

Michigan Waste & Recycling Association Statewide Study on Landfill Leachate PFOA and PFOS Levels and Relative Influence on Water Resource Recovery Facility (WRRF) Influent



Completed in Collaboration with Michigan Department of Environmental Quality

Summary Report

March 1, 2019

Introduction and Overview

This report summarizes the results of a statewide study completed on behalf of the Michigan Waste & Recycling Association (MWRA) to determine levels of PFOA and PFOS in the leachate of those landfills participating in the study, and to estimate the leachate's relative contribution to the total amount found in wastewater influent at water resource recovery facilities (WRRFs) (aka POTWs or publicly owned treatment works, or sewage or wastewater treatment plants). The study involved testing leachate at 32 active municipal solid waste landfills (Type II landfills) located throughout the state. This summary presents general background information on PFAS for readers who may not be familiar with these compounds, summarizes testing results, and summarizes available PFAS information from WRRFs that receive leachate and those that do not. An accompanying technical report describes sampling and analysis procedures, provides test results and leachate information for individual landfills, and evaluates available PFAS information from WRRFs.

PFOA and PFOS are two compounds in a class of compounds known as Per- and polyfluoroalkyl substances (PFAS). They have been used for over 50 years in household products such as non-stick coatings in cookware, in stain and water-resistant coatings and fabrics, and in industrial products such as firefighting foam. More recently, certain PFAS compounds were identified as having potentially adverse effects on human health and the environment. In general, PFAS compounds are resistant to natural degradation, and can therefore persist in the environment for a long time.

Each solid waste landfill in the study is licensed by the State of Michigan to accept household, commercial, and industrial solid waste generated by the communities they serve. Some of the wastes received for disposal contain PFAS. Leachate is the liquid that occurs in landfills when rainwater combines with moisture contained within the waste. Chemicals present in the waste may be present in the leachate. The leachate is effectively captured by



utilizing engineered liner and active liquid collection systems. A common method of leachate management is through discharge to a local WRRF where it is handled with other household, commercial, and various industrial wastewaters. In this way, leachate is managed in a closed system where there is no direct exposure to the public.

Landfill leachate sent to a WRRF is typically directly discharged via pipeline or stored in onsite tanks prior to being transferred to tanker trucks and hauled to the treatment facility. WRRFs are engineered structures that apply various technologies to treat wastewater to meet certain regulatory criteria prior to discharge of these waters.

In 2018, the Michigan Department of Environmental Quality (MDEQ) and various WRRFs requested that landfills test for PFAS in leachate as part of a statewide effort to better understand the presence of PFAS in the environment and to work toward plans for PFAS reduction, where needed.

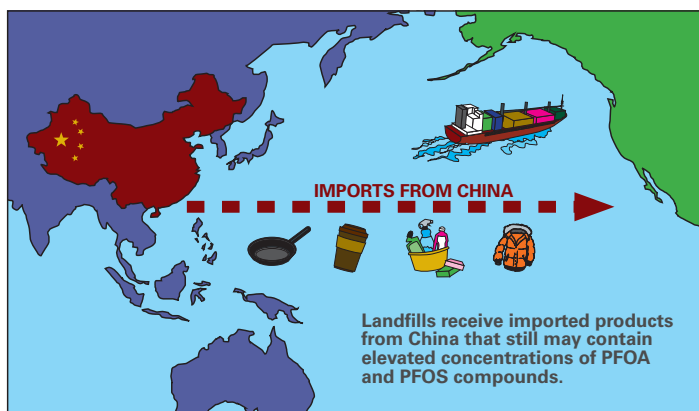
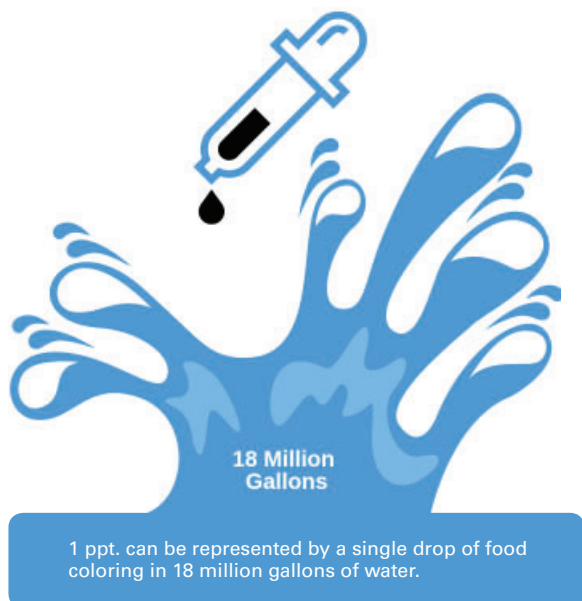
The information was also useful to examine the interdependent cycle of waste disposal, leachate generation, wastewater treatment, and wastewater sludge disposal.

PFAS Occurrence and Regulation

It is now known that PFAS compounds are widely present in the environment and have been detected globally in many common media including lakes, rivers, oceans, soil, air, plants, and animals. PFAS compounds enter the environment through manufacturing processes, industrial use, and the use and disposal of common consumer products. Two of the most widely used and studied compounds (PFOA and PFOS) are the focus of this study.

The US Environmental Protection Agency (EPA) has not regulated any PFAS compounds under the Safe Drinking Water Act. Nevertheless, in 2016, it established a drinking water health advisory (HA) for PFOA+PFOS of 70 parts per trillion (ppt), either individually or in combination. The HA is not an enforceable drinking water standard but was established as a protective guidance for the most sensitive persons over a lifetime of exposure. Michigan adopted the 70 ppt level in 2018 as a standard for cleanup of groundwater at remediation sites. For reference, one ppt is equivalent to a single drop of food coloring in 18 million gallons of water.

In the early 2000's, toxicity and environmental persistence concerns caused a voluntary phase-out of PFOA and PFOS production in the US. However, these compounds continue to be used in products manufactured overseas in countries such as China. Importing of these products leads to continued and pervasive disposal of PFAS-containing materials in US landfills. The persistence and widespread presence of PFAS has led to calls for increased regulation. However, there remains scientific disagreement regarding application of the toxicity data, which complicates developing reasonable strategies of how best to manage these compounds.



This MWRA study provides important context regarding the influence that landfill leachate has on PFOA and PFOS in the influent to WRRFs. Managing PFAS-containing waste is a challenge that touches all sectors of the economy, including the solid waste industry, manufacturing and commercial sectors, and the general public. It is a societal concern that we need to work together to effectively manage. Some factors important to the study results include:

- PFAS-containing products and waste materials routinely sent to landfills for disposal include non-stick cookware coatings, stain resistant fabrics (clothing, furniture, carpet), grease-resistant paper coatings (food packaging), cleaning products, soaps, cosmetics, lotions, WRRF biosolids (wastewater sludge), firefighting foams, lubricants, wetting agents, corrosion inhibitors, recycled paper, metal plating/refinishing waste, and pesticides.
- Because PFAS such as PFOA and PFOS are in so many consumer and industrial products, it is not surprising they are present in landfills and, hence, in landfill leachate.
- Many PFAS containing consumer products that are disposed in landfills are imported from foreign countries with little to no regulation regarding the use of PFAS (e.g., from China).
- Data on other PFAS-containing industrial and municipal solid waste streams that are disposed in landfills is currently very limited.

MWRA's Study Results and Conclusions

This MWRA study encompassed a majority of landfills and associated WRRFs in Michigan. The study included:

- PFOA and PFOS data from 35 out of a total of 45 active Type II landfills in Michigan, including:
 - Data collected from 32 MWRA member active Type II landfills as part of this study.
 - Publicly available data from 3 other active Type II landfills.
- PFOA and PFOS data from 39 Michigan WRRFs, which include:
 - 11 with influent data and that accept leachate from 23 MWRA participating landfills that were part of this study
 - 2 with influent data and that accept leachate from 2 other landfills that had publicly available PFOA and PFOS data
 - 6 with influent data and that accept leachate but for which data from the landfills was not available
 - 20 with influent data but do not accept leachate

PFOA and PFOS were detected in all of the leachate samples taken in the study. The concentration ranges were similar to previous leachate studies conducted elsewhere in the US. The variability from landfill to landfill may reflect variations in waste-types, waste age, size of landfills in the study, and the relative state of decomposition. In summary:

- In leachate sampled from MWRA member landfills that participated in this study, PFOA ranged from 240 to 3,200 ppt and PFOS ranged from 100 to 710 ppt.
- In published studies of landfill leachate in the United States, PFOA ranged from 30 to 5,000 ppt and PFOS ranged from 3 to 800 ppt.
- Michigan leachate concentrations were substantially lower than some other countries, such as China, where published studies show PFOA ranged

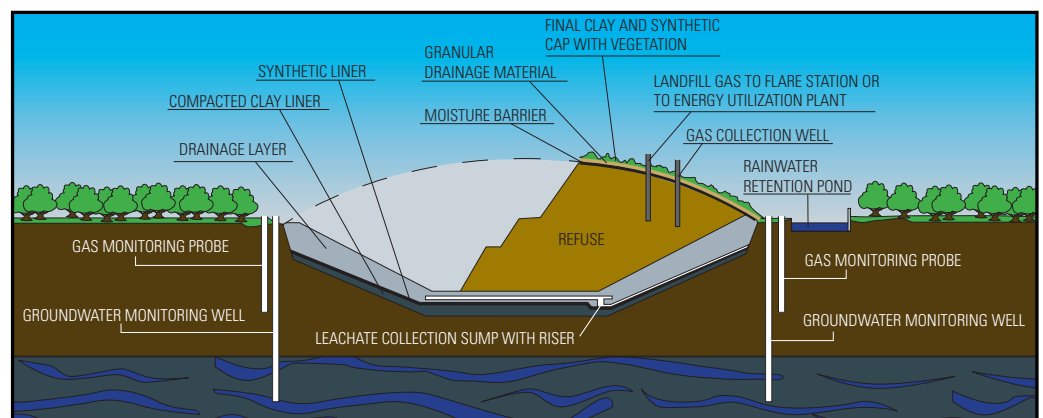
from 281 to 214,000 ppt and PFOS ranged from 1,150 to 6,020 ppt.

Comparing leachate volume and mass contribution from the 35 landfills examined to the total influent mass at the 39 WRRFs shows that the contribution of PFOA and PFOS is mostly from non-landfill sources.

- On a statewide basis, available data indicates that the 35 landfills contribute approximately one million gallons of leachate to WRRF influent, with approximately 0.01 lbs / day of PFOA and 0.003 lbs / day of PFOS.
- On a statewide basis, available data indicates that the 34 WRRFs that have influent data receive approximately 1.4 billion gallons of influent daily (based on design capacity), with approximately 0.09 lbs / day of PFOA and 0.15 lbs / day of PFOS.

The ranges of PFOA and PFOS concentrations in WRRF influent that do not accept leachate show overlap with those that do accept leachate.

- In WRRFs that do not accept landfill leachate, influent levels of PFOA range from non-detect to 17.9 ppt while PFOS ranges from non-detect to 499 ppt (next highest value is 128 ppt).
- In WRRFs that accept landfill leachate, influent levels of PFOA range from non-detect to 64.6 ppt while PFOS ranges from non-detect to 62.4 ppt.
- Available data show that PFOA levels in WRRF influent are well below Michigan's most conservative surface water criteria (420 ppt) at all WRRFs examined, and that PFOS levels in WRRF influent are below Michigan's most conservative surface water criteria (11 ppt) at approximately two-thirds of the WRRFs examined.



- The data collected during this study indicate that leachate provides a relatively minor contribution to the overall PFOA and PFOS concentration in most WRRF influent; non-leachate sources of PFOA and PFOS contribute greater mass to WRRF influent than leachate.

MWRA's Study Recommendations

Based on the results of this study, we present the following recommendations:

- The solid waste industry in Michigan (and nationally) must continue working to understand the significance of the contribution of leachate to PFOA and PFOS received by WRRFs and work towards reduction solutions.

The overall PFAS issue is complex and will require cooperation between the government, industry, and the general public to develop meaningful, long-term solutions.

- The conclusions of this study are based mainly on a single leachate sample from each landfill and limited available data for WRRFs. Therefore, calculated mass values are estimates and more data and information are needed. This should include additional leachate data, WRRF influent data, and biosolids data.
- Facilities will need to present and discuss their individual results with the WRRF receiving their leachate to help evaluate any appropriate solutions on a local basis.

The information gathered during this study and other research can be used to develop, where needed, improved practices for management of waste that contains PFAS within and between landfills and WRRFs. Future collaboration should involve forming a workgroup consisting of MWRA members, MDEQ, MPART, and WRRFs. Discussions should take into consideration the unique aspects of landfills as a component of PFAS management and their interdependence with WRRFs in providing an important function to society. Further, the stakeholder parties need to work with toxicologists and other environmental scientists to better understand the potential impacts of PFOA and PFOS on human health in the context of landfill leachate and in general.

MWRA is committed to continue playing an active role in this process, as demonstrated by its funding of this statewide leachate report and ongoing participation with state and federal technical and scientific committees working toward solutions that follows sound scientific principles and implements best management practices where needed.