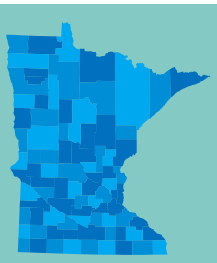
PFAS planning

March 2022

PFAS Monitoring Plan

A path forward for PFAS monitoring at solid waste, wastewater, and stormwater facilities, hazardous waste landfills, facilities with air emissions, and sites in the Brownfield or Superfund programs.

MINNESOTA POLLUTION CONTROL AGENCY



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Introduction

What are PFAS?

Per- and polyfluoroalkyl substances (PFAS) are a large group of manmade chemicals containing at least one fully fluorinated carbon in a chain attached to a "functional group" that has specific characteristics. Invented in the 1930s, PFAS have been used in multiple applications across many industries. PFAS are desirable in commercial and industrial applications because of their durability, but that durability also means that they do not readily break down over time in environmental conditions. In addition, they are not easily removed through conventional pollution treatment at facilities like wastewater treatment plants (WWTP). The persistence of PFAS in the environment has led to the nickname of "forever chemicals."

PFAS are unlike other classes of environmental contaminants in terms of the number of unique structures in the group, their persistence in the environment, and their widespread use. There are currently over 5,000 PFAS structures included in the U.S. Environmental Protection Agency's (EPA) master list of structurally defined PFAS, and over 9,000 identified PFAS chemistries. New PFAS are being invented, used in industry, incorporated into commercial products, and released to the environment every day.

Minnesota's PFAS Initiatives

Minnesota's PFAS Blueprint, released in February 2021, provides more information about PFAS toxicity and their occurrence in Minnesota.[1] In addition, it lays out the state's approach to managing and addressing PFAS. Across the topics covered by the PFAS Blueprint, themes emerge among the needed actions. These include:

- Pollution prevention
- Investigation of PFAS discharges
- Environmental monitoring
- Toxicity research
- Regulatory development

The Minnesota Pollution Control Agency (MPCA) has developed this cross-program PFAS Monitoring Plan as part of ongoing work to investigate PFAS discharges, which the Blueprint further described as working to understand "the wide range of places where PFAS have been or are currently used and how these uses result in PFAS releases to the environment." The PFAS Monitoring Plan will provide the initial understanding of PFAS presence (a necessary step to supporting pollution prevention) and identify scenarios where immediate measures to protect human health and the environment are necessary.

The MPCA has received funding for various other initiatives related to PFAS. This includes:

- Funding for a source evaluation and reduction initiative to develop tools that improve the understanding of PFAS sources in two waste streams: municipal wastewater and solid waste.
- Funding to support the development of a protocol that uses available data to identify potential sources of PFAS in order to support multiple MPCA programs in making data-based interventions at the highest-impact sites.
- Funding under the Infrastructure Investment and Jobs Act, though additional information is pending on the allowable uses of these funds for various PFAS-related activities.

[1] *https://www.pca.state.mn.us/waste/minnesotas-pfas-blueprint*

Goals and objectives for PFAS monitoring

Across all our permitting and cleanup programs, the MPCA has general authority to take actions to protect human health and the environment. Understanding PFAS discharges through targeted sampling and monitoring is a key component of moving forward to address PFAS and minimize adverse impacts to human health and the environment.

The goals of the PFAS Monitoring Plan are:

1. Gather Minnesota-specific information in order to craft effective policies around PFAS and their incorporation into MPCA programs;
2. Identify areas of particular concern (due to PFAS concentrations or routes of exposure) that need quick action; and
3. Gather data that galvanizes support for PFAS source reduction and pollution prevention.

The MPCA chose to create this coordinated PFAS Monitoring Plan across all relevant programs in keeping with our commitment to address PFAS holistically. Crafting this plan across all programs allows us to ensure we are addressing key connections between programs.

We also recognize that the complexity of PFAS makes engagement with partners, stakeholders, and regulated facilities particularly critical. The MPCA held a multi-program kickoff meeting when beginning to develop this plan, and individual programs used a variety of tools to seek input – from hosting working groups, to information meetings, to sending out surveys. The input improved the draft plan, on which we also sought public input. Finally, we made additional adjustments to the final plan to reflect suggestions and feedback provided during the draft public input phase.

In developing this plan, we found consistent needs and themes across programs. Each detailed program plan is unique, however, due to different program needs and frameworks. Furthermore, no big picture plan will ever speak to the precise needs or situation of every individual facility, and individual considerations will be addressed as appropriate.

As PFAS regulations change, at both the state and federal level, monitoring needs will likely have to change to conform to regulatory requirements. However, at this time, this coordinated PFAS Monitoring Plan provides the best immediate path forward for better understanding PFAS entering Minnesota's environment.

PFAS Monitoring Plan – overview

This section provides an overview of what is being requested across all agency programs. Each program has a full plan, laid out in Appendices A through E.

What facilities and sites will be included in the Monitoring Plan?

The MPCA permits a broad range of facilities that discharge (or could discharge) pollutants into the environment – whether that be air, land, or water – and sets standards for cleanup of sites where contamination has already occurred. MPCA's permitting and remediation programs already require sources or sites to conduct sampling and reporting of multiple pollutants. These existing regulatory structures provide a framework in which to incorporate PFAS monitoring. Each program has a unique structure, with different types or tiers of permits, and each program covers a different number of sites or facilities. Each MPCA permitting program reviewed the broad range of facilities and sites that they permit in order to make decisions about where PFAS monitoring will be requested.

In considering how to prevent and manage PFAS pollution, the MPCA finds it useful to differentiate between industrial facilities that may be *sources* of PFAS pollution and facilities that are likely *conduits* for PFAS releases into the environment (usually waste management, recycling, or treatment facilities).

When looking for potential PFAS sources, MPCA programs generally chose to focus their PFAS monitoring strategy on facilities or sites related to those industry sectors that MPCA and EPA experts identified as likely to use, emit, or discharge PFAS based on media- and program-specific information. The programs relied on a shared set of North American Industry Classification System (NAICS) codes (Appendix F) to identify facilities or sites of potential concern. Because the uses and understanding of PFAS are ever-evolving, decisions about monitoring in the future may change, as new information about industrial PFAS uses is uncovered. Within the large list of facilities with NAICS codes associated with PFAS use, programs have committed to prioritizing staff time to implement monitoring based on current understandings of potential risk.

Programs regulating facilities that act as PFAS conduits chose to take a different approach. Because it is not always known what specific sources of industrial or commercial PFAS pollution may be causing elevated PFAS levels in the stormwater, leachate, contact water, biosolids or effluent generated by these "conduit" facilities, programs opted for a phased monitoring approach based on risk factors. Where possible, the initial phase of monitoring also focuses on areas with potential industrial impacts; for example, the municipal wastewater program is initially requesting monitoring PFAS in the influent to municipal facilities with delegated industrial pre-treatment programs or significant industrial users to understand PFAS incoming concentrations and identify potential upstream industry sources. Other programs prioritized monitoring based on the likelihood of environmental risk or harm. For solid waste facilities, that means prioritizing requesting monitoring at facilities with current land application of leachate, facilities with known leaks in the leachate collection system that are causing groundwater impairments, and unlined facilities.

This PFAS Monitoring Plan was developed with cross program coordination in an effort to avoid duplication of responsibilities for facilities that may be fall under two or more relevant programs (i.e., the Solid Waste Program, Wastewater Program, Industrial Stormwater Program, and the Air Program). The programs are coordinating monitoring requests in order to focus the monitoring in the area that is likely to be the most significant vector of PFAS release to the environment or the most likely to support source reduction activities. If a facility finds significantly elevated levels of PFAS in the monitored media, facility-specific actions will be taken to ensure that across all media, the facility is not currently posing a public health risk.

Altogether, this PFAS Monitoring Plan is designed to identify the largest and most environmentally significant sources of PFAS pollution as expeditiously as possible – working with waste management conduits to identify their upstream industrial sources, with industrial facilities or sites that may be directly releasing PFAS into the environment, and with responsible parties to address PFAS contaminated sites.

What materials will be monitored?

Each program has carefully considered what should be monitored at what phase in the process – incoming pollution, or outgoing discharges. The choices about which media will be monitoring are different depending on the types of facilities covered in the program. The choices also reflect which of the three main goals (support PFAS policy development, support PFAS source reduction, and identify areas of concern for human health or ecological exposure) the program finds their monitoring data are most needed to support first.

How frequently will monitoring occur?

Levels of PFAS in various media can change depending on the time of year, the weather, the activities occurring at industrial facilities, and other variables. It is important to collect a dataset robust enough to achieve the goals set out in this plan. In determining how frequently PFAS monitoring should be conducted, MPCA's permitting programs considered existing pollutant monitoring frequency and location reporting requirements; site remediation programs considered when and how sampling of pollutants and sites already occurs. PFAS monitoring and reporting requests will generally be aligned with existing monitoring and reporting that facilities already conduct for other pollutants. Aligning PFAS monitoring with other required monitoring and reporting will be efficient for both MPCA and permittees. Most programs aim to collect a baseline dataset over the course of four quarters to understand the current landscape of PFAS concentrations.

What methods will be available for monitoring?

Because many PFAS can be toxic at low levels and because PFAS can be ubiquitous in consumer products, accurately measuring PFAS at concentrations relevant to human health can be challenging. Significant gains have been made in the last 30 years to improve the technology and standardize the approaches to measuring PFAS. Analytical methods for PFAS continue to rapidly develop; MPCA's programs chose to rely on the labs accredited for PFAS analysis in Minnesota's Environmental Lab Accreditation Program (MNLAP) in their plans, which perform a number of PFAS analytical methods. Many regulatory programs only use EPA methods that are promulgated in the Code of Federal Regulations, but other methods are often available and valid for measuring a given set of analytes. EPA currently has standard (final, but not promulgated) analytical methods available for various environmental substrates including potable water (groundwater, treated drinking water; EPA 537.1 and EPA 533), and air (vapor phase, particulate-bound; EPA OTM 45). For non-potable water and solids, EPA has a draft method available (Draft EPA 1633), which will be finalized in fall 2022. The U.S. Department of Defense and the EPA are requiring use of EPA 1633 even before this method is finalized, and many other contract labs have similar methodologies for measuring PFAS in non-potable water that are currently approved by MNLAP. Even without the finalization of EPA Method 1633, environmental labs in Minnesota and elsewhere have PFAS analytical capability for all media included in Monitoring Plans.

MPCA published new PFAS sampling guidance and updated PFAS analytical guidance. The PFAS sampling guidance outlines best practices in sample collection for PFAS that minimize risk of contamination or sampling bias. The PFAS analytical guidance updates the current guidance available for measuring PFAS in various media

by incorporating information about the newest methods and best practices. These documents will continue to be updated as new information emerges.

For water-based samples, costs for PFAS monitoring will depend on the facilities' contracts with their chosen environmental consultant and the accredited lab for PFAS analysis. Typical costs for laboratory analysis of PFAS in water or solid media range from $300 to $500 per sample. Costs associated with measuring PFAS released from stacks are higher, and could exceed $30,000 per stack test.

How will MPCA use these monitoring data?

The monitoring data will be used to support the three main goals articulated above. All data gathered will help support future creation of effective policies around PFAS prevention, management, and clean up. Different programs have the ability to gather information that more clearly supports the other two goals – gathering data that PFAS supports source reduction and identifying areas of concern for PFAS exposure that warrant rapid follow-up actions.

At industrial facilities, PFAS monitoring will be used to identify scenarios where PFAS use and release can be eliminated or minimized. At conduits of PFAS releases to the environment, such as landfills, wastewater treatment plants, waste-to-energy facilities, and auto shredders, the monitoring data will be used to identify upstream PFAS sources so those sources can be targeted for reduction. The data may be used to further motivate bans on nonessential uses of PFAS in commercial and industrial products, especially those that appear to be disproportionately contributing to PFAS pollution in waste streams. Data gathered on environmental conditions will support actions, where needed, to address or prevent impacts to the health of humans, aquatic life, or wildlife.

How and when will this Monitoring Plan be implemented?

Acquiring PFAS monitoring data is critical to support the MPCA's overall goal to prevent, manage, and mitigate PFAS pollution and by extension, fulfill MPCA's mission to protect human health and the environment. The implementation of MPCA's PFAS Monitoring Plan will coincide with the implementation of EPA's PFAS Roadmap.[2] As EPA implements their roadmap from 2021-2024, they will be laying the foundation for nation-wide regulation of PFAS across multiple federal programs. Collecting data on PFAS in Minnesota at this time will facilitate a smoother transition as PFAS move from "contaminants of emerging concern" to widely regulated chemicals under state and federal law.

Programs intend to work collaboratively with sites and facilities to effectively and efficiently acquire the needed information about PFAS at the site or facility. The first step will likely be notification to facilities that are identified for monitoring using the framework laid out in this plan. The specific mechanisms for acquiring the data will be considered as necessary in each program, and MPCA will use all of our key tools and authorities needed to ensure that the agency is provided the data important to meeting our mission. This plan itself does not establish any facility-specific requirements.

MPCA has demonstrated the need for gathering PFAS information from facilities and sites across our programs. This document lays out an overall approach to phasing-in monitoring based on potential risks and provides information about implementation schedules that will allow facilities and other responsible parties to understand the path forward. The timeline for implementation of the plans will vary by program and for

[2] *EPA. (2021). PFAS Strategic Roadmap: EPA's Commitments to Action 2021-2024. Retrieved from: https://www.epa.gov/pfas/pfas-strategic-roadmap-epas-commitments-action-2021-2024*

facilities within each program (*see* Appendixes A-D). Most plans have a phased implementation approach, with some period of initial monitoring followed by future decisions based on how the results compare to response thresholds. In some cases, these phases and processes are laid out in the current PFAS Monitoring Plan. In other cases, the future phases will be designed entirely based on the results of the initial baseline monitoring.

Appendix A – Air Program Plan

Introduction

The MPCA protects air quality by monitoring pollutants, making rules, enforcing laws to maintain air quality, and issuing permits to facilities to control air pollution. Beginning to monitor PFAS is an important component to protecting air quality and preventing PFAS contamination through atmospheric deposition.

MPCA has general authority to improve air quality, and both statutory and regulatory authority to authorize emissions reporting and testing under Minn. Stat. § 116.07, subd. 9; the performance test requirements outlined in Minn. R. ch. 7017; and the emissions inventory requirements outlined in Minn. R. ch. 7019.

PFAS are contaminants that easily cross media; for example, many PFAS emitted to the atmosphere are deposited on land where they can contaminate soil, surface water, and fish. Air emissions from stationary sources have caused widespread environmental contamination of multiple media in the surrounding region.[3] The MPCA's air program has begun to look at levels of PFAS in air through a one-year ambient air monitoring study to increase the understanding of PFAS sources, "background" levels in ambient air, and atmospheric transport. Data from this project, in conjunction with information from the PFAS Monitoring Plan, will help advance our understanding of PFAS in air emissions and air transport.

The goal of the PFAS Monitoring Plan for air is to understand release of PFAS emissions and mitigate risks posed 1) from inhalation of PFAS in the air[4] and 2) from exposure to PFAS in other media that resulted from air emissions. Production and release of PFAS to the air has resulted in a large reservoir of atmospheric PFAS that is deposited back to the surface through rain and dust settling.[5] Single industrial facilities have the potential to cause widespread environmental impacts when PFAS is released through air emissions and is deposited in soil or groundwater offsite, or is carried offsite by water runoff. Our understanding of PFAS releases to air and subsequent impacts to other media is less advanced than our understanding of direct PFAS discharges to water; however, MPCA has traced air emissions releases of PFAS constituents to water quality impairments in the state. Incidents of cross-media PFAS impacts are being discovered nationwide. Characterizing which permitted air facilities use PFAS products and may be releasing PFAS to the air is a key first step in reducing PFAS impacts to surrounding surface water, soil, and groundwater.

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[3] Chemical and Engineering News. 2020. PFAS pollution from Chemours plant distributed by air. Retrieved from: https://cen.acs.org/environment/persistent-pollutants/PFAS-pollution-Chemours-plant-distributed/98/i21; Science. 2020. Nontargeted mass-spectral detection of chloroperfluoropolyether carboxylates in New Jersey soils. Retrieved from: https://www.science.org/doi/abs/10.1126/science.aba7127

[4] The Minnesota Department of Health (MDH) is developing inhalation risk-based values for 6 PFAS (PFOA, PFOS, PFBA, PFBS, PFHxA, and PFHxS) which currently have oral (ingestion) health assessments. (See https://www.health.state.mn.us/communities/environment/risk/guidance/air/table.html#form). MDH is continuing to review the peer-reviewed literature for inhalation toxicity studies on other PFAS to determine if additional inhalation risk assessments are possible. MDH, EPA, and the Agency for Toxic Substances and Disease Registry (ATSDR) either have or are potentially working on health-based guidance values for three additional PFAS compounds – GenX (HFPO-DA), PFNA, and PFDA. Toxic effects from these compounds can occur from inhalation or ingestion exposures – given that these substances are known to not break down in the environment or in our bodies (i.e., they are not metabolized) and can transfer from air to soil, surface water, and groundwater, care must be taken to consider potential risks associated with both inhalation exposure associated with air emissions from a facility and secondary environmental exposures across other impacted media.

[5] Environmental Pollution. 2017. Atmospheric concentrations and trends of poly- and perfluoroalkyl substances (PFAS) and volatile methyl siloxanes (VMS) over 7 years of sampling in the Global Atmospheric Passive Sampling (GAPS) network. Retrieved from: https://doi.org/10.1016/j.envpol.2018.03.017

MPCA's air programs solicited and incorporated feedback from regulated stakeholders and the general public in the development and refining of the program's Monitoring Plan. In addition to the written public input period, MPCA sent a survey to facilities that may be covered by the air PFAS Monitoring Plan and conducted a public meeting on November 29, 2021. MPCA considered this feedback in finalizing the plan. The plan does not change any other stakeholder engagement opportunities, including those that are conducted around the annual air emission inventory or for changes to any MPCA rules.

What facilities will be included in the Monitoring Plan?

Monitoring will occur via two methods: emission inventory reporting and stack testing. Emissions inventory reporting is a process by which permitted and non-permitted air facilities estimate the amount of pollutants they are releasing. Performance testing is also known as stack testing or source testing, is the quantification, measurement or determination of the physical or chemical properties of a stationary source's emissions. There are roughly 2,000 permitted air facilities in Minnesota. This plan focuses on key facilities that, based on current industry knowledge and available data, are known or likely to be contributing to environmental PFAS pollution and exposure.

EPA and MPCA analyses have identified approximately 50 NAICS codes, corresponding to approximately 200 permitted air emission facilities, with higher likelihood of PFAS releases. These facilities were selected based on the type of facility (determined by primary NAICS codes). Direct communication with EPA Region 5, discussions with PFAS knowledge experts at the MPCA, data from the MPCA Air Emission Inventory and the National Emissions Inventory database, and collaboration between MPCA programs on their plans for PFAS monitoring, helped identify and support the identified list of approximately 50 NAICS codes on which to focus efforts. The list of NAICS codes representing the types of facilities is found in Appendix F. These facilities will be asked to report in their 2023 air emission inventory report (due April 1, 2024) emissions of the 50 PFAS Target Analytes from EPA's Other Test Method 45 (OTM-45). The process for reporting PFAS emissions will be the same as existing processes for submitting air toxics emissions. Should facilities that are considered to be high-risk for PFAS release not complete the emissions reporting, MPCA may consider additional options to acquire the information necessary to understand potential environmental risks.

Stack testing for PFAS will be requested at the subset of these facilities that regularly conduct stack testing (provided that the facility is not in-scope for baseline PFAS monitoring in another media that is potentially a more significant vector of release from the facility, *see* Appendixes B-D). The PFAS monitoring will be requested during the next regularly scheduled stack test that occurs after the air program begins implementation of this plan.

This plan was developed in coordination with other program plans to avoid duplication of responsibilities for facilities that may fall under two or more relevant programs (i.e., the Solid Waste Program, Industrial Wastewater Program, Industrial Stormwater Program, and the Air Program). Though some facilities may be asked to estimate PFAS air emissions while also being asked to participate in monitoring other program plans, the programs are coordinating monitoring requirements (i.e., stack testing in the air plan) such that phase one monitoring will be scoped in for the program plan associated with the media that is likely to be the most significant vector of PFAS release to the environment.

What materials will be monitored?

PFAS monitoring in the air program will take place in two parts – the first part focuses on PFAS emissions reporting (emissions inventory) and the second part will focus on PFAS stack testing. Monitoring of PFAS

emissions from permitted point source facilities will consist of quantifying air emissions of selected PFAS at identified facilities. Facilities without regular stack testing may be asked to take additional steps on source reduction in future phases of this plan based on the results of the emissions reporting.

How frequently will monitoring occur?

The facilities scoped into the PFAS Monitoring Plan will report at least the PFAS emissions of analytes identified in Table 1 on the 2023 air emission inventory and air emission inventories every third year after.

A subset of facilities scoped into the PFAS Monitoring Plan will be asked to perform OTM-45 stack tests the next time their permit requires any stack tests to be performed at the facility. At this time, stack testing for PFAS is voluntary, though the MPCA has the authority to request a stack test where it has been determined that emissions from a facility pose a possible environmental or public health concern. Future stack testing will be dependent on the initial testing results and on-going updates on PFAS health information, standards development, and dispersion modeling capabilities. Stack testing may also be informed based on the results of monitoring from other program Monitoring Plans, including industrial stormwater or industrial wastewater monitoring results.

What methods will be available for monitoring?

Annual emissions reporting uses a standard process to calculate emissions of air toxics. Emission inventory calculation methodology uses the following general hierarchy per Minn. R. 7019.3030:

1. Continuous emissions monitoring (CEM),
2. Stack test,
3. Material balance or MPCA-approved emission factor, and
4. MPCA-approved facility proposal.

CEM methods are not yet available for PFAS, so emissions reporting are likely to rely on estimates from stack tests or material balance/emission factor approaches.

Emissions reporting will be requested for the PFAS analytes included in EPA's Other Test Method 45 (OTM-45), which are copied in Table 1 for reference. Most stack testing companies have the ability to test for PFAS emissions using EPA's Other Test Method 45 (OTM-45) Measurement of Selected Per- and Polyfluorinated Alkyl Substances from Stationary Sources.[6] This method includes analysis of the nine compounds for which MDH, EPA, and ATSDR either have or are developing risk-based guidance values protective of human health: PFOA, PFOS, PFBA, PFBS, PFHxS, PFHxA, GenX (HFPO-DA), PFNA, and PFDA. The estimated cost for a stack test using OTM-45 is likely between $25,000 and $30,000, but may be higher.

Table 1. OTM-45 analyte list

Chemical name	CAS	Chemical name	CAS
PFBA	375-22-4	N-EtFOSE	1691-99-2
PFPeA	2706-90-3	MeFOSAA	2355-31-9
PFHxA	307-24-4	EtFOSAA	2991-50-6
PFHpA	375-85-9	4:2 FTS	757124-72-4
PFOA	335-67-1	6:2 FTS	27619-97-2

[6] *EPA (2021) Other Test Method 45 (OTM-45) Measurement of Selected PFAS from stationary sources.* *https://www.epa.gov/sites/default/files/2021-01/documents/otm_45_semivolatile_pfas_1-13-21.pdf*

Chemical name	CAS	Chemical name	CAS
PFNA	375-95-1	8:2 FTS	39108-34-4
PFDA	335-76-2	10:2 FTS	120226-60-0
PFUnDA	2058-94-8	ADONA	919005-14-4
PFDoA	307-55-1	HFPO-DA (GenX)	13252-13-6
PFTrDA	72629-94-8	9Cl-PF3ONS (F-53B Major)	756426-58-1
PFTeDA	376-06-7	11Cl-PF3OUdS (F-53 Minor)	763051-92-9; 83329-89-9
PFHxDA	67905-19-5	NFDHA	151772-58-6
PFODA	16517-11-6	PFEESA	113507-82-7
PFBS	375-73-5	PFDoS	1260224-54-1
PFPeS	2706-91-4	PFMBA	863090-89-5
PFHxS	355-46-4	PFMPA	377-73-1
PFHpS	375-92-8	PFecHS	67584-42-3
PFOS	1763-23-1	8:2 FTUCA or FOUEA	70887-84-1
PFNS	68259-12-1	10:2 FDEA	53826-13-4
PFDS	335-77-3	8:2 FTA or FOEA	27854-31-5
PFDoS	79780-39-5	6:2 FHUEA	70887-88-6
FOSA	754-91-6	6:2 FTCA or 6:2 FHEA	53826-12-3
MeFOSA	31506-32-8	3:3 FTCA	356-02-5
EtFOSA	4151-50-2	5:3 FTCA	914637-49-3
N-MeFOSE	24448-09-7	7:3 FTCA or FHpPA	812-70-4

How will MPCA use these monitoring data?

MPCA will use the emission inventory data and stack test data to determine current state of PFAS emissions from permitted facilities. This information will be used to help estimate risk and inform emissions reduction efforts at facilities acting as sources of PFAS into the environment. The data could also be used to help inform PFAS monitoring requests in other media, such as industrial stormwater and industrial wastewater. Finally, this information will inform MPCA if there are potential health risks posed by PFAS releases that warrant additional site investigations, potentially across media.

How and when will this Monitoring Plan be implemented?

Facilities will be notified that they are scoped into the air PFAS Monitoring Plan via a letter sent to the facility after this plan has been finalized. These facilities will be asked to report all PFAS emissions on the 2023 air emission inventory via the CEDR e-Services application. The due date of the 2023 air emission inventory will be April 1, 2024. The 2023 air emission inventory is an air toxics reporting year. All scoped-in facilities for stack testing will be asked to use the most comprehensive EPA PFAS test method the next time a stack test is required to be performed at the facility.

Appendix B – Wastewater Program Plan

Introduction

The MPCA has long-term goals to improve and maintain water quality, and a broad statutory mandate to prevent pollution to all waters of the state. The MPCA's wastewater program works to ensure that pollutants from industrial and municipal wastewater are managed so as not to cause adverse effects to Minnesota's water quality.

Reducing human health and ecological risks associated with PFAS discharges from wastewater facilities is a complex challenge. Monitoring to understand PFAS sources to wastewater facilities is part of this responsibility, and requires close collaboration between the agency, industrial and municipal wastewater treatment plants, and the significant industrial users that discharge to municipal wastewater facilities. The agency has broad statutory authority under Minn. Stat. § 115.03(b), to collect information "necessary or desirable … to prevent, control, or abate water pollution" from wastewater treatment plants. The MPCA also has specific regulations for biosolids under Minn. R. ch. 7041.

This PFAS Monitoring Plan takes a step-wise approach that allows for flexibility to assess and react to incoming data. The goal of the first phase of monitoring will be to identify PFAS sources coming into municipal wastewater plants and PFAS used at industrial facilities with wastewater permits. The first phase will develop a baseline understanding of influent concentrations at municipal plants and concentrations associated with process waste streams at industrial wastewater facilities – these data will inform source identification and reduction activities.

Future phases of monitoring will be informed based on the sources identified and source reductions realized in the first phase. The MPCA anticipates that it will be necessary to collect effluent and biosolids samples in future phases to further inform PFAS reduction efforts for wastewater discharges and assess risk. The development of water quality criteria or standards and completion of state or federal risk assessments for biosolids may lead to effluent and biosolids monitoring, effluent limitations, or land application thresholds for some facilities in the future.

The geographical scope of this PFAS Monitoring Plan includes those areas that: 1) do not currently have applicable ambient water quality criteria and 2) do not discharge to waterbodies impaired for PFOS.[7] MPCA has site-specific criteria for PFOS that apply to a small number of waterbodies, including Pool 2 of the Mississippi River and Lake Saint Croix. Permit conditions for facilities that directly discharge to these waterbodies and other water bodies that are impaired based on PFOS levels in fish tissue will be evaluated separately; monitoring will be included, where necessary, directly into permits.[8] The development of additional site-specific criteria to respond to regional areas of PFAS surface water contamination or statewide PFAS water quality standards are under consideration, as described in Minnesota's PFAS Blueprint.

In developing this statewide monitoring approach, the wastewater program used a stakeholder engagement process to understand concerns and gain early input. This process consisted of a public meeting and multiple meetings with a working group that provided feedback on ideas and the draft approach. The feedback received was considered in finalizing this portion of the PFAS Monitoring Plan.

[7] Additional information, such as on local environmental conditions, may inform the development of site-specific permit monitoring conditions.

[8] Some facilities have been subject to requirements based on site-specific criteria for some time, and already have requirements in their permits. Others may need such requirements in the future.

In addition to this PFAS Monitoring Plan, MPCA is also conducting a PFAS source evaluation and reduction initiative with the goal of supporting operators of PFAS conduits to the environment such as municipal WWTPs and landfills. The initiative, funded by a $600,000 appropriation from the Minnesota Legislature, includes an advisory panel with representatives from municipal, county, and private operators of potential PFAS conduits. A key goal of this source reduction initiative is to support municipal WWTPs and landfills in understanding the sources of PFAS to their facilities and to identify and communicate strategies for reducing those sources of PFAS. MPCA looks forward working with this advisory panel in parallel to the development and implementation of the PFAS Monitoring Plan to ensure these two projects effectively align to best support source reduction at municipal WWTPs and landfills.

What facilities will be included in the Monitoring Plan?

The PFAS Monitoring Plan for wastewater applies to a subset of municipal WWTPs and industrial facilities that do not discharge to waters subject to site-specific criteria for PFAS or waterbodies impaired for PFOS.[9] Facilities discharging to these waterbodies subject to site-specific criteria or listed as impaired for PFOS will be evaluated through the permitting process.

This plan calls for PFAS monitoring at all municipal WWTPs with a delegated industrial pre-treatment program (IPP) and communities that have identified significant industrial users (SIUs) discharging to their wastewater treatment plants. This will enable the evaluation of SIUs that are possibly passing PFAS to their facilities. There are approximately 80 WWTPs statewide that are being evaluated for inclusion in phase-one monitoring.

The plan also applies to some industrial wastewater permittees. MPCA will request monitoring of industrial wastewater dischargers that have an individual permit and perform activities that fall within the industrial categories included in the NAICS codes found in Appendix F. As our understanding of industries that have used or currently use PFAS grows, the industry categories included in Appendix F may be adjusted. If facilities have multiple permits and could fall under multiple Monitoring Plans (i.e., air, industrial stormwater, wastewater), MPCA will determine the media with the highest potential for PFAS release and include the facility in the relevant program's Monitoring Plan.

What materials will be monitored?

This plan begins by working to understand concentrations of PFAS entering municipal WWTPs and wastewater within industrial facilities through monitoring PFAS within process waste streams. The primary goals of phase one of this effort is to identify opportunities for source reduction and measure the effectiveness of source reduction interventions. Influent monitoring data at municipal WWTPs are essential for determining how PFAS are moving through our waste systems and identifying future source reduction work.

Internal monitoring at industrial facilities will help identify where PFAS are present, especially if PFAS use is incidental. Characterization of PFAS loads at the headworks will help to better identify sources and support the development of guidance and materials that will improve the efficacy of source reduction activities among all of our WWTPs in the future. Identified municipal WWTPs will be asked to conduct baseline monitoring of influent at the facilities' designated influent station. For industrial facilities included in this plan, the specific location of internal wastewater sample collection sites will be specific to each facility.

[9] Facilities discharging to these waterbodies will have separate path forward for monitoring and considerations for effluent limits. Additional information, such as on local environmental conditions, may inform the development of site-specific permit monitoring conditions beyond the geographic scope listed here.

The first phase of wastewater monitoring does not include monitoring for effluent or biosolids. There is currently a Legislative-Citizen Commission on Minnesota Resources (LCCMR) research project studying the potential impacts of land applied substances, including biosolids, underway. A number of municipal WWTPs are anonymously providing biosolids samples for the project. The results of the project will identify levels of PFAS found within biosolids and how, once land applied, the PFAS in the biosolids impacts groundwater, surface water, soil, and crops. Results from this study and the results of the phase one baseline influent monitoring will be used to inform future efforts in biosolids monitoring and land application criteria. In addition, the EPA is currently working on a risk assessment for PFOA and PFOS in biosolids, which is scheduled to be completed in 2024.

Future phases of monitoring at municipal and industrial facilities may include monitoring of effluent and/or biosolids if the phase one influent monitoring and source reduction efforts show that additional PFAS reduction efforts are needed. Monitoring of effluent and/or biosolids would then be used to further focus PFAS reduction efforts and identify potential risks to receptors. Based on similar monitoring work in neighboring states, it is expected that the majority of municipal WWTPs will be able to reduce PFAS through source identification and minimization efforts such that only a subset of WWTPs have ongoing elevated levels of PFAS in influent. In instances where it is warranted, the additional phases of monitoring will facilitate a more detailed understanding of the correlations between influent, biosolids, and effluent PFAS levels to determine opportunities for additional interventions and minimize risks to receptors.

Past monitoring of influent, effluent, and biosolids in Minnesota, as well as studies in other states, demonstrate that the concentration of some PFAS measured in effluent and biosolids can be significantly higher than concentrations of those PFAS measured in influent. The pattern occurs because some pre-cursors to terminal PFAS of concern, such as PFOS or PFOA, transform into these terminal PFAS over the course of wastewater treatment. However, monitoring influent, identifying PFAS sources, and working to reduce those sources will allow MPCA to gain an understanding of the composition of PFAS entering into a WWTP and will reduce the initial amount of PFAS entering WWTPs. Reducing the amount of PFAS entering a WWTP will reduce the amount that may also transform into other terminal PFAS.

How frequently will monitoring occur?

Identified municipal WWTPs will be contacted and asked to conduct quarterly sampling of influent and evaluate institutional or industrial users that have the potential to pass PFAS to their WWTP. After completing the first two quarters of influent monitoring, there will be a 6-month period where WWTPs will focus on source identification and source reduction. Where elevated PFAS concentrations above response thresholds are found, actions will be taken to reduce or eliminate potential PFAS sources or activities. The MPCA will be developing response thresholds based on data submitted from all facilities in a manner similar to Michigan's development of response thresholds based on the primary dataset collected.[10] Once WWTPs have completed their source identification and reduction efforts, influent monitoring will start again for two additional quarters. All facilities will submit a total of four quarterly influent samples. The previously mentioned legislatively-funded source reduction and evaluation project (see page 12) will provide additional support to these facilities in identifying PFAS sources and developing their source reduction plans. Optimally, for both municipal and industrial facilities, the final two quarterly PFAS samples may demonstrate significant concentration reductions as a result of source elimination actions.

[10] MPART. (2021). Evaluation of PFAS in Influent, Effluent, and Residuals of Wastewater Treatment Plants (WWTPs) in Michigan. Retrieved from: https://www.michigan.gov/documents/egle/wrd-pfas-initiatives-statewide-full-report_722902_7.pdf

Samples may be collected by individual permittees or an outside provider. If samples are collected by individual permittees, the sample collectors should follow MPCA's PFAS sample collection guidance, which provides detailed direction on how to prevent PFAS contamination of samples. Facilities are welcome to consult with MPCA staff who specialize in best practices for PFAS sampling and analysis.

Industrial facilities scoped into this plan will be contacted and asked to conduct baseline quarterly monitoring of internal process water for four quarters (one year). Additionally, during the first two quarters, industries will develop an inventory of potential internal PFAS sources. During the second two quarters, actions will be taken to reduce or eliminate potential PFAS sources or activities. Industrial facilities will not have the same six-month window as municipal WWTPs to identify and reduce PFAS sources because they have more access to information about materials being incorporated into their wastewater.

What methods will be available for monitoring?

Permittees will be asked to report all PFAS analytes provided by the specific method used to analyze the samples. The number of analytes included in PFAS methods varies somewhat from lab to lab depending on the analytical method the lab chooses to employ. However, the majority of methods used for wastewater consist of 30 to 40 analytes.[11] There are currently many PFAS accredited labs in Minnesota and elsewhere that WWTPs will be able to utilize, and this number will likely grow as PFAS analysis becomes more widespread. Lab methods used for analyzing samples in accredited labs are consistent with MPCA's PFAS analytical guidance.[12] EPA is currently implementing a strategy to monitor for PFAS at facilities with federally issued NPDES permits, and has developed this frequently asked questions document about PFAS methods in the wastewater facility context: Frequent Questions about PFAS Methods for NPDES Permits | US EPA.

How will MPCA use these monitoring data?

The initial influent/process water sampling will be used to identify the current levels of PFAS that are reaching the municipal WWTPs or found within industrial facilities. These initial data, along with other existing assessments and research, will be used to identify, reduce, and potentially remove sources of PFAS to wastewater. These data acquisition and source reduction or elimination efforts in phase one will be used to direct further activities in future phases of this work to sample additional points throughout the treatment processes and continue reducing the levels of PFAS that are entering our environment.

Implementation of future phases of wastewater sampling will be guided by:

1. The results of the phase one monitoring;
2. The effectiveness of source reduction activities (as identified during the source reduction initiative or in response to phase one monitoring in minimizing PFAS); and
3. Further development of a regulatory framework (that may include water quality standards or criteria, federal effluent limit guidelines, a federal or state risk assessment on biosolids etc.)

In collaboration with the PFAS source reduction legislative advisory group, MPCA will use these data and existing research to help regulated parties and the public interpret the results of PFAS monitoring. The source reduction legislative advisory group will also be collaborating with MPCA to communicate important best-practices on

[11] Most laboratories run a "modified" version of EPA's Method 537.1 that includes isotope dilution, which is analogous to the draft EPA Method 1633. See https://www.epa.gov/water-research/pfas-analytical-methods-development-and-sampling-research
[12] MPCA. (n.d) MPCA Quality System, Guidance for PFAS. https://www.pca.state.mn.us/data/mpca-quality-system

identifying PFAS sources to the regulated parties and best prioritize who to work with first on source reduction efforts.

How and when will this Monitoring Plan be implemented?

MPCA will notify facilities that are identified as being covered by this plan. For municipal facilities, phase one of the sampling (to identify baseline concentration data) will be implemented for municipal facilities with delegated pretreatment programs as well as WWTPs with SIUs. Scoped-in industrial facilities will be notified at the same time.

MPCA's preferred approach to implementing the PFAS Monitoring Plan for municipal wastewater is to work outside of permit requirements, cooperatively with WWTPs through memorandum of understandings (MOUs). MPCA will engage with municipal facilities to develop tools, such as a sampling and analysis plan needed to implement the monitoring. It is the MPCA's desire to work collaboratively with permittees to obtain the requested sampling data; however, in the interest of a comprehensive data set and fairness amongst permittees, the MPCA will use its statutory authority to require data collection from permittees who choose not to voluntarily participate. Facilities who elect not to voluntarily sign the MOU will likely be required to conduct the monitoring, under the statutory authority identified in Minn. Stat. § 115.03(b). Facilities will be notified after the PFAS Monitoring Plan is finalized and asked to enter into a MOU to implement the Monitoring Plan. The expected start date for municipal WWTP influent sampling approximately the first quarter of 2023.

Phase one sampling for scoped in industrial facilities will begin in similar timeframes and be approached in a similar manner as mentioned above. MPCA will evaluate facilities on a case-by-case basis and utilize a variety of tools that may include, but not be limited to schedules, agreements, and/or orders. Covered facilities will be notified via letter after the PFAS Monitoring Plan is finalized in early 2022, at which time MPCA will engage facilities to discuss implementation of the Monitoring Plan. The expected start date for baseline sampling is likely to be between the third quarter of 2022 and the second quarter of 2023.

Appendix C – Solid Waste and Hazardous Waste Program Plan

Introduction

Solid waste facilities perform an essential function in society of managing waste while minimizing environmental and human health impacts. Unlike industrial facilities using or producing PFAS products, landfills have limited options for managing PFAS inputs into their facilities, and PFAS levels will reflect a composite of historic and ongoing levels in disposed materials. The MPCA regulates solid and hazardous waste in Minnesota to support an integrated waste management system and to ensure protection of public health and Minnesota's land, air, and water resources.

The MPCA has general authority to impose requirements on facilities to protect water, air, and soil quality under Minn. Stat. § 115.03 and Minn. Stat. § 116.07, particularly as implemented on solid waste and hazardous waste facilities through Minnesota rules chapter 7035 and 7001, and on hazardous waste facilities under Minnesota rules chapter 7045.

The goals of the PFAS Monitoring Plan for solid waste facilities and hazardous waste landfills are primarily focused on understanding and reducing potential PFAS impacts on the environment that may be stemming from these facilities, rather than on source reduction efforts. Ongoing source reduction in the solid waste context will continue to be a priority at MPCA through additional initiatives, such as PFAS product bans and chemical use regulation. MPCA has already published a report on potential sources of PFAS to compost facilities and will continue to report new information in this topic area.[13]

In developing this plan, the Solid Waste and Hazardous Waste Programs held public engagement meetings to brief the public on the PFAS Monitoring Plan development process, present the topics that would be covered in the draft PFAS Monitoring Plan, and solicit feedback. As the plan is implemented, the MPCA will continue to share information and engage with stakeholders through:

- Communications with individual facilities regarding PFAS monitoring. Facility-specific considerations will be discussed, and some monitoring requirements may be adjusted based on site-specific factors.
- Announcements and updates using the Solid Waste Permitting GovDelivery mailing list.
- Engaging groups such as the National Waste and Recycling Association (NWRA) and the Solid Waste Association of North America (SWANA).
- Discussing PFAS monitoring at MPCA landfill operator trainings.

What facilities will be included in the Monitoring Plan?

The following facility types will be asked to monitor for PFAS in some capacity. This list includes individually permitted solid waste facilities, facilities in post-closure care, and hazardous waste landfills. The majority of these facility types are already required to perform other analytical monitoring as part of their permit requirements.

- Mixed municipal solid waste land disposal facilities as defined by Minn. R. 7035.0300, subp. 64.

[13] *More information on PFAS sources to compost can be found here: https://www.pca.state.mn.us/waste/composting-and-pfas*

- Municipal solid waste combustor ash land disposal facilities as defined by Minn. R. 7035.0300, subp. 67b.
- Demolition debris land disposal facilities as defined by Minn. R. 7035.0300, subp. 31.
- Industrial solid waste land disposal facilities as defined by Minn. R. 7035.0300, subp. 46.
- Solid waste compost facilities as defined by Minn. R. 7035.0300, subp. 19 and Minn. R. 7035.2836.
- Source-separated organic material compost facilities as defined by Minn. R. 7035.0300, subp. 105b and Minn. R. 7035.2836.
- Hazardous waste landfills as defined by Minn. R. 7045.0020, subp. 49.

Land disposal facilities will be assessed based on facility and risk characteristics and prioritized in the following order:

1. Land disposal facilities with drinking water advisories at nearby private wells due to contamination by a non-PFAS parameter that has been attributed to the facility.
2. Land application areas for landfill leachate.

- Solid waste facilities that land apply their landfill leachate are already required to perform PFAS analysis in leachate and at monitoring wells in the area of the land application activity. [14] Additional action to define groundwater plumes may be necessary if treatment of leachate to remove PFAS is not occurring or if existing data suggest the extent and magnitude of the plume is not currently defined.

3. Land disposal facilities with unlined areas and the following risk characteristics:

- Identified contaminant releases.
- Proximity of downgradient receptors.

4. Solid waste compost facilities and source-separated organic material (SSOM) compost facilities.

- Solid waste compost sites or SSOM facilities that land apply their compost contact water are already required to perform PFAS analysis of the contact water prior to issuance of approval for land application.

5. Lined land disposal facilities.

Industrial facilities that only accept a single waste type from a designated facility (i.e., monofills) may be able to demonstrate that PFAS are not present in their waste type. In conversation with industrial monofills, MPCA will discuss if these facilities believe that they can reasonably demonstrate that PFAS are not present in their waste stream using PFAS leachate testing or other waste characterization testing to investigate the presence or absence of PFAS in their waste stream over the life of the facility. These discussions will help determine if the facility is high-risk for PFAS releases and how it should be considered in MPCA's PFAS Monitoring Plan. Industrial monofills that have accepted paper products, paper sludge, and other wastes related to paper production would not be included in this category due to known uses of PFAS in paper products.

Hazardous waste landfills will be prioritized in the order described below:

1. Hazardous waste landfills without liners or leachate collection systems.
2. Hazardous waste landfills in a corrective action program as required by Minn. R. 7045.0484, subp. 2.
3. Hazardous waste landfills in a compliance monitoring program as required by Minn. R. 7045.0484, subp. 13.

[14] *In recent years, facilities that proposed to start land applying leachate or contact water for the first time have only been allowed to land apply leachate or contact water with analyte concentrations below intervention limits (ILs); in these cases, groundwater monitoring was not required. The Solid Waste Program is working to develop consistent management of land application across all facilities in the program.*

4. Hazardous waste landfills in a detection monitoring program as required by Minn. R. 7045.0484, subp. 12.

Most facility types that do not perform existing analytical monitoring and/or do not have an individual solid waste permit will not be included in this plan for PFAS monitoring. This includes the following types of facilities:

- Transfer facilities as defined by Minn. R. 7035.0300, subp. 111.
- Permit-by-rule facilities as described in Minn. R. 7001.3050, subp. 3.
- Recycling facilities as defined by Minn. R. 7035.0300, subp. 88.
- Yard waste compost facilities as described in Minn. R. 7035.2836.

Additional information about the concentrations of PFAS in environmental media at any facility may result in future re-evaluation of the need for monitoring. Waste-to-energy facilities will be considered in the context of the air PFAS Monitoring Plan, (*see* Appendix A).

What materials will be monitored?

Solid waste facilities and hazardous waste landfills are sometimes divided into two categories: those with the infrastructure and capabilities to collect landfill leachate or compost contact water and those without. Current research[15] and MPCA's own data[16] indicate that PFAS are commonly found in landfill leachate collected from lined landfills. However, many landfills in Minnesota began operating before landfill liners were required by rule, which means that most of the landfills in Minnesota are either unlined or have an unlined component within their current waste footprint.

Without a liner and leachate collection system under the waste, the leachate generated in the unlined waste areas may infiltrate directly into the soil and groundwater below. Groundwater data collected from the MPCA's Closed Landfill Program[17] and from the State of Michigan[18] provide evidence that unlined landfills are a source of PFAS contamination to groundwater. Furthermore, some groundwater data collected from unlined facilities regulated by the MPCA Solid Waste Program show groundwater contamination for other monitoring parameters like metals and volatile organic compounds (VOCs), and the legacy of the waste materials in these historically unlined areas may also result in PFAS contamination to groundwater. To further identify releases of known contaminants like PFAS that can adversely affect human health and the environment, the MPCA is asking facilities to sample groundwater in select up- and down-gradient wells. Evidence of releases and landfill construction and proximity to receptors will be used to prioritize solid waste disposal facilities for PFAS monitoring (as described in the "what facilities will be included" section above).

Waste disposal facilities that have leachate collection systems may propose to analyze the leachate to investigate whether the lined portions pose a potential risk of PFAS contamination to groundwater. The results from the leachate sampling for PFAS would be considered with other risk factors for the facility to determine whether groundwater monitoring may be requested downgradient of the lined portion at the facility to identify

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[15] *Hamid, H., L.Y. Li, and J.R. Grace. 2018. Review of the fate and transformation of per- and polyfluoroalkyl substances (PFASs) in landfills.* Environmental Pollution *235:74-84*

[16] *Leachate was sampled and analyzed for PFAS at landfills as part of the MPCA's PFAS evaluation at solid waste facilities from 2005 to 2008. https://www.pca.state.mn.us/waste/pfas-studies-and-reports*

[17] *PFAS have been detected in groundwater at 98 of 101 landfills in the MPCA's Closed Landfill Program, and 59 of those detections exceeded MDH drinking water guidance values. https://www.pca.state.mn.us/waste/pfas-landfills*

[18] *Data has been collected from 46 of the 48 high priority landfill sites as identified he Michigan PFAS Action Response Team (MPART), and 32 sites had PFAS levels in one or more groundwater monitoring wells that exceeded Michigan's groundwater cleanup criteria. https://www.michigan.gov/pfasresponse/0,9038,7-365-86513_99807_99808-527972--,00.html*

any impacts from the facility to groundwater. Facilities may choose to proceed directly to groundwater monitoring.

For source separated organic material (SSOM) or solid waste compost facilities with contact water collection, MPCA will initially request PFAS monitoring of contact water to determine whether there is a risk of PFAS contamination to either surface water or groundwater from the facility. If PFAS are detected in contact water, MPCA will work with the facility on a case-by-case basis to identify any potential large contributing source(s) of the PFAS. The MPCA will then collaborate with each individual facility to determine an appropriate course of action.

A Legislative-Citizen Commission on Minnesota Resources (LCCMR) research project studying the potential impacts of land applied substances, including compost, is currently underway. Several composting facilities are providing compost samples for the project. The results of the project will identify levels of PFAS found within compost and help inform how, once land applied, the PFAS in the compost could impact groundwater, surface water, soil, and crops. Results from this study and the monitoring results from compost contact water will be used to inform future efforts in compost monitoring and the development of risk-based criteria.

How frequently will monitoring occur?

Baseline PFAS monitoring will be implemented according to the prioritization process. Baseline sampling will consist of three sampling events completed within one 12-month period. Sampling events should be scheduled to adequately represent seasonal variation (for example, using the sampling windows specified for regular solid waste sampling indicated below).

Season	Sampling window
Spring monitoring	March 14 – May 14
Summer monitoring	June 21 – August 7
Fall monitoring	October 1 – November 21

Facilities will be required to receive approval from the MPCA on their baseline sampling schedule prior to sampling.

The results from the baseline sampling will be used to prioritize next steps. Results below intervention limits (ILs) in groundwater will be considered low risk, and any results above ILs will result in further conversations between the facility and MPCA to determine the need for additional actions, including potentially additional monitoring.

What methods will be used for monitoring?

Facilities will be required to analyze samples at a laboratory that is accredited for PFAS analysis. Analytical methods that the labs use to measure levels in various media will include a large number of PFAS analytes (from 20-40 depending on the method). The cost of PFAS analysis is based on the method and lab used, not the number of analytes measured. The Solid Waste Program will require that labs submit results for the PFAS that are measured in the method. All accredited labs for PFAS will use methods that measure the PFAS for which there are health-based values, and therefore ILs available.

Costs for PFAS monitoring will depend on the facilities' contracts with their chosen environmental consultant and accredited lab for PFAS analysis. Typical costs for laboratory analysis of PFAS in water range from $300 to $500 per sample.

Upon notification that the facility is in-scope for the PFAS Monitoring Plan, the facility will be asked to submit addenda to their Solid Waste Sampling and Analysis Protocols (SAPs), Hazardous Waste Quality Assurance Project Plan, or Hazardous Waste Groundwater Protection Plan, as applicable, that outline PFAS-specific sampling and analysis procedures and propose a sampling schedule for baseline sampling. These addenda are necessary to ensure that acceptable labs, analysis methods, and sampling procedures will be used by facilities. Solid waste and hazardous waste facilities' SAPs should demonstrate that the analytical laboratory selected can achieve reporting limits that are at or lower than the applicable ILs, if possible. MPCA approval on these items must be obtained before PFAS sampling can begin.

How will MPCA use these monitoring data?

The primary goals of PFAS monitoring at solid waste facilities and hazardous waste landfills are to:

1. Characterize the presence of PFAS in the environment associated with solid waste facilities and hazardous waste landfill management activities to determine where reduction efforts should be prioritized.
2. Develop sampling prioritization that protects human health and the environment. If human health levels are exceeded, respond to drinking water exposures.
3. Provide the necessary data and information for further development of an agency-wide regulatory strategy for PFAS.

The MPCA's goal is to protect human health and the environment. In the short term, MPCA will use these PFAS data to help identify any potential risks to human health receptors. MPCA will also use the data to survey the breadth of PFAS pollution from solid waste facilities and hazardous waste landfills, which will help identify appropriate actions to alleviate the threat to human health.

Additionally, monitoring for PFAS at solid and hazardous waste facilities will allow MPCA to identify impacts to the environment, track them over time, and address them as necessary. For example, PFAS monitoring data will help inform future source reduction efforts.

The MPCA's PFAS Blueprint, published in February 2021, outlines strategies and proposals for prevention of PFAS contamination and PFAS source reduction. The positive impact that these efforts (for example, the ban on intentional use of PFAS in food packaging by 2024) may have on PFAS concentrations at solid waste facilities will be tracked by the PFAS monitoring data collected at these facilities.

How and when will this Monitoring Plan be implemented?

To implement PFAS monitoring, the MPCA will notify facilities via letters sent electronically about PFAS monitoring. If agreed to, MPCA will follow up with additional information for the facility. Alternative measures to retain PFAS monitoring data may be considered if a facility does not agree to the initial request. Monitoring will be phased in based on potential risk posed by facilities, and within those prioritization groups, monitoring will be implemented starting at facilities that appear to pose the highest potential risk of PFAS environmental release.

As described in the "what facilities will be included" section, facilities will be prioritized for PFAS monitoring in an order that reflects potential risk to human health receptors. Facilities with the highest risk characteristics will receive communications regarding PFAS monitoring in early 2022. These communications will request that monitoring is implemented at these facilities in the 2023 monitoring season. Facilities with lower risk characteristics will receive communications regarding PFAS monitoring in early 2023, with requests to

implement monitoring in the 2024 monitoring season. Facilities with multiple land disposal activities will be addressed based on the priority of each activity listed above.

Hazardous waste landfills will be notified after the PFAS Monitoring Plan is finalized in 2022. Given the small number of hazardous waste landfills in Minnesota, these facilities will likely be contacted simultaneously.

Appendix D – Industrial Stormwater Program Plan

Introduction

The MPCA has long-term goals to improve and maintain water quality, and a broad statutory mandate to prevent pollution to all waters of the state. The MPCA's stormwater program works to protect water from pollutants that are carried with precipitation runoff. The industrial stormwater program focuses on runoff from specific types of industrial facilities.

The agency has broad statutory authority under Minn. Stat. § 115.03 to collect information, require monitoring, and take other actions to prevent, control, or abate water pollution from stormwater discharges. Minnesota Rules chapter 7090 further provides programmatic powers for regulating discharges of stormwater from industrial activities.

The goals for monitoring PFAS in industrial stormwater are twofold. The first goal is to protect human health and the environment by identifying and responding to the most significant PFAS releases through stormwater. Pollutants in industrial stormwater may contaminate waters of the state and impair the use of groundwater or surface water. These waters provide important resources to Minnesota as sources of drinking water, sources of irrigation water, and fisheries. The second goal is to support PFAS source identification and reduction at these facilities.

The first phase of this plan will focus on a subset of industrial stormwater facilities that are likely to have ongoing PFAS releases. Future phases of this plan may consider monitoring at additional facilities and changes to the industrial stormwater general permit.

The ISW program has worked, and will continue to work, with stakeholders and the public to develop a PFAS Monitoring Plan that is health protective and feasible for permittees. The program has already begun using the stakeholder engagement process to listen to concerns and gain early comments or suggestions to assist in developing a statewide monitoring approach. Any future changes to ISW permits, including individual permits or a general permit, would go through the normal regulatory and engagement process.

What facilities will be included in the Monitoring Plan?

The North American Industrial Classification System (NAICS) uses a numeric coding system to group businesses with similar outputs (i.e., goods or services). Each industry type and process is associated with a specific code. Working across programs and in partnership with EPA, MPCA has identified a large number of NAICS that may be associated with PFAS use and release (*see* Appendix F). Phase one of the industrial stormwater PFAS Monitoring Plan will focus on only a subset (three categories) of those facilities with NAICS codes identified as being associated with PFAS use or release. In the future, should additional industry sectors emerge as having a high potential for PFAS releases via stormwater, monitoring requests may be extended to other facilities with NAICS codes listed in Appendix F or other facilities that are suspected, based on monitoring data compiled through other program's PFAS Monitoring Plans, to be contributing to PFAS releases through stormwater.

This plan was developed in coordination with other program plans to avoid duplication of responsibilities for facilities that may fall under two or more relevant programs (i.e., the solid waste program, wastewater program, industrial stormwater program, and the air program). Coverage of certain types of facilities under multiple PFAS Monitoring Plans was considered during the prioritization of facility types to be included in phase one of the industrial stormwater program – phase one of this PFAS Monitoring Plan focuses on facilities with potential PFAS

releases that are not likely captured in monitoring requests for other plans. If monitoring through another program identifies high PFAS releases from a facility warranting further investigation, stormwater may be tested.

The following table summarizes which facilities will be scoped into the phase one PFAS Monitoring Plan for industrial stormwater.

Table 2. Proposed Industrial Stormwater PFAS Monitoring Plan facility sectors for phase one.

Industrial stormwater (ISW) facilities in sectors of greatest concern based upon other states results and for which other MPCA programs are not initially interacting with for PFAS sampling.	**Airports** (~8 total): There are 9 Part 139 airports in MN, but one already has monitoring for PFAS taking place. This plan includes the other 8 airports because these sites, out of all 121 airports in MN, have the highest likelihood of having PFAS releases	Chrome platers (~22 total)	Automotive shredding facilities: (~6 total)

Within the categories included in Table 2, the prioritization of which facilities will be selected for monitoring may be influenced by a facility's proximity to drinking water sources or surface waters and other factors.

Airports

Aqueous film-forming foam (AFFF) and other PFAS-containing firefighting foams have been used at airports as a fire-extinguishing agent to prevent, extinguish, or control fires of flammable and combustible liquids such as crude oil, gasoline, and fuel oils. Although the presence and extent of potential environmental impact depends on the nature and history of past firefighting foam use at each airport, PFAS contamination is frequently found during environmental investigations at airports.[19] A subset of larger airports are required by Federal Aviation Agency (FAA) regulations to keep PFAS-containing firefighting foams on the premises; the likelihood of PFAS use and release at those facilities is higher than at the smaller airports not subject to this regulation (14 CFR 139). Sources of PFAS at airports may include the following:

- Past and ongoing firefighting, training, and maintenance activities. These can lead to groundwater and soil contamination by PFAS due to uncontained release of firefighting foam.
- Testing firefighting systems (e.g., deluge system, roof turrets).
- PFAS-containing hydraulic brake fluid historically used for aircrafts.[20]

Chrome plating facilities

Fume suppressants used in chrome plating operations often contained PFOS as an active ingredient. Although PFOS based fume suppressants have been phasing out in recent years, newer non-PFOS fume suppressants may contain other PFAS. There have already been examples of chrome plating facilities in Minnesota that have been

[19] Michigan's PFAS Action Response Team (MPART) has prioritized investigation of airports, finding many airports with surrounding groundwater that exceed Michigan's groundwater criteria for PFAS. Information about MPART sites is available on EGLE's webpage: https://www.michigan.gov/pfasresponse/0,9038,7-365-86511_95645---,00.html

[20] EGLE (2020). Current Knowledge of Physiochemical Properties, Environmental Contamination, and Toxicity of PFECHS. https://www.michigan.gov/documents/pfasresponse/Current_Knowledge_of_Physiochemical_Properties_Environmental_Contamination_and_Toxicity_of_PFECHS_Whitepaper_702591_7.pdf

shown to be releasing PFAS through stormwater. In these cases, PFAS adsorbed to particles that were vented and later deposited on the roof, where they moved to soil, surface water, and groundwater. Liquid waste streams were also released to storm drains or sewers connected to WWTPs, which then discharged to surface water. In at least one case, these discharges resulted in a lake requiring "DO NOT EAT" fish consumption advisory for PFOS due to the significant levels of contamination. A 2003 survey conducted by the California Air Resources Board (CARB) found that 190 of the 222 Cr(VI) electroplating operations in California used a fume suppressant.[21] Almost all of the 190 operations used a chemical fume suppressant with PFOS as the active ingredient, and 124 reported using the same suppressant (Fumetrol 140®) as chrome platers in Minnesota with significant PFOS releases. Based on the above discussion, it is reasonable to conclude that PFAS may be present in and around most Cr(VI) electroplating operations.

Automotive shredding facilities

PFAS are frequently used to render materials used as upholstery in cars water as stain resistant. As automotive shredding facilities accept cars that contain PFAS, they could be conduits of PFAS into the environment. A study in Ireland measured PFAS in automotive shredding residue.[22] Another study in New York found the combined PFOA and PFOS limit to be exceeded at the downgradient side of a shredder residue area.[23] Massachusetts has prioritized sampling PFAS at certain sectors of facilities including those with shredder fluff.[24] For these reasons, MPCA finds that automotive shredding facilities could have significantly elevated levels of PFAS in stormwater and therefore should be included in initial phases of this PFAS Monitoring Plan.

What materials will be monitored?

The primary material monitored at these facilities will be industrial stormwater (ISW). Characterization of PFAS concentrations and loads will help to better identify sources and the efficacy of source reduction activities in the future.

How frequently will monitoring occur?

For the facilities included in phase one of the industrial stormwater plan, three[25] quarterly samples will be taken within the first half-hour of a stormwater discharge from the facility. Samples should be taken so that at least three days pass between measurable runoff events. In the absence of a measurable runoff event during a quarter due to weather conditions and/or site soil characteristics, the Permittee shall provide an explanation, and submit the monitoring report form to the MPCA. The Permittee shall submit monitoring data to the MPCA no later than the 21st day of the month following the sampling quarter.

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[21] California Water Boards. WATER CODE SECTIONS 13267 AND 13383 ORDER FOR THE DETERMINATION OF THE PRESENCE OF PER- AND POLYFLUOROALKYL SUBSTANCES AT CHROME PLATING FACILITIES. Retrieved from: https://www.waterboards.ca.gov/pfas/docs/pfas_final_order_chrome_plating.pdf

[22] ELV Environmental Services CLG. (2016). Analysis of Automotive Shredder Residue from the Composition, Recycling and Recovery Trial for End of Life Vehicles in the Republic of Ireland.

[23] New York DEC. (2018). SITE CHARACTERIZATION REPORT FOR THE CNY CAR CRUSHERS SITE (NYSDEC SITE 738048) HASTINGS, OSWEGO COUNTY, NEW YORK. Retrieved from: https://www.dec.ny.gov/data/DecDocs/738048/Report.HW.738048.2018-10-17.Site%20Characterization_Final.pdf

[24] MassDEP. (2020). Interim Guidance on Sampling and Analysis for PFAS at Disposal Sites Regulated under the Massachusetts Contingency Plan. Retrieved from: https://www.mass.gov/doc/interim-guidance-on-sampling-and-analysis-for-pfas-at-disposal-sites-regulated-under-the/download

[25] Three samples will be requested unless sample reduction form submitted after two results samples show non-detect or results consistently or significantly above response threshold(s).

If PFAS are elevated in stormwater sampling during the first two quarters, the facility will be asked to identify and eliminate potential PFAS sources to stormwater. For the remainder of the sampling period, quarterly monitoring will ideally reflect the reductions of PFAS discharges seen from this source identification and elimination effort. If efforts to reduce PFAS levels are not successful, additional steps may be taken to ensure protection of human health and the environment, including ongoing PFAS monitoring. Any additional facilities scoped into later phases of this plan will follow the same or similar monitoring frequencies.

Locations

Facilities have existing stormwater monitoring locations required by MPCA's MNR050000 permit referred to as Benchmark Monitoring Locations (BMLs). Some facilities have one while other facilities may have ten or more BMLs. BMLs were most often established without considering PFAS as a pollutant of concern. Resultantly, an area of the facility where the industrial activity uses or processes PFAS containing materials (Area of Concern – AOC) may have stormwater runoff not currently captured by an existing BML. One of the following PFAS sampling regimes should be followed:

I. Minimum of two locations (one of which is an existing BML and one AOC location).
II. All existing BMLs unless a BML reduction form is submitted and approved.
    a. BML reduction form should include:
        i. Historical PFAS use information in a narrative format inclusive of AOC.
        ii. Wind Rose showing prevailing wind directions.
        iii. SWPPP drainage map depicting all permit-required elements including but not limited to:
    1. All existing BMLs and what BML(s) are proposed to have PFAS monitored.
    2. Sector-specific PFAS area(s) of concern (AOC).
III. Minimum of one location adjacent to PFAS AOC.
    a. PFAS AOC examples – adjacent and/or downgradient (consider prevailing winds and water flow) of:
        i. Shredder fluff pile.
        ii. Chrome plating bath vented portion of facility.
        iii. AFFF or firefighting training areas.

What methods will be available?

Permittees will be asked to report all PFAS analytes provided by the specific method used to analyze the samples. The number of analytes included in PFAS methods varies somewhat from lab to lab depending on the analytical method the lab chooses to employ. However, the majority of methods used for stormwater consist of 30 to 40 analytes.[26] There are currently many PFAS accredited labs in Minnesota and other locations that permittees can use, and this number will likely grow as PFAS analysis becomes more widespread. MPCA has updated guidance for PFAS analysis and guidance for PFAS sampling available.

How will MPCA use these monitoring data?

Once sample results are received from all requested sampling, the quarterly average will be compared against response thresholds. Response thresholds are currently proposed for PFOS, which is believed to be the

[26] *Most laboratories run a "modified" version of EPA's Method 537.1 that includes isotope dilution, which is analogous to the draft EPA Method 1633. See https://www.epa.gov/water-research/pfas-analytical-methods-development-and-sampling-research*

compound driving overall health-risks in many contamination scenarios. Source reduction activities for PFOS may also reduce the presence of other PFAS. However, if monitoring shows frequent detection of other PFAS analytes at concentrations of concern, MPCA may adjust response thresholds used to prioritize source reduction activities.

Average PFOS concentration	**Follow up action**
PFOS < 10 ng/L	No source reduction plan needed at this time. Maintain PFAS inventory and reduction activities at the site along with PFAS BMPs
PFOS between 10 ng/L and 1,000 ng/L	Submit a PFAS source and exposure reduction plan within 180[27] days of last sampling quarter.
PFOS > 1,000 ng/L	Submit a PFAS source and exposure reduction plan within 90[28] days of last sampling quarter.

These data will be used to facilitate the reduction of PFAS pollutant load sources and manage likely sources at ISW facilities if concentrations warrant such action. In addition, these results will be used to inform the need for more widespread PFAS monitoring in later phases of the stormwater PFAS Monitoring Plan (i.e., at other facilities falling under the NAICS code categories listed in Appendix F) or if PFAS monitoring should be added to the general industrial stormwater permit when it is re-issued.

Given that products do not list "PFAS" as an ingredient, MPCA will be available to assist facilities in identifying specific products or materials that are most likely to contain PFAS. The upcoming legislative source reduction project may also provide information to support source reduction efforts.

How and when will this Monitoring Plan be implemented?

Facilities will be notified by letter that they are in-scope for phase one of the stormwater PFAS Monitoring Plan after the plan is finalized. MPCA anticipates starting to send notification letters in 2022. Permittees will be expected to cover the costs associated with sample collection, analysis, and reporting.

[27] Note – More expedited timelines may be warranted depending on site-specific considerations such as proximity to drinking water sources, etc.

[28] Note – More expedited timelines may be warranted depending on site-specific considerations such as proximity to drinking water sources, etc.

Appendix E – Remediation Program Plan

Introduction

MPCA's remediation programs oversee the clean-up of sites that are contaminated with pollution, so that those sites can be redeveloped without the pollutants causing an adverse impact to human health or the environment. The Site Remediation and Redevelopment Section oversees the identification, intake and remediation of sites with hazardous substances, or pollutants and contaminants. Because the Remediation Program addresses sites that have a release or threatened release, this program is unlike the other programs participating in the PFAS Monitoring Plan that oversee permitted facilities.

During the initial intake period, sites are categorized for either redevelopment or remediation, after which the appropriate program shepherds the Site through the remediation process, followed by closure. The assessment phase includes an investigation to identify the contaminants of concern present in affected media (i.e., soil, groundwater, surface water, soil vapor, and/or sediment), then determine their extent and magnitude. The results from the investigation are then used to develop a remediation plan that is implemented upon review and approval from MPCA. A site is complete once the site's contaminants of concern have been remediated to the extent required by the remediation plan and the threat to human health and the environment has been mitigated.

Minnesota has an established history of responding to PFAS contamination through the remediation and redevelopment programs using its authority under Minnesota Statute section 115B, the Minnesota Environmental Response and Liability Act (MERLA).

MERLA

MERLA authorizes the MPCA to take removal or remedial action when there is a release or threatened release of a hazardous substance from a facility (*see* Minn. Stat. § 115B.17). The statute also authorizes MPCA to undertake other actions, including investigations, to identify the existence and extent of a release or threatened release of a hazardous substance, or a pollutant or contaminant.

The Agency takes the position that PFAS, because of their quantity, concentration, or chemical characteristics, may pose a substantial present or potential hazard to human health or the environment, and are therefore hazardous wastes as defined in Minn. Stat. § 116.06, subd. 11, clause (b). Because PFAS found in releases and threatened releases meet the definition of a hazardous waste under Minn. Stat. § 116.06, subd. 11, they are therefore hazardous substances under MERLA, Minn. Stat. § 115B.02, subd. 8. As such, the Site Remediation program evaluates PFAS in the same manner as other hazardous substances that result in an identified release to the environment. Note that all PFAS-containing materials do not necessarily qualify as "hazardous wastes" as defined in RCRA.

Responsibilities

As stated above, MERLA provides statutory authority for the MPCA to take removal or remedial action relating to a hazardous substance when there is a release or threatened release from a facility; however, before taking any action the Agency must request any responsible party known to the Agency to take the actions the agency deems reasonable and necessary to protect the public health or welfare or the environment. A Responsible Person is defined in Minn. Stat. § 115B.03 and may be an individual, an organization, a corporate body, or public entity.

Sampling requirements

This PFAS Monitoring Plan clarifies expectations for PFAS sampling that are in place while the more extensive PFAS guidance document is being developed.

The goal of the PFAS Monitoring Plan is to document and standardize the process of PFAS assessment, investigation, remediation, and redevelopment at incoming and existing sites within the Remediation and Redevelopment programs. This standardized process will ensure that PFAS contamination is identified and remediated to an extent that is protective of human health and the environment, while providing transparent processes for responsible parties.

The decision to require PFAS sampling at a site considers evidence of nearby or on-site PFAS contamination, current or historic land use, and other factors. Responsible parties enter the site remediation program through either a cooperative or formal assessment process and are obligated to address all actual and threated releases of PFAS. These requirements will apply to all responsible parties, during the near and long-term, regardless of the mode of entry into the program. Voluntary parties who are not deemed responsible under Minn. Stat. ch. 115B may enroll in the Brownfields program to receive technical assistance and, if eligible, liability assurances for PFAS at redevelopment sites.

What sites will be included in the Monitoring Plan?

This plan identifies the highest priority sites for PFAS assessment in the near-term (i.e., phase one), and sets a schedule for the development of a PFAS Guidance Document. MPCA is working with stakeholders to develop the PFAS Guidance Document, which will complement this PFAS Monitoring Plan and specify requirements related to PFAS sampling and remediation at Superfund or Brownfield sites (phase two).

The site Remediation program has convened a stakeholder advisory group to support the development of the PFAS Guidance Document, similar to the approach taken to develop vapor intrusion guidance in the past.[29] The represented sectors in the advisory group include, but are not limited to, municipalities, environmental consultants, and related industries. The program will also engage with the non-profit, Minnesota Brownfields. This “phase one” Monitoring Plan will guide agency actions in the near term, but MPCA is working closely with stakeholders to develop the longstanding PFAS Guidance Document to guide agency actions related to remediation and redevelopment for the medium to long-term. The development of this PFAS Guidance Document is considered “phase two” of the PFAS Monitoring Plan and will not be discussed in detail in this document.

Sampling criteria

The “phase one” PFAS sampling requirements outlined in this section are drawn from the results of the PFAS Pilot Inventory Study, and site-specific sampling results. The Pilot Inventory Study has developed a scalable tool (protocol) to evaluate potential PFAS sources. Industrial practices that may generate, use, or dispose of PFAS are cross-referenced against potential risk to nearby receptors using hydrogeological and exposure route inputs. The information gained from developing the Pilot PFAS Inventory Study and remediating PFAS sites throughout the state has informed the sampling requirement information listed below.

The MPCA considers the following criteria when assessing whether PFAS sampling is required at a site; these criteria will be applicable to all programs within Site Remediation:

[29] *MPCA. (2020). Minnesota Pollution Control Agency. Vapor investigation and mitigation decision best management practices. https://www.pca.state.mn.us/sites/default/files/c-rem3-06e.pdf*

- *Site usage:* The historical and current usage of the site will be evaluated to determine the types of industrial practices conducted. The North American Industrial Classification System (NAICS) uses a numeric coding system to group businesses with similar outputs (i.e., goods or services). Each industry type and process is associated with a specific code. Industrial processes with the potential to use PFAS include, but are not limited to, electroplating, petroleum refining, waterproof outerwear, non-stick cookware, and commercial printing. See Appendix F for a list of NAICS codes that may be associated with PFAS use and subsequent environmental release.
- *Proximity to detections or releases:* An incoming site will be assessed for proximity to known contamination. This includes previous detections at nearby sites or municipal wells where PFAS concentrations were above Minnesota's media-specific risk-based values. Also included are sites with known releases such as areas where aqueous film forming foam (AFFF) was used for fire suppression, fire training, or storage.
- *Proximity to dumps or landfills:* Results from a statewide evaluation indicate that PFAS are present in more than 95% of closed landfills and dumps.[30] A further 60% have at least one PFAS chemical present above regulatory criteria. As a result, the third indicator that will be assessed is the proximity of an incoming site to a current or former dump or landfill facility.

Sampling for PFAS will be required at responsible party/Superfund sites that meet the above criteria. For a non-responsible party enrolled in the Brownfield Program, the need to sample for PFAS is modified according to the specific proposed actions to be taken at the site and the type of assurance letter requested. For additional information, see the 2021 Brownfield Program Annual Report on the MPCA's Brownfield Program webpage.[31]

What materials will be sampled?

At sites that are scoped in the "phase one" PFAS Monitoring Plan, an investigation into the presence of PFAS in all potentially impacted media will be required. Available guidance and results from site-specific sampling show that PFAS has been identified as present in the following media: groundwater, drinking water, surface water, soil, sediment, soil vapor, and ambient air.

How frequently will sampling occur?

Sampling for PFAS will be required during the assessment phase of the MERLA process. Following a PFAS detection, requirements around frequency of sampling will be developed as part of the site-specific Sampling and Analysis Plan (SAP) and in accordance with media type (i.e., drinking water, soil etc.). Each site will require an adapted approach; therefore, it is likely that during the investigation and initial remediation (i.e., implementation) phases, a higher monitoring frequency may become necessary. The monitoring frequency may decrease during the later stage of remediation (i.e., post-cleanup).

What methods are available for monitoring?

The PFAS analytes available for measurement will vary by media and by laboratory, but generally include 20-40 individual PFAS. Non-targeted or suspect screening PFAS analysis, which identifies the presence of all PFAS but not their concentrations, is recommended in scenarios where a diverse mixture of modern or replacement PFAS is expected. EPA's webpage on PFAS analytical methods provides useful information on which methods are

[30] *MPCA. PFAS in Landfills. https://www.pca.state.mn.us/waste/pfas-landfills*
[31] *https://www.pca.state.mn.us/waste/brownfields*

available for various media.[32] Several laboratories across North America provide the EPA-approved analytical methods, and there are numerous laboratories in Minnesota that are accredited to perform PFAS analysis. Additionally, MPCA recently released guidance on PFAS analysis and sampling specific to field sampling for PFAS analytes.[33]

How will MPCA use these monitoring data?

MPCA will compare the PFAS data collected during site assessment and investigation against existing health-based guidance values for various media. Health-based guidance values for various PFAS analytes are currently available for soil,[34] groundwater or drinking water,[35] surface water,[36] and air.[37] The remedial phase, for all sites with PFAS exceedances of health-based values during "phase one" of the PFAS Monitoring Plan implementation (i.e., before updated PFAS guidance has been finalized), will follow the existing MERLA framework.

Remedial strategies to address PFAS contamination will be evaluated for their ability to protect human health and the environment. The Response Action documents submitted during the start of the remedial phase will develop strategies based on the extent and magnitude of identified contamination. The Remedial Design will present the implementation of the strategies. The closure of a site or the issuance of a liability letter will depend upon the outcomes from the implementation of the remedial strategies. Sites may have associated Institutional Controls (ICs) or require long term monitoring to ensure that PFAS levels remain below established clean-up levels.

The data from PFAS sampling at sites in the Remediation Program will also be used to enhance current knowledge of the extent, magnitude and mixtures of PFAS contamination associated with various types of historic land uses. This information will allow the Remediation Program to further refine sampling guidance during the development of the PFAS guidance document (i.e., phase two of this plan). The data collected from sites will support the Program's ability to identify PFAS sources. The generation and disposal of PFAS closely correlates with certain industrial practices and, to date, several industries are linked with specific PFAS. The monitoring data will expand this body of knowledge by providing information on commonly occurring PFAS and past or present practices.

How and when will this Monitoring Plan be implemented?

The framework for site assessment, investigation and remediation exists under MERLA, therefore, efforts to ensure that PFAS sampling are integrated into the existing framework in a consistent manner for existing sites and sites entering the program in the future. PFAS will be addressed through the MERLA framework for both the Superfund and Brownfields programs, which is consistent with the approach taken for other contaminants of concern. An incoming site will be assessed according to the criteria listed in the above sections and PFAS sampling will be requested if any of the indicators are met. If PFAS are detected, a site investigation will be

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[32] EPA. (N.D.) PFAS Analytical Methods Development and Sampling Research. Retrieved from: https://www.epa.gov/water-research/pfas-analytical-methods-development-and-sampling-research
[33] MPCA. (N.D.) MPCA quality system. Retrieved from: https://www.pca.state.mn.us/data/mpca-quality-system
[34] MPCA. (2021). Soil Reference Value spreadsheet. Retrieved from: https://www.pca.state.mn.us/waste/cleanup-guidance
[35] MDH. (N.D.) Human Health Based Water Guidance Table. Retrieved from: https://www.health.state.mn.us/communities/environment/risk/guidance/gw/table.html
[36] MPCA. (N.D.) Water Quality Criteria development for PFAS. Retrieved from: https://www.pca.state.mn.us/waste/water-quality-criteria-development-pfas
[37] MDA. (N.D.) Air Guidance Values. Retrieved from: https://www.health.state.mn.us/communities/environment/risk/guidance/air/table.html#forms

needed to determine the extent and magnitude of contamination. Closure of the site will require remedial action (i.e., clean-up to site-specific values) and the establishment of relevant institutional controls.

Existing sites in the Superfund Program that fall under the scope of this plan will be asked to assess PFAS during the 5-year review process. Specific procedures will be published in the Guidance Document, which is expected to be launched in 2023.

Appendix F – List of NAICS codes associated with potential PFAS use or release

NAICS	NAICS title
221320	Sewage Treatment Facilities
313110	Textile goods, Not Elsewhere Classified
313210	Broadwoven Fabric Mills, Manmade Fiber and Silk
313230	Non-woven Fabrics
313310	Finishers of Broadwoven Fabrics of Manmade Fiber and Silk
313320	Coated Fabrics, Not Rubberized
314110	Carpets and Rugs
314999	Waterproof Outerwear
314999	House furnishings, Except Curtains and Draperies
316110	Leather & Hide Tanning & Finishing
316998	All Other Leather Good & Allied Product Mfg
322121	Paper Mills
322219	Sanitary Food Containers, Except Folding
322220	Packaging Paper and Plastics Film, Coated and Laminated
322220	Coated and Laminated Paper, Not Elsewhere Classified
322220	Plastics, Foil, and Coated Paper Bags
323111	Commercial Printing, Lithographic
323120	Platemaking and Related Services
324110	Petroleum Refining
324110	Oil Refineries (same primary NAICS as Petroleum Refining above)
324122	Asphalt Shingle and Coating Materials Manufacturing
324191	Lubricating Oils and Greases
325199	Chemicals and Chemical Preparations, Not Elsewhere Classified
325211	Fluoro-polymer resins manufacturing
325220	Manmade Organic Fibers, Except Cellulosic
325510	Paints, Varnishes, Lacquers, Enamels, and Allied Products
325611	Perfumes, Cosmetics, and other Toilet Preparations
325612	Specialty Cleaning, Polishing, and Sanitation Preparations
326113	Unsupported Plastics Film and Sheet
326121	Unsupported Plastics Profile Shapes

NAICS	NAICS title
326121	Plastics Products, Not Elsewhere Classified
326130	Laminated Plastics Plate, Sheet, and Profile Shapes
332813	Electroplating, Plating, Polishing, Anodizing, and Coloring
332999	Metal Foil and Leaf
333249	Surgical and Medical Instruments and Apparatus
333316	Photographic Equipment and Supplies
333318	Service Industry Machinery, Not Elsewhere Classified
333994	Industrial Process Furnaces and Ovens
334413	Semiconductor Manufacturing
423930	Recyclable Material Merchant Wholesalers
334613	Magnetic Tape Manufacturing Operations
424690	Chemicals and Allied Products, Not Elsewhere Classified
442291	Miscellaneous Home Furnishings Stores
488119	Airports
561740	Carpet and Upholstery Cleaning
562211	Hazardous Waste Incinerators
562212	Landfills
562213	Solid Waste Combustors
562219	Other Nonhazardous Waste Treatment and Disposal
928110	National Security (DoD sites)