09 (2) (f) 3. | • Description of sampling methods to be used, including methods for collecting, preserving, and delivering samples and leak detection methods (for vapor sampling) | |
| ☐ NR 716.09 (2) (f) 4. | • List of the parameters for which samples will be analyzed, analytical methods to be used including method detection limits | |
| ☐ NR 716.09 (2) (f) 5. | • Description of quality control and quality assurance procedures to be used per sampling method, including the items listed in NR 716.13 | |
| ☐ NR 716.09 (2) (f) 6. | • Description of procedures to prevent cross-contamination between samples | |
| ☐ NR 716.09 (2) (f) 7. | • Description of the type of investigative wastes that will be generated during the site investigation and how they will be collected, stored, transported, treated or disposed | |
| ☐ NR 716.09 (2) (f) 8. | • Discussion of how the sampling and analysis results will be related to previous investigations at the site or facility and how the results will be used to determine the degree and extent of contamination and the selection of a remedial action, including natural attenuation, where appropriate | |
| ☐ NR 716.09 (2) (g) | Description of other procedures to be used for site management, including erosion control and repair of structural, soil or ground disturbance | |
| ☐ NR 716.09 (2) (h) | Schedule for conducting the field investigation and reporting the results to the DNR | |
| ☐ NR 712 | Certification of professional(s) that will conduct or supervise the work necessary to obtain data, develop conclusions and recommendations, and prepare the site investigation submittal, per Wis. Admin. Code NR 712 | |

# APPENDIX B

WDNR Notice of Proposed Guidance (Site Investigation Scoping: Identifying Contaminants of Concern; RR-19-0101-D)

# WISCONSIN DEPARTMENT OF NATURAL RESOURCES
# NOTICE OF PROPOSED GUIDANCE

*Pursuant to s. 227.112, Wis. Stats., the Wisconsin Department of Natural Resources is hereby seeking comment on the following proposed guidance document.*

## DOCUMENT ID

RR-19-0101-D

## DOCUMENT TITLE

Site Investigation Scoping: Identifying Contaminants of Concern

## BACKGROUND/SUMMARY

Guidance to help select appropriate chemicals for analysis and identify potential contaminants of conern in a Wis. Admin. Code ch. NR 716 site investigation.

## STATUTORY AUTHORITY OR LEGAL CITATION

Wis. Stat. 292.63; Wis. Admin. Code NR 747

## PROGRAM/BUREAU

Remediation and Redevelopment

## STAFF CONTACT & EMAIL ADDRESS (FOR PUBLIC COMMENTS)

DNRRRGuidance@wisconsin.gov

Please use subject line: “RR-19-0101 Comments”

## DATE SENT TO LEGISLATIVE REFERENCE BUREAU (FOR PUBLIC COMMENTS)

September 16, 2019

# Site Investigation Scoping: Identifying Contaminants of Concern, Wis. Admin. Code § NR 716.07

**Purpose**

This guidance can help select the appropriate chemicals for analysis in a Wis. Admin. Code ch. NR 716 site investigation. Identifying the potential contaminants of concern is an important first step in any site investigation and is needed to comply with the following regulatory requirements:

- Scope and develop a workplan for a site investigation based on knowledge of the type of contamination (Wis. Admin. Code §§ NR 716.07 and 716.09(2)(f)).
- Select and use laboratory methods that are suitable for the type and anticipated levels of contamination (Wis. Admin. Code § NR 716.13).

In Wisconsin, responsible parties (RPs) and their environmental consultants are required to evaluate all relevant factors in scoping a site investigation under Wis. Admin. Code NR § 716.07 to ensure that the scope and detail of the field investigation are appropriate for the complexity of the site or facility. Wis. Admin. Code §§ NR 716.09 and NR 716.15 require RPs to develop and submit to the department both a site investigation (SI) work plan and report which evaluate the "history of the site or facility, including industrial, commercial or other land uses that may have been associated with one or more hazardous substance discharges at the site or facility."

This guidance was developed to assist RPs and consultants identify the types of hazardous substances and/or environmental pollution that may be appropriate to include in the SI workplan and report based on a site or facility's history and use. Table 1 of this guidance summarizes substances commonly associated with certain types of industry and/or land use. This table functions as a general guide for department staff, RPs, and consultants, and should not be used as a definitive list of substances that will always be present or absent at a site.

It is important to note that inclusion of a type of industry or land use on the table does not mean a discharge of a hazardous substance or environmental pollution has or has not occurred at a facility or site. The table is simply a guide to present common substances that may be associated with a particular industry or land use. Analysis for all parameters listed in the table for a specific site activity is not required. However, if listed parameters are not included in the SI workplan and report, consultants may wish to provide an explanation of why a given parameter was omitted. For example, if an RP is addressing contamination at a dry-cleaning facility, the department expects the RP to sample for tetrachloroethene (PCE). Further, if an RP is submitting an SI workplan for a shooting range, the department expects the RP to include sampling for lead in the work plan.

## Contaminants with and without Numeric Cleanup Standards

The potential contaminants of concern for a site may include chemicals that currently do not have promulgated numeric cleanup standards. This is often the case for emerging contaminants such as per and poly-fluoroalkyl substances (PFAS). Contaminants resulting from environmental pollution and/or a hazardous substance discharge to the environment must be assessed in an investigation even if they do not have a cleanup standard.

## Contaminants with and without Numeric Cleanup Standards

When there is evidence of environmental pollution and/or a discharge of a hazardous substance, the DNR has authority to require that the RP address the discharge and/or pollution and can require that the RP develop site-specific cleanup levels for contaminated environmental media, per Wis. Admin. Code § NR 722.09.

In Wisconsin law, the definitions of "environmental pollution" and "discharge" of a "hazardous substance" are not the same as the definition of a hazardous substance in the federal Superfund law and in some other states' laws. In Wisconsin:

"**Environmental pollution**" means the contaminating or rendering unclean or impure the air, land or waters of the state, or making the same injurious to public health, harmful for commercial or recreational use, or deleterious to fish, bird, animal or plant life. See Wis. Stats. § 292.01(4).

"**Discharge**" means, but is not limited to, spilling, leaking, pumping, pouring, emitting, emptying or dumping. See Wis. Stats. § 292.01(3).

"**Hazardous substance**" means any substance or combination of substances including any waste of a solid, semisolid, liquid or gaseous form which may cause or significantly contribute to an increase in mortality or an increase in serious irreversible or incapacitating reversible illness or which may pose a substantial present or potential hazard to human health or the environment because of its quantity, concentration or physical, chemical or infectious characteristics. This term includes, but is not limited to, substances which are toxic, corrosive, flammable, irritants, strong sensitizers or explosives as determined by the department. See Wis. Stats. § 292.01(5).

**What are "emerging contaminants?"**

Emerging contaminants are generally substances that may be found in the environment – the air, land or water – and where the state or federal regulatory authorities may have: (a) limited health or toxicological data; (b) limited sampling and analytical protocols; and/or (c) no promulgated, numeric cleanup standard to assist in adequately assessing and responding to these substances.

Emerging contaminants are important because the risk they pose to human health and the environment is not yet fully understood and systems may not be in place to address them.

For additional information, see EPA's "Emerging Contaminants and Federal Facility Contaminants of Concern" web page at https://www.epa.gov/fedfac/emerging-contaminants-and-federal-facility-contaminants-concern.

**Reporting discovery of a hazardous substance discharge, including emerging contaminants:**

Hazardous substances and environmental pollution may include emerging contaminants. In Wisconsin, persons responsible for the discharge of a hazardous substance to the air, land or waters of the state **shall notify the department immediately**, conduct a site investigation, determine the appropriate clean-up standards for the hazardous substance or environmental pollution in each media impacted (e.g., soil, groundwater, surface water and sediment), and conduct the necessary response actions. See Wis. Stats. §§ 292.11(2) and 292.11(3). Notification must be done in compliance with Wis. Admin. Code ch. NR 706; submittal of a Phase II environmental assessment or site investigation report does not satisfy the requirement to "immediately" notify the department.

## Laboratory Methods

Per Wis. Admin. Code § NR 716.13(2), all laboratory analyses must be completed by a Wisconsin certified lab meeting the criteria outlined in Wis. Admin. Code ch. 149. Work with the laboratory to select the appropriate sampling methods for the contaminant of concern at a site, the appropriate reporting limits, and to establish the correct sample preparation and hold times.

The EPA's *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods Compendium (SW-846) – Chapter 2: Choosing the Correct Procedure* provides further information.

In most cases, the list of chemicals reported by the lab for a method should be kept broad in the initial sampling until the sources and contaminants of a concern have been defined. The analytes reported by the lab may be narrowed to specific subsets of parameters based on the results from the initial sampling (i.e. full VOCs list vs specific VOC list).

## Additional Information on Potential Sources

This section provides information on the common sources of contamination for chemicals in Table 1.

**Metals:** Metals are naturally occurring and can be found at elevated concentrations in combustion residuals, waste streams from certain manufacturing operations (e.g. chromium plating), and discharges of products containing metals (e.g. leaded gasoline).

**RCRA 8:** This is a prescribed list of metals that includes: arsenic (As), barium (Ba), cadmium (Cd), chromium (Cr), lead (Pb), mercury (Hg), selenium (Se) and silver (Ag). Professional judgement should be exercised when determining whether the full suite of analytes in the RCRA 8 list should be considered based on site activity and potential sources. Analysis for all RCRA 8 metals is often appropriate for evaluating discharges of combustion residuals.

**Arsenic:** Inorganic arsenic compounds were mainly used to preserve wood. Organic arsenic compounds are used as pesticides, primarily for cotton and orchards, and are in residual products of coal combustion. The most common forms of arsenic in the environment are arsenite (As+3) and arsenate (As+5).

**Mercury:** Mercury impacts are most often associated with emissions from the burning of fossil fuels and where mercury-based compounds were used as fungicides in agriculture.

Discharges of elemental mercury can also occur. Elemental mercury is a shiny, silver-white metal that is a liquid at room temperature, and was used in older thermometers, fluorescent light bulbs and some electrical switches. When spilled, elemental mercury breaks into smaller mobile droplets and can evaporate to become an invisible, odorless, toxic vapor.

**Hexavalent Chromium:** Hexavalent chromium was used historically in the chrome plating of metals, as an ingredient in dyes and pigments, in the leather tanning process, and as a wood preservative.

Chromium primarily exists as two oxidation states, trivalent Cr(III) and hexavalent Cr(VI). Hexavalent chromium is a much more toxic and soluble form of chromium and will often reduce to the more stable and less soluble form, Cr(III), when electron donors are available.

**Cyanide:** Cyanide is a chemical compound that contains one carbon and one nitrogen atom. Cyanide may be used in electroplating, treatment and cleaning of metals, and as an insecticide for fumigating enclosed spaces. Cyanide may also be found in water discharged from organic chemical industries, iron and steel works, and wastewater treatment.

**VOCs:** Volatile Organic Compounds (VOCs) are a class of contaminants commonly associated with discharges of solvents, petroleum fuels, oils, and other hydrocarbons. The list of VOCs reported by the laboratory is typically left broad during site discovery and initial site investigation activities but, can be narrowed to a specific list of parameters based on site history and the results from the initial sampling.

**n-nonane:** A component in petroleum fuel (~0.4% in gasoline, ~0.4% in diesel and ~2% in kerosene), paint thinners (1 to 6%), mineral spirits (~10%), and Stoddard solvents (1 to 5%). Most hydrocarbons in Stoddard solvent and mineral spirits will not be detected in a standard VOC scan[1]. When investigating discharges of mineral spirits and Stoddard solvent, analysis for n-nonane is recommended to determine the degree and extent of contamination. Upon request, some laboratories will report n-nonane in their VOC analysis.

**1,4-Dioxane:** Used primarily as a stabilizer in solvents like 1,1,1-trichlorethane and trichloroethene, and as a solvent in lacquers, paints, resins, and in surfactants and detergents. It is known to be present in greases, dyes, paint stripping, antifreeze, cosmetics, shampoos, pharmaceuticals, and pesticides. 1,4-dioxane should be looked for in the site discovery and initial investigation for any of these types of sites. (Note, liquid detergents [e.g. Dawn and Liquinox] contain some 1,4-dioxane and use of these detergents should be avoided during sampling and analysis). For more information, see USEPA 1,4-Dioxane Factsheet[2].

**SVOCs:** Semi-volatile Organic Compounds (SVOCs) encompass a broad range of potential contaminant sources including phenols, cresols, extractable pesticides, and PAHs. This broad suite of chemicals is typically analyzed during site discovery and initial site investigation activities. Once the results from the initial sampling are available, the SVOCs reported by the lab can be narrowed to a specific list of parameters based on the initial findings.

**PAHs:** Polycyclic aromatic hydrocarbons (PAHs) refer to a large class of organic compounds that contain only carbon and hydrogen, and are comprised of two or more fused aromatic rings. PAHs are seldom found separately; rather, they occur as complex mixtures in the environment. PAHs are primarily classified as petrogenic or pyrogenic.

- Petrogenic PAHs are generated from geological processes and are associated with fossil fuels. Petrogenic PAHs can be found at discharges of unprocessed coal and crude oil, and refined petroleum products (e.g. gasoline, diesel, motor oil, home heating oil, lubricants and asphalt).
- Pyrogenic PAHs are generated by high temperature combustion of organic matter. Pyrogenic PAHs can form from natural sources (e.g. forest and grass fires), but mainly come from anthropogenic sources; such as residential wood burning, engine exhausts, coal-fired power plant emissions, coke-oven emissions, coking plant byproduct, creosote, and coal tar.

There are hundreds of chemicals comprising the PAH class, but the specific number remains unknown. A total of 18 PAHs are typically analyzed for in soil and groundwater. Remediation and Redevelopment's program guidance RR-087[3], *Calculating Soil RCLS for PAHs* includes a list of the 18 PAHs typically analyzed.

[1] At sites where GRO and VOCs are both collected, it is typically noted that GRO results > sum of the VOCs. This shows that the standard VOC analysis leaves out many compounds, one of which is often n-nonane.

[2] https://www.epa.gov/sites/production/files/2014-03/documents/ffrro_factsheet_contaminant_14-dioxane_january2014_final.pdf

[3] http://dnr.wi.gov/files/PDF/pubs/rr/RR087.pdf

**PCBs:** Polychlorinated Biphenyls (PCBs) are a group of synthetic chemicals comprised of carbon, hydrogen, and chlorine. PCBs were manufactured from 1929 to 1979 for their non-flammability, chemical stability, and electrical insulation. Although no longer manufactured, PCBs may be present in products produced before 1979 (e.g. transformers and capacitors, hydraulic oils, oil-based paint, carbonless copy paper, caulking, adhesives and tapes), and found as contaminants at sites with these products, or where improper management or disposal of waste containing PCBs occurred.

PCBs are typically discussed in terms of congeners and Aroclors. A PCB congener is a single, uniquely well-defined compound, of which there are 209. PCBs were typically manufactured as a mixture of congeners and sold under trade names. The most common was the Aroclor series, of which there are 16 common name Aroclor mixtures. Laboratory analysis for PCBs can be done to identify congeners or Aroclors. For more information, see U.S EPA PCB Website[4].

**PFAS:** Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) are a large class (thousands of compounds) of synthetic organic chemicals comprised of a fluorinated carbon chain with a functional group at the end of the carbon chain. The specific name of a PFAS is determined by the length of its carbon chain, whether the carbon chain is fully (per) or partially (poly) fluorinated, and the type of functional group. Perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) are two of the commonly referenced PFAS.

PFAS are produced and used for their properties including oil and water repellency, temperature resistance, and friction reduction. PFAS have been found at high concentrations at sites where the chemicals were manufactured and disposed, fire training areas that use Aqueous Film Forming Foam (AFFF), and disposal areas for waste containing PFAS (e.g. tannery materials treated with PFAS). PFAS also have the potential to be contaminants at sites which used them in their manufacturing process (e.g. coatings for textiles, paper products and cookware, and a range of industrial applications; aerospace, photographic imaging, semiconductor, automotive, construction, electronics and aviation). For more information, see ITRC PFAS Factsheets[5].

**Dioxin/Furan:** Dioxin and furans refer to a family of toxic chemicals with similar chemical structure. Most are not created intentionally but are formed during chlorine bleaching of pulp and paper, copper smelting, chemical manufacturing, cement kiln burning, coal-fired electricity generation, manufacturing of chlorine-containing chemicals and polyvinyl chloride, and incineration of waste. Dioxins are highly toxic and take a long time to break down in the environment. For more information, see the U.S. EPA Dioxin Website[6], ASTDR Dioxin Website[7] and ASTDR Furan Website[8].

**Glycol:** Glycol is class of organic compounds in the alcohol family, where two hydroxyl (−OH) groups are attached to different carbon atoms. The term glycol is often applied to the simplest member of the class, ethylene glycol. Ethylene glycol is a prominent component in de-icing fluids and antifreeze, and is also used as a moisturizer in funeral homes.

**Ammonia:** Ammonia is a compound comprised of one nitrogen and three hydrogen atoms. Approximately 90% of the ammonia that is commercially produced is used as fertilizer. The other 10% is used as corrosion inhibitor, household cleaner, refrigerant, and in the pulp and paper, metallurgy, rubber, and textile and leather industries.

[4] https://www.epa.gov/pcbs/learn-about-polychlorinated-biphenyls-pcbs
[5] https://pfas-1.itrcweb.org/fact-sheets/
[6] https://www.epa.gov/dioxin
[7] https://www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=63
[8] https://www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=194

**Nitrate:** Nitrate is a compound comprised of one nitrogen and three oxygen atoms. A majority of nitrate in the environment comes from breakdown of inorganic (ammonium and urea) fertilizers. Other uses included herbicides, insecticides, food preservative for cured meats and beverages, and munitions or explosives.

**Phosphorus:** Phosphorus is an element that is most commonly associated with fertilizer. Other uses include detergents, pesticides, and steel production, explosives, and pyrotechnics.

**Pesticides:** This includes a wide range of herbicides, fungicides, and pesticides. For the Dept. of Agriculture, Trade and Consumer Protection's standard list of pesticide analytes, refer to DATCP's website[9]. There are many lab method(s) to consider depending on the pesticide source, so it is important to work with the laboratory to select the appropriate method(s) for a specific site.

**GRO and DRO:** Do not have regulatory standards. However, they may by useful parameters during site discovery and investigation to determine if a discharge has occurred, and to estimate the extent of contamination. After initial site screening and discovery are complete, analyses for other specific parameters are typically needed to determine the extent of contamination over cleanup standards and to select cleanup goals and remedial alternatives.

> **GRO:** Gasoline Range Organics (GRO) quantifies the total hydrocarbons within the range of $C_6$ - $C_{10}$ and a boiling point range between approximately 60°C and 220°C. GRO is a good screening tool to identify impacts associated with discharges of gasoline, chlorinated solvents, ketones, ethers, mineral spirits, Stoddard solvents, and napthas.
>
> **DRO:** Diesel Range Organics (DRO) quantifies the total hydrocarbons within the range of $C_{10}$ - $C_{28}$ and a boiling point range between approximately 170°C and 430°C. DRO is a good screening tool to identify impacts associated with discharges of diesel fuel, chlorinated solvents, phenols, phthalate esters, polycyclic aromatic hydrocarbons, kerosene, fuel oils, and heavier oils.



[9] https://datcp.wi.gov/Documents/ACCPAnalytesLabs.pdf

# Table 1
# Potential Contaminants of Concern

| Current & Historical Site Activity | Metals and CN | | Organics | | | | | | | | | | | Inorganics | | | | Other | | | Screening | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Metals | Cyanide | VOCs | VOC ( n-nonane) | VOC (1,4-Dioxane) | CVOCs | PVOCs | SVOCs | PAHs | PCBs | PFAS | Dioxin/Furan | Glycol | Ammonia | Nitrate | Phosphorus | Asbestos | Pesticides | Radiation | Explosives | GRO ($C_6$ - $C_{10}$) | DRO ($C_{10}$ - $C_{28}$) |
| **Adhesives** | | | • | | | | | • | | • | • | | • | | | | | | | | | |
| **Agricultural**[1] | • As, Hg, Pb | | | | | | | | | | | | | • | • | • | | • | | | | |
| **Airports** | | | • | • | • | | | | | | • | | • | | | | | | | | • | • |
| **Anti-fogging films** | | | | | | | | | | | • | | | | | | | | | | | |
| **Auto/Boat Manufacturing or Repair** | • RCRA 8[2] | | • | | | | | | • | • | | | | | | | | | | | • | • |
| **Cement Additives** | • RCRA 8[2] | | | | | | | | • | | • | | • | | | | | | | | | |
| **Chemical Production**[3] | | | | | | | See Note 3 | | | | | | | | | | | | | | | |
| **Cleaning Products (Industrial & Household)** | | | • | | | | | | | | • | | | • | | • | | | | | | |
| **Combustion (e.g. coal, oil, or wood)** | • RCRA 8[2], Al, Co, Cu, Zn | | | | | | | | • | | | • | | | | | | | | | | |
| **Cosmetics and Personal Care Products** | • RCRA 8[2] | | • | | • | | | • | | | • | | • | | | | | | | | | |
| **Dry Cleaning** [4] | | | • | • | • | • | | | | | • | | | | | | | | | | | |
| **Electrical Transformers** | | | • | • | | | | | | • | | | | | | | | | | | • | • |
| **Electronic Industry (Production, Recycling)** | • RCRA 8[2] | | • | | | | | | | • | • | | | | | | | | | | • | • |
| **Etching** | • RCRA 8[2] | | • | | | | | | | | • | | | • | | | | | | | | |
| **Fire Training & Products** | • RCRA 8[2] | | • | | | | | | • | | • | | | | | | | | | | • | • |
| **Funeral Home/Morturary** | | | • | | | | | • | | | | | • | | | | | | | | • | • |
| **Furniture Refinishing** | • RCRA 8[2] | | • | • | • | | | | | | • | | | | | | | | | | • | |
| **Manufactured Gas Plant (MGP)** | • As, Cr, Hg | • | • | | | | | • | | • | | | | • | | | | | | | • | • |
| **Medical** | • RCRA 8[2], Co | | • | | | | | • | | | • | • | | | | | | | • | | | |
| **Metal Casting (Foundry)** | • RCRA 8[2], Al, Zn | | • | | | | | | • | | • | | | | | | | | | | | |
| **Metallurgical Processes (e.g. smelting, plating, refining)** | • RCRA 8[2], Al, Co, Cu, Zn, | • | • | | | | | • | | • | • | • | | • | • | • | | | | | | |
| **Mining Industry** | • RCRA 8[2], U, Al, Fe, Ni, Cu, Zn | • | • | | | | | | | | • | | | • | • | | | | | • | | |
| **Paint and Printing (surface coatings, paint, varnish, inks, enamels)** | • RCRA 8[2] | | • | | • | • | • | • | • | • | • | | | | | • | | | | | • | • |
| **Pesticides** | • RCRA 8[2] | | • | | | | | | | | • | | | | | | | • | | | | |
| **Petroleum & Refineries** | | | | | | | | | | | | | | | | | | | | | | |
| **Fuel Oil and Diesel Fuel** | | | • | • | | | • | | • | | • | | | | | | | | | | | • |
| **Gasoline (including E-85 Fuel)** | • Pb[5] | | • | | | | • | | | | • | | | | | | | | | | • | |
| **Kerosene and Aviation Fuel** | | | • | | | | • | | | | • | | | | | | | | | | • | • |
| **Mineral Spirits and Stoddard Solvent** | | | • | • | | | • | | | | • | | | | | | | | | | • | |
| **Waste Oil** | • RCRA 8[2], Cu, Ni, Ag, Zn | | • | • | | | • | | • | • | • | | | | | | | | | | • | • |
| **Photographic Industry** | • RCRA 8[2] | | • | | • | • | | | | | • | | | | | | | | | | | |
| **Plastics, Resins, and Rubber** | • RCRA 8[2] | | • | | | | | | | | • | | | | | | | | | | | |
| **Pulp and Paper, Cardboard Packaging** | • Hg | | | | | | | | | • | • | • | | • | • | • | | | | | | |
| **Railroad - Line and Switch/Maint Yard** | • RCRA 8[2] | | • | | | | | • | | | | | | | | | | | | | • | • |
| **Semiconductor Industry** | • RCRA 8[2] | | • | | • | • | | | | | • | | | | | | | | | | | |
| **Shooting Ranges/Gun Clubs** | • See ITRC, 2005[6] | | | | | | | | • | | | | | | | | | | | • | | |
| **Tannery** | • Cr | | | | | | | • | | | • | | | | | | | | | | | |
| **Textiles, stain and water repellants** | • RCRA 8[2], Cu, Ni, Co | | • | • | | | | | | | • | • | | | | | | | | | | |
| **Tombstone (Cemetery Monument) Maker** | | | • | | | | | | | | | | | | | | | | | | | |
| **Waste** | | | | | | | | | | | | | | | | | | | | | | |
| **Junk/Salvage Yard** | • RCRA 8[2] | • | • | • | • | | | • | | • | | | • | | | | • | | | | • | • |
| **Landfills and other waste disposal** | • RCRA 8[2] | • | • | • | • | • | • | • | • | • | • | • | | • | • | | | | | | • | • |
| **Wood Treatment / Preservation** | • As, Cr, Cu | | • | • | | | | • | • | | | • | | | | | | | | | • | • |

[1] Agricultural: The DATCP oversees cleanup of fertilizer and non-household pesticides, per Wis. Stat. § 94.73 and Wis. Admin. § ATCP 35.

[2] RCRA 8: Analysis of the full suite of metals in the RCRA 8 list may not always be necessary.

[3] Chemical Production: Potential contaminants of concern will be specific to the process and type of chemicals manufactured at the site.

[4] Dry cleaning solvents were often tetrachlorethene (PCE) or Stoddard solvent.
Other dry cleaning industries include formal ware, uniform rental, drapery cleaners, commerical rug cleaning, stain treatment, and water proofing.

[5] The DATCP's Tank System Site Assessment (TSSA) defines analyses to close certain underground storage tanks. TSSA is not equivalent to a NR 716 Site Investigation.

[6] ITRC, 2005 *Environmental Management at Operating Outdoor Small Arms Firing Ranges* Table 2-1 provides a summary of the metals potentially found at ranges.

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