



REPORT TO THE
LEGISLATURE

JANUARY 2023

Reduction of PFAS

Progress update on efforts to reduce sources of PFAS to wastewater and solid waste facilities.

Legislative charge

[B]y January 31, 2023, report to the chairs and ranking minority members of the house of representatives and senate committees and divisions with jurisdiction over the environment and natural resources on the development and implementation of the initiative. This is a onetime appropriation. Laws of Minnesota 2021, 1st Special Session Chapter 6, Article 1, Section 2, Subd. 2(k).

Authors

Maya Gilchrist

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Lori McLain

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Minnesota Pollution Control Agency

520 Lafayette Road North | Saint Paul, MN 55155-4194 |

651-296-6300 | 800-657-3864 | Or use your preferred relay service. | Info.pca@state.mn.us

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Foreword

Per- and polyfluoroalkyl substances (PFAS) are a class of thousands of manmade chemicals that have been widely used in industry and consumer products for several decades. They have attracted significant scientific and regulatory attention due to their ubiquity in the environment, resistance to breakdown, and adverse effects on human and ecological health. Because of the difficulty in treating PFAS or removing them from the environment, pollution prevention efforts are necessary to reduce human and wildlife exposure to these chemicals.

Municipal wastewater systems and solid waste disposal facilities have been identified as potential “conduits” of PFAS to the environment. Although they do not produce or use PFAS, PFAS-containing waste from industrial, commercial, and consumer sources could pass through these facilities and ultimately be discharged to water, soil, and air. In 2021, the Legislature appropriated funding to the Minnesota Pollution Control Agency to identify strategies that will reduce the levels of PFAS entering wastewater and solid waste facilities. The purpose of this project is to evaluate upstream sources of PFAS to conduit facilities and develop implementable strategies to reduce those source emissions.

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Executive summary

Municipal wastewater systems and solid waste disposal facilities have been identified as potential conduits of PFAS to the environment, as they do not directly produce or use PFAS but may present pathways for environmental release. In 2021, the Legislature directed the Minnesota Pollution Control Agency (MPCA) to develop and implement an initiative to reduce PFAS loading to waste and treatment facilities. MPCA worked closely with a stakeholder advisory group to determine the project steps and define desired outcomes. Antea Group USA ("Antea") was contracted to implement the final Workplan developed based on this input. The key goals of this project are to 1) identify sources of PFAS to conduit facilities, 2) identify strategies to reduce source emissions of PFAS to conduits, and 3) develop useful tools for facility operators and local governments to implement these strategies. The project will also identify areas for future study that would advance PFAS source identification and reduction efforts. Efforts will continue to be guided by input from the advisory group as project work progresses.

The outcomes of the first project stage include identification of key industries found throughout Minnesota that potentially use PFAS. Details are outlined in this report and have been shared with MPCA and the advisory group. Antea has also finalized a detailed database documenting potential sources of PFAS to conduits. The second stage of the project, identifying source reduction strategies for PFAS entering conduit facilities, is in progress. Once finalized, MPCA will solicit formal feedback from the advisory group to determine strategies to prioritize in the development of educational and guidance materials. A final toolkit for distribution to waste operators and local governments is anticipated in spring 2023.

Legislation overview

In 2021, MPCA received a onetime appropriation of \$600,000 from the State Legislature to “develop and implement an initiative to reduce sources of perfluoroalkyl and polyfluoroalkyl substances (PFAS) in the environment that are eventually conveyed to municipal wastewater treatment facilities...and contained in solid waste that are disposed at solid waste facilities.” MPCA was directed to complete this initiative in partnership with the Minnesota Department of Health (MDH) and an advisory group consisting of members from specified organizations representing the waste and energy industries and local, regional, and state government bodies in Minnesota. The project directive consists of 5 components:

1. Identify the sources of PFAS to conduit facilities
2. Identify strategies to reduce source emissions of PFAS to conduit facilities
3. Develop guidance documents and educational materials on PFAS source reduction strategies
4. Identify issues for future study
5. Report project progress to the Legislature

These requirements are outlined in the Laws of Minnesota 2021, 1st Special Session Chapter 6, Article 1, Section 2, Subd. 2(k).

PFAS advisory group

MPCA is working with an advisory group to develop and implement the initiative to reduce sources of PFAS to municipal wastewater and solid waste facilities. The advisory group provided input in the early stages of project development to determine the goals for and desired outcomes of the initiative. MPCA used this input in drafting a request for proposals (RFP) and selecting a contractor to conduct the work. Initial outcomes have been presented to the advisory group, who will have the opportunity to provide direct feedback on the potential source reduction efforts identified by the project. MPCA will continue to solicit input from the advisory group as the initiative progresses.

Members

The PFAS Advisory Group consists of waste, environmental, and energy professionals as well as officials at the local, regional, and state levels. The following organizations are represented:

- The League of Minnesota Cities
- The Coalition of Greater Minnesota Cities
- The Minnesota Environmental Science and Economic Review Board
- The Minnesota Municipal Utilities Association
- Metropolitan Council Environmental Services
- Minnesota Association of Small Cities
- National Waste and Recycling Association
- Minnesota Rural Water Association
- Association of Minnesota Counties
- Solid Waste Administrators Association
- Partnership on Waste and Energy
- Minnesota Resource Recovery Association
- Minnesota Inter-county Association
- Minnesota Manufacturers' Coalition
- Association of Metropolitan Municipalities

Meeting history

Working meetings

In December 2021 and January 2022, MPCA held four meetings with the PFAS Advisory Group to work towards agreement on the components of the project.

The first meeting on December 10 focused on introduction of the advisory group and the project tasks outlined by the legislation. The advisory group discussed ideas for scoping the work to meet the legislative directives of identifying sources of PFAS to waste facilities, source reduction strategies, issues for future studies, and developing tools for implementation. Key themes that emerged from this conversation included the necessity to narrow the focus of the project (since PFAS represent a large and complex chemical class), the desire to identify practical solutions and develop tools that are useful to waste treatment operators and local governments, and the emphasis on learning from both successful State projects and PFAS actions in other states.

The subsequent meetings aimed to deepen the discussion on methods to achieve each of the project components: PFAS source identification, development of source reduction strategies, publication and distribution of guidance documents, and identification of subjects for future study. The advisory group generally concluded that that effective work would draw on existing scientific research, work done by

federal and state environmental agencies, and local case studies, while tailoring findings for relevance to Minnesota. It was noted that source reduction strategies and the corresponding guidance materials should be practical and implementable in Minnesota, be specific to both wastewater treatment plans and solid waste facilities, and consider potential broader impacts. Knowledge gaps identified over the course of this work should be communicated as items for future study.

Presentations

MPCA used the ideas generated by the working meeting discussions to develop the RFP for contracting this work and finalize the project workplan. Contractor work on this project began in May 2022. Since then, two meetings have been held to present project progress to the advisory group. In September 2022, MPCA presented an overview of the final Workplan, timeline for contractor deliverables, and advisory group feedback opportunities. Complementary State efforts to identify PFAS sources and reduce emissions were also shared. In October 2022, the contractor presented detailed findings from the first project task, identification of sources of PFAS to conduit facilities as applicable to Minnesota.

Contracting and workplan

In March 2022, MPCA opened an RFP for contractors to implement the finalized PFAS Source Evaluation and Reduction initiative. The RFP included a detailed workplan incorporating feedback from the advisory group and the project components directed by the legislation. Antea Group USA (“Antea”) was selected to perform the work beginning in May 2022. The Workplan consists of 5 project tasks:

1. Identify sources of PFAS to conduits
2. Identify source reduction strategies
3. Formally solicit stakeholder feedback on Tasks 1 and 2
4. Develop a toolkit of source reduction strategies for implementation
5. Identify issues for future study

Input from MPCA and the advisory group will be incorporated into each of Antea’s final deliverables.

Identify sources of PFAS to conduits

The first project task is to identify likely sources of PFAS to wastewater treatment and solid waste facilities in Minnesota. To narrow the project scope and ensure relevance to conduits in Minnesota, this task included a PFAS prioritization process to determine the compounds to target for source reduction. Industrial, commercial, and consumer sources of these PFAS were searched in the literature and compiled into a usable table. Findings have been reported to MPCA and the PFAS Advisory Group in writing and via presentation.

Identify source reduction strategies

The second project task is to compile information on strategies to effectively reduce PFAS emissions to conduit facilities. These strategies will be evaluated and prioritized based on factors including relevance to Minnesota, feasibility, impact of implementation, and target audience. Outcomes including the priority source reduction strategies will be reported to MPCA and the PFAS Advisory Group in writing and via presentation.

Solicit stakeholder feedback

The advisory group will have the opportunity to offer direct feedback on tasks 1 and 2. At least two focus groups will be held for participants to review the prioritized list of source reduction strategies and

determine which strategies are implementable, how they may be implemented, and what tools would be needed to support implementation. Feedback will be provided to MPCA in writing.

Develop a toolkit for implementation

The implementable source reduction strategies identified in tasks 2 and 3 will be used to create a toolkit of guidance and educational materials for use by operators of conduit facilities. These tools may include printed materials such as pamphlets or fact sheets, templates for traditional or social media publications, and educational videos. A draft toolkit will be provided and presented to MPCA and the advisory group.

Identify issues for future study

A written summary will be provided identifying informational needs to support further PFAS source identification and reduction work. These may include areas such as toxicity information, data gathering, product testing, cost analysis, and/or pilot studies of source reduction strategies.

Project progress

Antea has completed Workplan task 1, identification of sources of PFAS to conduits. They shared initial project outcomes with the PFAS Advisory Group in October 2022, and final written materials were provided to MPCA in November 2022. Workplan task 2, identification of source reduction strategies, is currently in progress.

The key products of Workplan activities thus far are:

- A catalog of high priority PFAS compounds for conduit facilities
- A searchable database of sources of these PFAS to conduit facilities
- An analysis of industries that are likely sources of PFAS to conduits in Minnesota

These products will provide a foundation for the source reduction strategies and toolkits that will be developed in the latter half of this project.

PFAS catalog

PFAS were prioritized for source evaluation based on health criteria and relative presence in conduit wastes. The six compounds that have been assigned health-based guidance values by MDH were included. Antea reviewed studies of PFAS commonly found in conduit wastes to inform the rest of the list. The final catalog consists of 17 PFAS that are the focus of the source identification work in task 1 (Table 1).

Sources to conduits

Antea reviewed the literature to determine the possible sources of each of these 17 PFAS compounds to wastewater and solid waste facilities. Products and waste streams from a breadth of industries were identified as sources of these compounds. Table 1 includes illustrative examples of these industrial sources.

Table 1. Select industrial sources of PFAS for each target compound included in the catalog. Compounds denoted with an asterisk (*) are those for which MDH has developed health-based guidance values.

Catalog PFAS compound	Common name	Industrial Sources
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Perfluorooctane sulfonate*	PFOS	Plastic, rubber, resins, textiles, electronics, building
Perfluorobutanesulfonate*	PFBS	Plastic, rubber, resins, textile, electronics, building
Perfluorohexanoate*	PFHxA	Textiles, paper, personal care products
Perfluorobutanoate*	PFBA	Metal plating, textiles, cookware, personal care products
Perfluorooctanoate*	PFOA	Automotive, paints, textiles, wood processing
Perfluorohexanesulfonate*	PFHxS	Wood processing, textiles, rubber
Octanoic acid, 3,3,4,4,5,5,6,6,7,7,8,8,8-tridecafluoro-	6:2 FTCA	Food packaging
6:2 Fluorotelomer Sulfonic Acid	6:2 FTSA	Metal plating
Decanoic acid, 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-heptadecafluoro-	8:2 FTCA	Carpet
N-Methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	Textiles
Perfluoroheptanoate	PFHpA	Textiles, wire, personal care products
Perfluoropentanoic acid	PFPeA	Textiles
2H,2H,3H,3HPerfluorooctanoic Acid	5:3 FTCA	Textiles, packaging, personal care products
Perfluorononanoate	PFNA	Wax, paint, metal plating, textiles
Perfluorododecanoic Acid	PFDoDA	Personal care products, paints, textiles, floor cleaners
Perfluoroundecanoic Acid	PFUnDA	Personal care products, medical, textiles, packaging
Dodecanoic acid, 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,12-heneicosafuoro-	10:2 FTCA	Food packaging

A searchable database was developed detailing specific products containing the relevant PFAS compound(s), industry types and classification codes, chemical identifying information, and the types of conduit facilities that may receive these products via waste streams (Figure 1). Further description and literature citations are available within the database.

Figure 1. Excerpt from searchable database of PFAS sources. There are additional columns in the database with further information about each source.

Product	Industry	NAICs Code (MPCA List)	NAICs Code (Other)	Conduit Facility	PFAS Name	Chemotox ID #	CAS Number (pdf)
Photographic Film, Paper, and Plates	Photographic Industry	325992		Solid Waste	Perfluorooctane Sulfonate	DTXSID80108992	not identified
Non-Decorative Hard Chrome Plating Mist Suppressant and Wetting Agent	Metal and Plastic Plating		332813	Both Solid Waste and Waste Water	Perfluorooctane Sulfonate	DTXSID80108992	not identified
Non-Decorative Hard Chrome Plating Mist Suppressant and Wetting Agent	Metal and Plastic Plating		332813	Both Solid Waste and Waste Water	6:2 Fluorotelomer Sulfonic Acid	DTXSID6067331	27619-97-2

Key industries in Minnesota

Publicly available databases were used to assess the relative importance of industries potentially using PFAS in Minnesota. Databases detailing information about PFAS chemistries, associated industry sectors, and businesses in Minnesota were analyzed to link these businesses with the specific PFAS chemicals known to be used by their industry sector. This analysis showed that the PFAS compounds targeted in this study, which are commonly found in waste at conduit facilities, are also used by industries present in Minnesota. These industries include but are not limited to:

- Metal plating
- Plastic products manufacturing
- Aerospace/automotive industries
- Waxes, paints, and varnishes
- Soaps and detergents
- Electronics and semiconductors
- Textiles
- Food packaging
- Paper
- Construction flooring
- Personal care products

The key outcome of this analysis is a list of industries potentially using PFAS in Minnesota, sorted by the industries' relative presence in the state (Figure 2). Businesses performing electroplating and plating, plastics product manufacturing, fabricated metal product manufacturing, and commercial printing were among the most prevalent potential PFAS users identified in Minnesota.

Figure 2. Industries known to use PFAS, sorted by relative presence in Minnesota (“Percent Relative Abundance”). Other industries with less than or equal to 1% relative abundance are not shown here. NAICS = North American Industry Classification System, the standard used by Federal agencies in classifying business.

NAICS Title	Percent Relative Abundance
Electroplating, Plating, Polishing, Anodizing, and Coloring	10
All Other Plastics Product Manufacturing	10
All Other Miscellaneous Fabricated Metal Product Manufacturing	9
Commercial Printing (except Screen and Books)	9
Surgical and Medical Instrument Manufacturing	5
All Other Miscellaneous Chemical Product and Preparation Mfg	4
Recyclable Material Merchant Wholesalers	3
Other Airport Operations	3
Surgical Appliance and Supplies Manufacturing	3
Paint and Coating Manufacturing	3
All Other Basic Organic Chemical Manufacturing	3
Boat Building	3

NAICS Title	Percent Relative Abundance
Other Chemical and Allied Products Merchant Wholesalers	2
Soap and Other Detergent Manufacturing	2
Unlaminated Plastics Film and Sheet (except Packaging) Mtg	2
Petroleum Lubricating Oil and Grease Manufacturing	2
Plastics Material and Resin Manufacturing	2
Polish and Other Sanitation Good Manufacturing	2
Showcase, Partition, Shelving, and Locker Manufacturing	2
Commercial and Service Industry Machinery Manufacturing	2
Semiconductor and Related Device Manufacturing	2
Unlaminated Plastics Profile Shape Manufacturing	2
Paper Mills	1
Laminated Plastics Plate, Sheet (except Packaging), and Shape Mfg	1
Paper Bag and Coated and Treated Paper Manufacturing	1
Asphalt Shingle and Coating Materials Manufacturing	1
Petroleum Refineries	1

Timeline for workplan completion

The draft report describing outcomes from Workplan task 1, identification of sources of PFAS to conduits, was revised following feedback from MPCA and the PFAS Advisory Group. The final report was submitted to MPCA in November 2022. Workplan task 2, identification of source reduction strategies for PFAS entering conduits, is in progress. Draft materials describing the outcomes of this work were submitted in December 2022 and will be shared with the advisory group in January 2023. Stakeholder focus group sessions will be held between January and February 2023 to provide formal feedback on the identified source reduction strategies and determine the most useful strategies to pursue for implementation. Using this input, a draft toolkit of guidance and educational materials (Workplan task 4)

will be provided by the end of February 2023. The toolkit will be finalized by the end of April 2023 following feedback from the advisory group. A final report including the results of workplan tasks 1-4 and issues identified for future study will be provided by June 2023. A full timeline of project activities is provided as Table 2.

Table 2. Timeline of completed ongoing, and anticipated project activities.

Date	Project activity
December 2021 – January 2022	PFAS Advisory Group meetings: work groups to develop project goals and RFP
March – April 2022	Solicitation for contractors
May 2022	Contract with Antea Group effective
June 2022	Project kick-off meeting with MPCA and Antea
June 2022	Start of bi-weekly check-in meetings between MPCA and Antea
June 2022	PFAS compound catalog developed
September 2022	MPCA presentation to advisory group on Workplan
October 2022	Draft materials for Workplan task 1 submitted
October 2022	Antea presented draft task 1 materials to the advisory group
November 2022	Final task 1 materials submitted to MPCA
December 2022	Draft of workplan task 2 submitted
January 2023	Final task 2 materials to be submitted
January 2023 – February 2023	Task 3: Stakeholder focus groups on tasks 1 and 2
February 2023	Draft task 4 materials (toolkit) to be submitted
February or March 2023	Draft toolkit to be presented to the advisory group
April 2023	Final toolkit to be submitted
June 2023	Antea to submit full report including issues for future study