MICHIGAN DEPARTMENT OF
ENVIRONMENT, GREAT LAKES, AND ENERGY

LAND APPLICATION OF BIOSOLIDS CONTAINING PFAS

Interim Strategy

Updated April 2022

EGLE, WATER RESOURCES DIVISION

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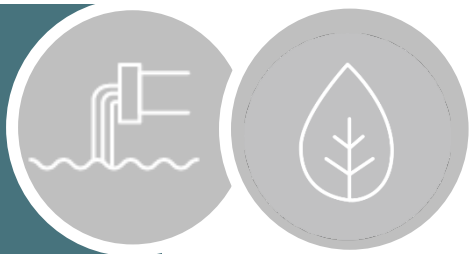

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2022 INTERIM STRATEGY FOR LAND APPLICATION OF BIOSOLIDS

The 2021 PFAS Interim Strategy, finalized in March of 2021, went into effect for land application occurring on or after July 1, 2021. Please see the 2021 Land Application of Biosolids Containing PFAS Interim Strategy (Michigan.gov) (hereafter 2021 Interim Strategy) for background and supporting information on the Department of Environment, Great Lakes, and Energy's (EGLE) approach to address and reduce Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) concentrations in biosolids. The intent of this document is to share what has been learned about PFAS in biosolids since implementation of the 2021 Interim Strategy, and to provide updates to the Interim Strategy based on this new information for biosolids land-applied in Michigan.

As implementation of the 2021 Interim Strategy is ongoing, EGLE's goal remains for wastewater treatment plants to continue reducing PFAS concentrations in biosolids to the maximum extent practicable, while achieving or maintaining compliance with Surface Water Quality Values (WQV) at the wastewater treatment plant (WWTP) effluent. EGLE acknowledges the United States Environmental Protection Agency's (USEPA) efforts in conducting a risk assessment of PFAS in biosolids, and strives to prevent further land application of industrially-impacted biosolids, mitigate (reduce) risks moving forward, and continue source identification and reduction efforts to drive down PFAS concentrations in impacted biosolids as quickly as possible.

2021 INTERIM STRATEGY

Since the strategy went into effect in July 2021, EGLE has received the results of biosolids sampling for PFAS analysis from 162 municipal WWTPs. This information has increased the understanding of PFAS concentrations present in biosolids at Michigan WWTPs, both at facilities that have known industrial users/sources (with Industrial Pretreatment Programs (IPPs)) as well as those that do not have known sources (without IPPs (hereafter non-IPPs)).

Industrially-Impacted Biosolids

In the 2021 Interim Strategy, EGLE utilized 150 micrograms per kilogram (µg/kg) of PFOs Perfluoro-octanesulfonic Acid (PFOS) as the threshold for biosolids to be considered industrially impacted (see the 2021 Interim Strategy document for additional information). This threshold was initially used by EGLE in 2017 to prohibit land application of biosolids from six WWTPs. Table 1 below shows the biosolids concentrations from the six WWTPs in 2017 and 2018, and the corresponding concentrations from the same facilities in 2021. Of the 162 facilities that submitted biosolids data in 2021, only one WWTP was identified with a PFOS concentration in biosolids above 150 µg/kg. This WWTP was one of the six WWTPs previously identified as having industrially-impacted biosolids in 2018. Through implementation of source reduction efforts required by the IPP PFAS Initiative, this WWTP had successfully decreased PFOS concentrations in their biosolids to 74 µg/kg in early 2021. However, in the Fall of 2021, the treatment plant was re-exposed to a source of PFAS, and concentrations increased to 180 µg/kg. Through additional source reduction efforts, the source has been controlled and alternative disposal of impacted biosolids is currently ongoing.

Two additional WWTPs from the original six with industrially-impacted biosolids had concentrations above 100 µg/kg in 2021, but were below the industrially-impacted threshold of 150 µg/kg. In accordance with the 2021 Interim Strategy, these facilities were required to either reduce application rates or implement an Alternative Risk Mitigation Strategy prior to land application. One previously industrially-impacted facility saw significant reductions in biosolids concentrations, with 2021 PFOS concentrations at 33 µg/kg. The two remaining WWTPs do not land apply their biosolids.

All three WWTPs with PFOS concentrations greater than 100 µg/kg in biosolids from the 2021 Interim Strategy have shown a significant drop in PFOS concentrations since 2018. Prior to implementation of source control under the IPP PFAS Initiative, their biosolids concentrations were an order of magnitude higher, with four of the six facilities having PFOS concentrations over or close to 1000 µg/kg. Continued compliance and enforcement of the facility's IPP, including the establishment of a local limit for PFOS, will be critical to further reduce concentrations at these facilities.

Table 1 and Figure 1 show the 2017/2018 and 2021 data for the six facilities that have been identified to-date with industrially-impacted biosolids/sludge and the significant reductions that have been achieved through the implementation of source control. Four of the original 6 WWTPs with industrially-impacted biosolids have seen over 85 percent reductions in PFOS concentrations in their biosolids/sludge in the three years since implementation of the IPP PFAS Initiative. Please note µg/kg is equivalent to parts per billion.

Table 1. Identified Industrially Impacted Solids: 2017 to 2021 PFOS Results

WWTP	IPP	Significant Sources	2017/2018 Biosolids PFOS (µg/kg)	2021 Biosolids PFOS (µg/kg)	PFOS Reduction Since IPP Initiative
WWTP #50	Yes	Yes	983	140	85.8%
WWTP #14	Yes	Yes	1060	120	88.7%
WWTP #57	Yes	Yes	1680	33	98.0%
WWTP #54	Yes	Yes	161	74/180	54%/-11%
WWTP #92	Yes	Yes	2150	113	94.7%
WWTP #69	Yes	Yes	160	NS	N/A

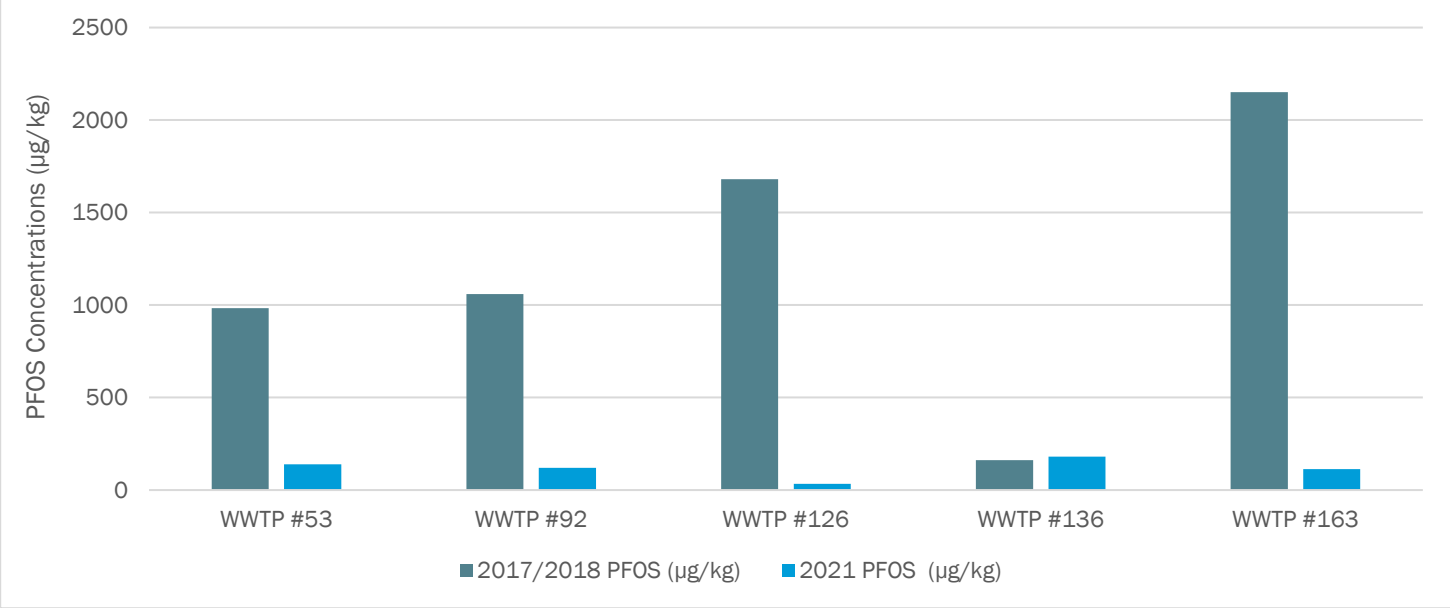
(NS = Not Sampled), N/A = not applicable

WWTPs #92 and #69 are WWTPs identified as having industrially-impacted solids through the IPP PFAS Initiative, but neither WWTP is included in the total number of WWTPs sampled for the 2021 Interim Strategy. WWTP #92 and WWTP #69 do not land apply biosolids.

*WWTP #92 had biosolids sampled as part of EGLE's 2021 Statewide Study.

**WWTP #69 does not have a 2021 biosolids PFOS result.

Figure 1. PFOS Concentration Reductions in Industrially Impacted Biosolids: 2017 to 2021



Overview of 2021 Interim Strategy Results

The 2021 Interim Strategy has provided data from a wide range of WWTPs both with and without industrial sources.

Of the 162 WWTPs that analyzed biosolids for PFAS in 2021, 155 WWTPs, or 96 percent, had PFOS concentrations at or below 50 µg/kg, with 136 WWTPs, or 84 percent, reporting PFOS under 20 µg/kg. Only seven WWTPs had a PFOS concentration above 50 µg/kg, four of which were below 100 µg/kg. The average concentration of all samples submitted under the 2021 Interim Strategy was 14 µg/kg and the median concentration was 8 µg/kg. PFOS concentrations in biosolids from all 162 WWTPs that submitted data in accordance with the 2021 Interim Strategy are displayed in the graphs below.

Figure 2. 2021 Interim Strategy PFOS Results

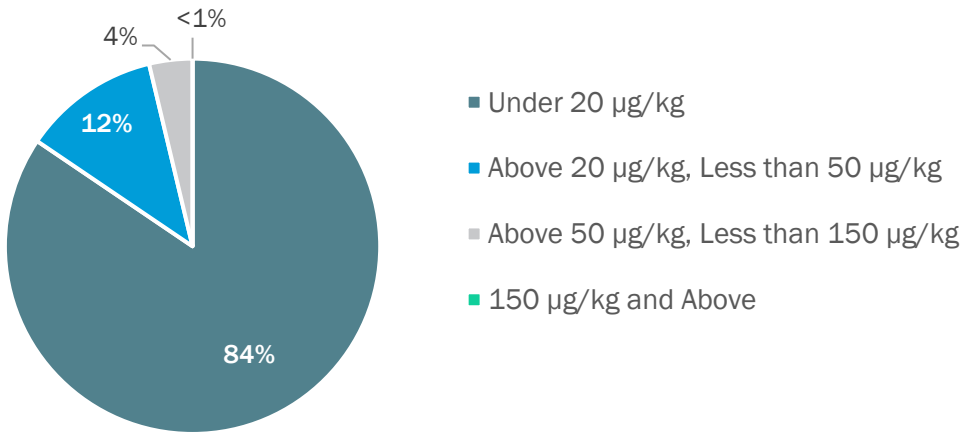
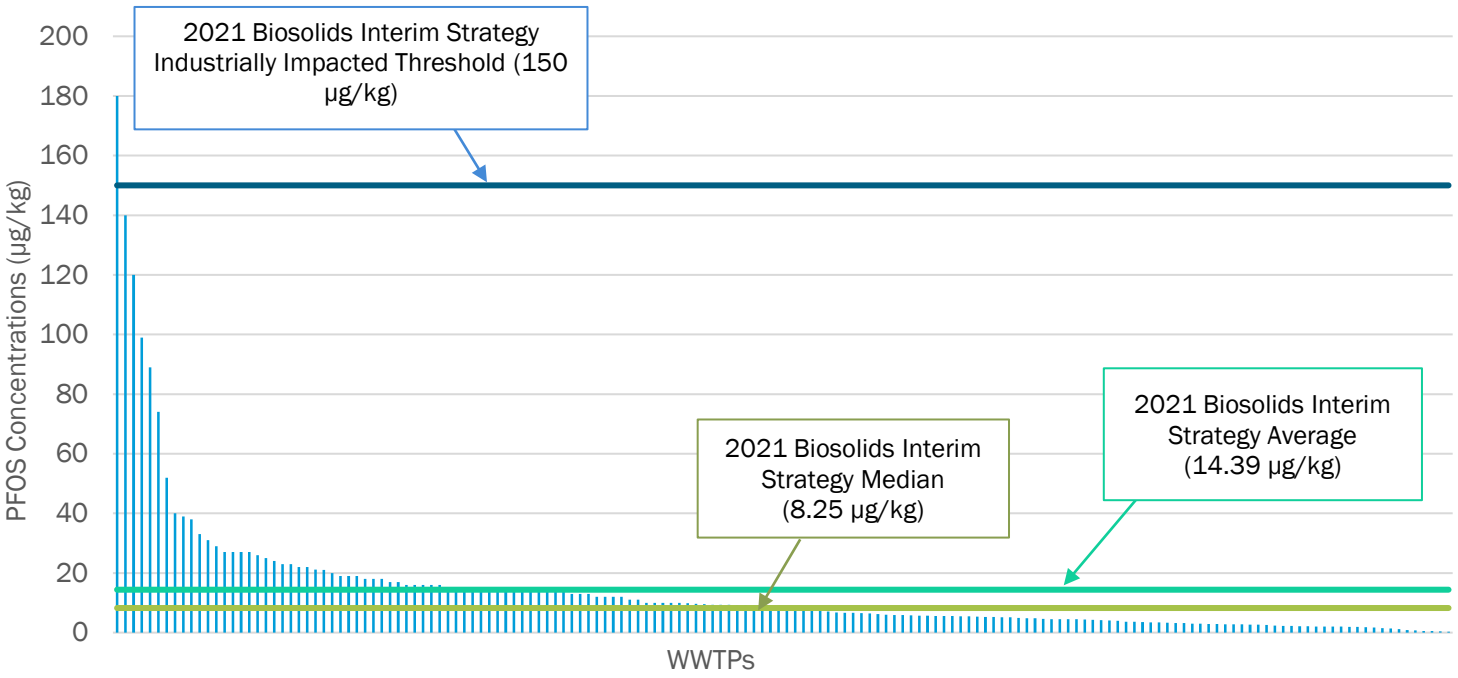


Figure 3. 2021 Interim Strategy PFOS Concentrations



Prior to 2021, most information on PFAS in municipal wastewater was associated with municipal WWTPs with IPPs, facilities that were included in statewide studies, and/or those that were sampled as part of a source tracking event. With implementation of the 2021 Interim Strategy, EGLE required all Municipal WWTPs, regardless of size or known sources, to sample their biosolids for PFAS prior to land application. With this requirement, PFAS concentrations in biosolids from 99 non-IPP WWTPs, was obtained. These facilities do not have industrial users to their systems that would require the establishment of an IPP under federal and state regulations. They are often smaller or mid-sized WWTPs that serve commercial/residential areas.

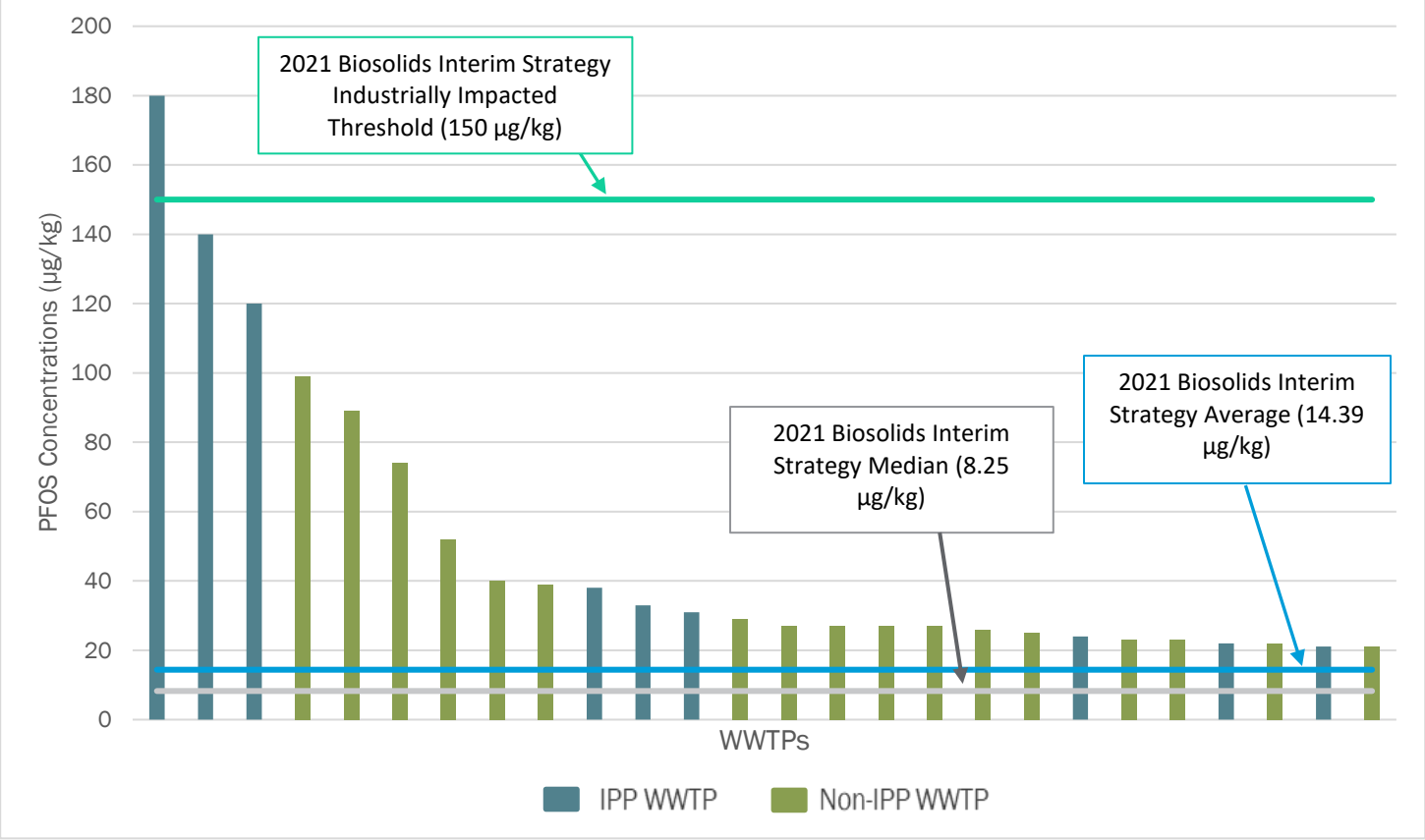
Of the 99 non-IPP WWTPs, 82 WWTPs, or 83 percent, had PFOS concentrations below 20 µg/kg. As shown in Table 2, 17 non-IPPs had PFOS concentrations above 20 µg/kg, with four of these WWTPs reporting a concentration above 50 µg/kg. The four non-IPP WWTPs above 50 µg/kg were required to sample the WWTP effluent and begin source identification. EGLE met with all four WWTPs to provide guidance on sampling procedures and identifying potential and probable sources of PFAS. Through the 2021 Interim Strategy requirements, three of these WWTPs have identified probable sources and source monitoring is ongoing. The fourth WWTP completed effluent sampling and is continuing with source identification. EGLE also met with one WWTP with a PFOS concentration above 20 µg/kg, but below 50 µg/kg. Per the 2021 Interim Strategy, source investigation is recommended for all WWTPs with biosolids concentrations greater than 20 µg/kg.

Table 2. 2021 Interim Strategy PFOS Results: IPP Status

WWTP IPP STATUS	Total Type of WWTP	20 µg/kg or below	Above 20 µg/kg, below 50 (µg/kg)	Above 50 µg/kg, below 150 µg/kg	150 µg/kg and above
Non-IPP	99	82	13	4	0
IPP	63	54	6	2	1
Total WWTPs	162	136	19	6	1

Figure 4 below displays the 26 WWTPs with a PFOS result over 20 µg/kg from the 2021 Interim Strategy. The 9 IPP WWTPs are shown in blue, while the 17 non-IPP WWTPs are shown in orange. The dashed lines indicate the 2021 Industrially-Impacted Threshold of 150 µg/kg, while the bolded lines indicate the 2021 median and 2021 average PFOS concentrations.

Figure 4. 2021 Interim Strategy PFOS Concentrations Above 20 (µg/kg)



2022 UPDATE TO BIOSOLIDS PFAS INTERIM STRATEGY

While we look for a fully vetted, risk-based evaluation for PFAS in biosolids to be completed by the USEPA and additional research, EGLE will implement the following updates to the Interim Strategy to guide WWTPs and landowners/farmers who make decisions on land applying biosolids with detectable concentrations of PFAS. The updates of the Interim Strategy align with EGLE's goal to continue to re-evaluate PFAS in biosolids as the science evolves. EGLE will also continue to evaluate the Interim Strategy as we move forward and make adjustments as appropriate. EGLE remains committed to ensuring that industrially impacted biosolids are not land applied and to evaluate historical land application scenarios that may present unacceptable risks to public health.

The implementation of these measures is part of a strategy to mitigate risk to public health and the environment from potential adverse effects of an emerging pollutant, PFAS. These additional requirements are considered a modification to approved Residuals Management Programs (RMPs) and made in accordance with provisions outlined within the Michigan's Part 24 Administrative Rules, specifically Rule 2404(1) and language contained within existing discharge permits.

Industrially-Impacted Threshold

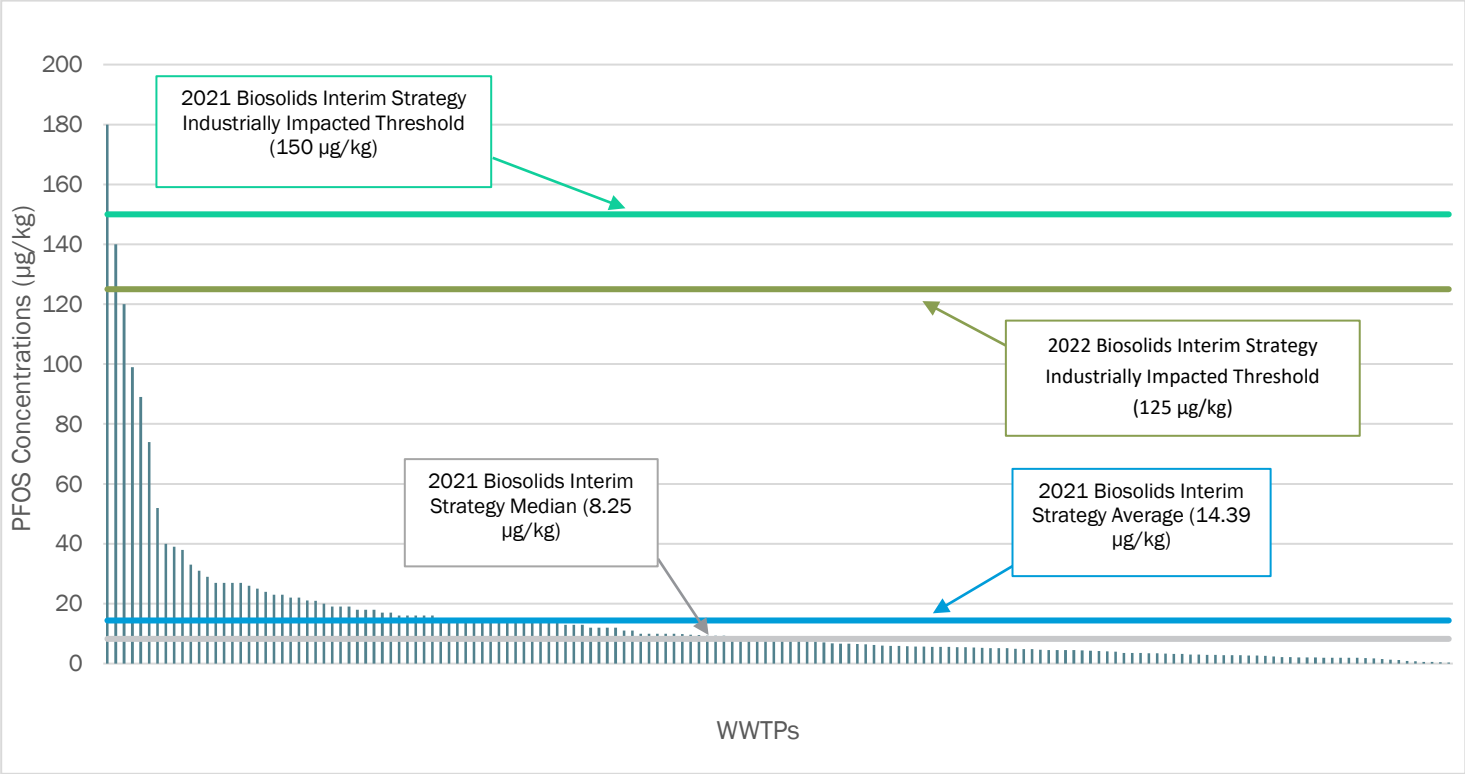
While Michigan continues to support the USEPA's effort to conduct a risk-based evaluation of PFAS in biosolids, EGLE's objective is to continue using source reduction to further reduce concentrations in biosolids. Based on the information collected in the 2021 Interim Strategy, and consistent with the objective, EGLE is revising the industrially-impacted threshold.

With this update to the Interim Strategy, beginning on July 1, 2022, biosolids will be deemed industrially-impacted if the PFOS concentration is 125 µg/kg or above. See Figure 5 below. The revision from 150 µg/kg to 125 µg/kg as the threshold for industrially-impacted biosolids is based on a number of factors, including EGLE's previous data reviews, as well as the review of the new data set received from WWTPs through the 2021 Interim Strategy implementation. It is consistent with continuing efforts to encourage WWTPs to control sources of PFAS/PFOS within their systems, whether they have IPP requirements in their permit or not. Finally, EGLE is committed to prevent land application of biosolids that have clearly elevated levels of PFOS from a significant industrial source.

Review of biosolids results from the large range of facilities collected in the 2021 Interim Strategy confirms that the majority of facilities in Michigan have levels of PFOS in biosolids much lower than the industrially-impacted threshold. In fact, 84 percent of the WWTPs had concentrations less than 20 µg/kg. Lowering the threshold is consistent with the main objectives of the strategy, which are to prohibit land application of industrially-impacted biosolids, focus efforts on source reduction and control, and continue to drive down PFOS concentrations in biosolids as quickly as possible.

Implementation of mitigation strategies for land applied biosolids above 50 µg/kg, but below 125 µg/kg, will continue to be required under this update.

Figure 5. 2022 Industrially Impacted Threshold



Additional Updates

In addition to lowering the industrially-impacted threshold, EGLE is seeking to provide clarification on sampling frequency for groundwater permittees, winter land application requirements, and requirements for Minor/non-IPP WWTPs with a PFOS result above 20 µg/kg. See details of the additional updates below.

The primary components of the biosolids strategy are as follows:

- **Effective Date** – All WWTPs are required to sample biosolids for PFAS prior to land application. Although EGLE is recommending that WWTPs consider implementing the updated industrially-impacted threshold for Spring 2022 land application season, implementation is required for land applications occurring on or after July 1, 2022.
- **PFAS Biosolids Sampling** - PFAS analysis of biosolids is required prior to land application. Sample frequency is determined by the size of the WWTP, whether an IPP is required, the type of groundwater permit, and previous Interim Strategy PFAS sample results.
- **PFAS Source Identification and Reduction** - PFAS analytical results of biosolids (and in many cases WWTP effluent) will dictate the level of source identification and reduction efforts.
- **Landowner and Farmer Communication** - Having an open dialogue with the landowner and farmer about PFAS in biosolids and source reduction efforts underway will be a critical step in moving forward. EGLE requires that analytical result information and additional educational resources and information specific to PFAS in biosolids work done in Michigan be made available.

BIOSOLIDS PFAS SAMPLING AND NOTIFICATION REQUIREMENTS

EGLE updated the Biosolids and Sludge PFAS Sampling Guidance. Updates include a discussion of the Draft USEPA Method 1633, sampling preparation, and laboratory report recommendations. Specifically, EGLE requests all biosolids and sludge, including those with low solids content, be analyzed as solids and reported on a dry weight basis. This analysis must be performed on the sample as received, not on centrifuged solids. Sufficient sample mass should be extracted to achieve a reporting limit of 2 µg/kg or less for PFOS. Additional updates in the guidance can be found in the Biosolids and Sludge PFAS Sampling Guidance document. Results of biosolids PFAS analysis shall be submitted to the WRD through MiEnviro at a minimum of two weeks prior to initial land application.

Required PFAS Sampling Prior to Land Application

One Sample Per Year – All USEPA Majors/All IPPs/All 2218 Groundwater Permittees that intend to land apply biosolids in Michigan shall collect and analyze a minimum of one representative biosolids sample for PFAS analysis in each year they intend to land apply, prior to the initial land application for the calendar year.

One Sample Each Permit Cycle (five years) – All other WWTPs that intend to land apply biosolids in Michigan shall collect a minimum of one representative biosolids sample analyzed for PFAS prior to land application. Thereafter, upon permit reissuance, WWTPs shall collect one representative sample for PFAS prior to the initial land application that occurs within the permit cycle (every five years). WWTPs under this sampling frequency shall conduct the biosolids PFAS sampling in the same year they intend to land apply in order to have the most representative sample. One-time RMP approvals, such as land application of biosolids removed from Wastewater Stabilization Lagoons, shall include a minimum of one representative sample for PFAS analysis. Sampling frequency is subject to change if PFOS concentrations are 20 µg/kg or above.

Analytical Results/Source Investigation and Control

- **PFOS at or above 125 µg/kg.**
  - Biosolids exceeding 125 µg/kg PFOS are deemed to be industrially impacted and cannot be land applied.
  - Immediately notify EGLE, WRD staff.
  - Sample effluent and investigate potential sources to develop a source reduction program, if they have not already done so under the IPP PFAS Initiative.
  - Arrange alternative treatment or disposal of solids.

- **PFOS at or above 50 µg/kg but below 125 µg/kg.**
  - Immediately notify EGLE, WRD staff.
  - Sample effluent and investigate potential sources to develop a source reduction program, if they have not already done so under the IPP PFAS Initiative.
  - To reduce overall loading to the site, reduce land application rates to no more than 1.5 dry tons per acre (or submit an Alternative Risk Mitigation Strategy).

- **PFOS above 20 µg/kg, but below 50 µg/kg.**
    - EGLE recommends investigating sources and sampling the WWTP effluent for PFAS. Guidance can be obtained from the WRD IPP PFAS staff.
    - If a WWTP on the Permit Cycle (five year) sampling frequency has a PFOS result above 20 µg/kg, the WWTP will be required to sample each year the WWTP intends to land apply, prior to land application.
- **PFOS at or below 20 µg/kg.**
    - This number is based on the averages derived from the Summary Report: Statewide Biosolids and WWTP Study and other available data. No additional requirements to comply with the Interim Strategy.

WWTPs are encouraged to collect more frequent PFAS samples for biosolids and may choose to sample annually, even if not required to do so. The WRD recommends including PFAS in routine sampling of biosolids prior to land application.

Communication to Landowners/Farmers

Prior to land application at a site, provide the PFOS analytical results to the landowner and farmer (if different) via hard copy or electronic mail. Also provide EGLE biosolids staff contact information and the additional PFAS-related resources provided in the PFAS Landowner/Farmer section of the PFAS Land Application Workgroup Web page.

Winter Land Application

EGLE requires WWTPs with a yearly sampling frequency to sample once per calendar year prior to the initial land application of the year. For some winter land applications, it can be difficult to complete sampling prior to land application when conducted within the first month of the year (January). If a WWTP had a seasonal land application that was intended to be completed by the end of the year (December 31), this application could be completed through January 31 of the following year. If there is a possibility land application may be extended past January 31, WWTPs are required to collect a new biosolids sample for PFAS analysis and submit the results prior to land application. Requests of land application extensions shall be submitted to the WRD via email. Decisions regarding winter land application extensions will be based on past biosolids PFAS data, WWTP effluent data, and any other relevant data.

Additional requirements, including other PFAS analytes, sampling frequency, limits, and notification requirements, may be amended as new information becomes available.

NEXT STEPS

In addition to implementing the measures discussed within this updated Interim Strategy for the land application of biosolids containing PFAS, EGLE has identified the following next steps that will continue to be implemented in the future as we expand implementation of the strategy.

- Continue implementing the recommendations of the Michigan PFAS Action Response Team (MPART) Science Advisory Panel.
- Engage the PFAS Land Application Workgroup stakeholders on implementation of the Biosolids Strategy.
- Continue supporting the USEPA's efforts to conduct a robust risk-based evaluation of PFAS in Biosolids.
- Collaborate with other states on strategies dealing with PFAS in biosolids.
- Review available documentation to identify historical land application sites associated with the previous use of PFOS and Perfluorooctanoic Acid (PFOA).
- Continue to implement IPP PFAS Initiatives at WWTPs and PFAS control strategies at non-IPP municipal NPDES and Groundwater discharges.
- Continue to support additional research to drive source reduction and reduce concentrations of PFAS in municipal wastewater and biosolids.
- Continue working with MPART workgroups to evaluate the fate and transport of PFAS in the environment.
- Continue to strictly implement NPDES, pretreatment, and biosolids regulations to facilitate the beneficial recycling of biosolids via land application to the extent the practice is compliant with applicable standards developed to assure the protection of public health and the environment. This is consistent with the advancement of the Utility of the Future (Water Resource Recovery Facility) concept which is cited as one of the recommendations to achieve the goals listed in the Michigan 21st Century Infrastructure Commission Final Report.

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Attachment A
MICHIGAN PFAS CRITERIA SUMMARY

Drinking Water - Safe Drinking Water Act (Act 399)

Compound	Concentration (PPT)	Standard	Established Date
PFOA (Perfluorooctanoic acid)	8	MCL*	Aug 2020
PFOS	16	MCL	Aug 2020
PFNA (perfluorononanoate)	6	MCL	Aug 2020
PFHxS (perfluorohexanesulfonate)	51	MCL	Aug 2020
PFBS (perfluorobutane sulfonate)	420	MCL	Aug 2020
PFHxA (perfluorohexanoate)	400,000	MCL	Aug 2020
GenX (Hexafluoropropylene oxide dimer acid)	370	MCL	Aug 2020

*MCL = Maximum Contaminant Levels for Public Water Supplies

Surface Water – Part 31

Compound	Concentration (PPT)	Standard	Established Date
PFOA (Drinking Water Source)	420	WQS	May 2011
PFOA	12,000	WQS	May 2011
PFOS (Drinking Water Source)	11	WQS	Mar 2014
PFOS	12	WQS	Mar 2014

*WQS = Water Quality Standards

Groundwater - Part 201

Compound	Concentration (PPT)	Standard	Established Date
PFOA	8	DW*	Dec 2020
PFOS	16	DW	Dec 2020
PFNA	6	DW	Dec 2020
PFHxS	51	DW	Dec 2020
PFBS	420	DW	Dec 2020
PFHxA	400,000	DW	Dec 2020
GenX	370	DW	Dec 2020
PFOA (DW Source)	420	GSI**	May 2011
PFOA	12,000	GSI	May 2011
PFOS (DW Source)	11	GSI	Mar 2014
PFOS	12	GSI	Mar 2014

*DW = Drinking water cleanup criteria
**GSI – Groundwater-Surface Water Interface