Emerging Contaminants & Landfill Leachate

SWANA Palmetto
2019 Annual Meeting
Pawleys Island

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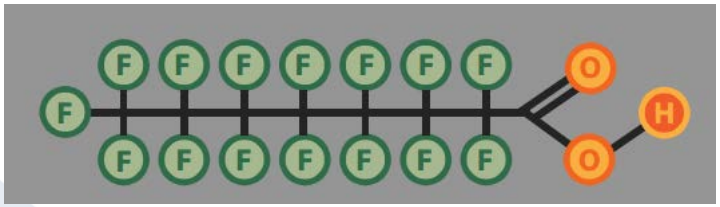
WILLIAMS MULLEN

Presentation Overview

1. Background on PFAS
2. Federal Actions and Laws
3. State Actions and Laws
4. Targets for Regulatory Oversight: SW Landfills
5. Crystal Ball



What are Emerging Contaminants?

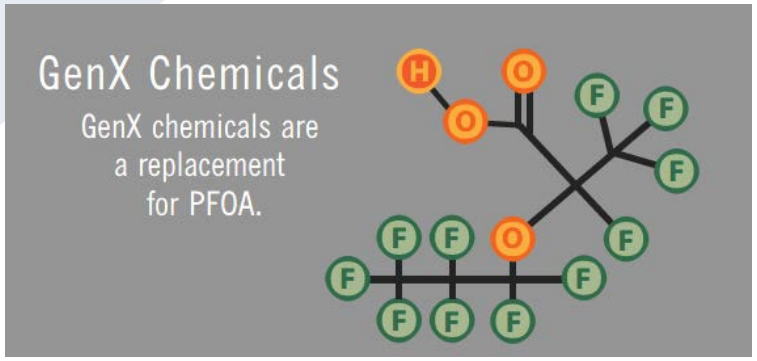
> Chemicals not previously detected (or previously far less) in the water supply.

> Also referred to as “contaminants of emerging concern”

> Risks to human health and the environment not yet fully understood.

> Introduced into water sources by way of agricultural runoff, foams, personal care pollutants, industrial

> Source: Municipal waste?



Emerging Contaminants

- Industrial chemicals like 1,4-Dioxane,
- PFAS: Per- and Polyfluoroalkyl Substances (PFAS) that include:
    - Perfluoro-octane Sulfonate (PFOS)
    - Perfluorooctanoic Acid (PFOA)
- GenX : technology used to make high performance fluoropolymers (e.g., some nonstick coatings) without the use of perfluorooctanoic acid (PFOA)

States: NC “GENX THE FILM”

> https://www.genxthefilm.org/
> https://youtu.be/OOOR5ab9M7c

PFAS

- Over 4,000 PFAS chemicals used in manufacturing worldwide since 1940s
- U.S. manufactures voluntarily phased out longer chain (more toxic and bio-accumulative)
- BUT: some replacement PFAS are capable of degrading to PFOA and other long-chain PFAS
- Widely distributed in air, soil and land
- Ecological and Human Health Risks
- Not regulated under the Federal Safe Drinking Water Act (yet)

PFAS and PFOA

> **Consumer and Industrial Uses:**

- Firefighting foam
- Chemical processing
- Building and construction
- Aerospace, electronic, semi-conductor and automotive industries
- Stain and water-resistant coatings
- Food packaging
- Waxes and cleaners

PFAS

- **2000 Started looking into health and ecological risks related to PFAS**
- **2006 U.S. companies began to voluntarily phase out of manufacturing and importing products using PFAS compounds**

Recent Federal PFAS Actions

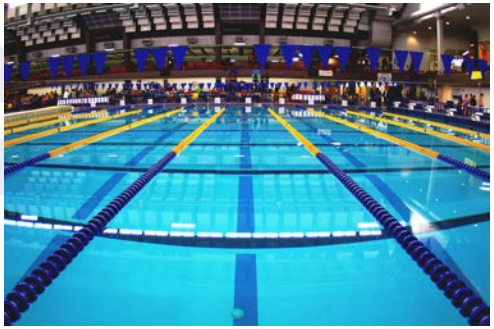
- **2012: EPA published third Unregulated Contaminant Monitoring Rule: to find data for 6 PFAS**
- **2013-2015: Collected Drinking Water Samples in nearly 5,000 public water systems**
  - using results to develop a SDWA regulatory drinking water determination process
- **2016: EPA released lifetime Health Advisories for PFOA & PFOS**
  - Non-enforceable, health based drinking water levels
  - 70 parts per trillion (PPT)
  - Gives state agencies technical information on health effects, analytical methods and treatment technologies

What is Parts Per Trillion

1 ppt = 1 second in 31,700 years

1 drop of water in 20 Olympic-sized pools

6 inches in the distance from here to the sun



*NWRA April 2019 Issue Brief: PFAS

Background EPA Actions

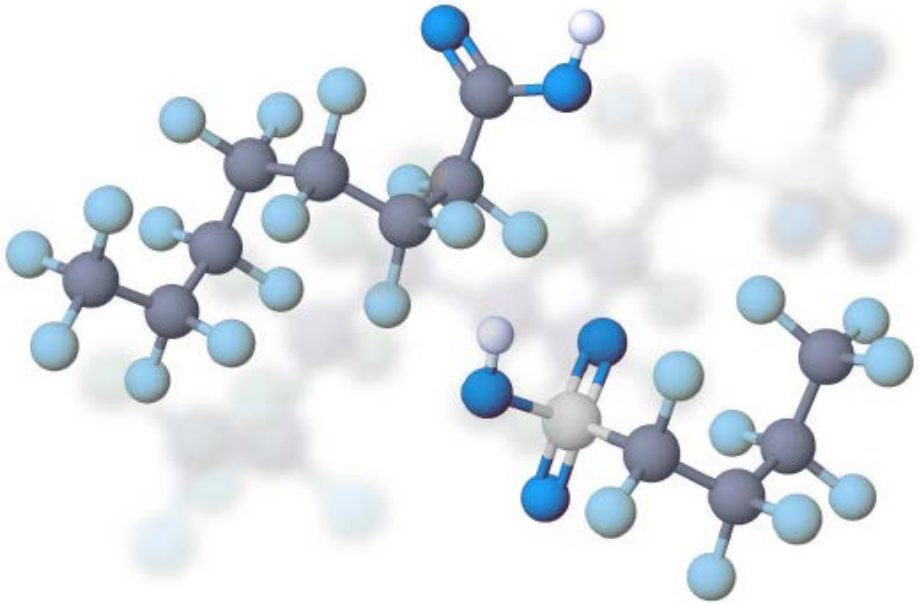
- **2015: Proposed a Significant New Use Rulemaking for Long-Chain PFAS**
  - Requires manufacturers and importers of PFOA and PFOA-related chemicals to notify EPA at least 90 days before starting or resuming new uses of these chemicals in products
- **2019: EPA Action Plan**
  - uncertainty across the US in how to most appropriately establish risk-based criteria for these compounds
  - consistency needed

FEB. 2019: EPA Action Plan

> **Priority Actions**

> **Short Term Actions**

> **Long Term Actions**



EPA Priority Actions

- **Propose a national drinking water regulatory determination (i.e. MCL) for PFOA and PFOS**
- **List PFOA and PFOS as CERCLA Hazardous substances**
- **Develop interim cleanup recommendations to address groundwater contaminated with PFOA and PFOS**
- **Finalize draft toxicity assessments for GenX Chemicals and PFBs**
- **Develop additional toxicity values for other PFAS Chemicals**
- **Use new TSCA Amendments to require reporting and review of new PFAS**

Short Term Actions (EPA)

1. **Understand and Address PFAS Toxicity and Occurrence**
   - Expand Drinking water Method 537 to include GenX chemicals and additional PFAS
   - Develop a new drinking water method for additional short-chain PFAS not measured by Method 537
   - DEVELOP AND VALIDATE METHODS FOR OTHER WATER MATRICES (WASTEWATER, SURFACE WATER, GW), SOLIDS (SOIL, SEDIMENT, BIOSOLIDS, FISH TISSUED) AND AIR

EPA SHORT TERM ACTIONS

2. **Identifying and Addressing PFAS Exposures**
3. **Risk Communication and Engagements**

United States Environmental Protection Agency

EPA Long Term Actions

1. Explore listing PFAS Chemicals to EPCRA Toxic Release Inventory reporting
2. Explore developing a CWA ambient water quality criteria for PFAS
   - States would create water quality standards and set permit limits on discharges to waterbodies
3. EXAMINE AVAILABLE INFO AND ASK FOR ADDITIONAL INFO FROM INDUSTRY TO IDENTIFY INDUSTRIAL SOURCES
4. ONCE IDENTIFIED, EXPLORE REGULATION THROUGH CONTROLS ON DISCHARGE AND INDIRECT DISCHARGE PERMITS

EPA LONG TERM ACTIONS

5. **Nationwide drinking water monitoring for PFAS**
   - Proposing new methods to detect more PFAS chemicals
   - Utilizing lower minimal reporting levels (MRLs) than previously possible
6. **Develop a PFAS data inventory**
7. **Identify sensitive and susceptible species**
8. **Incorporate info into the EPA atmospheric models – see if atmospheric fate and transport potential of PFAS**

EPA Draft Recommendations

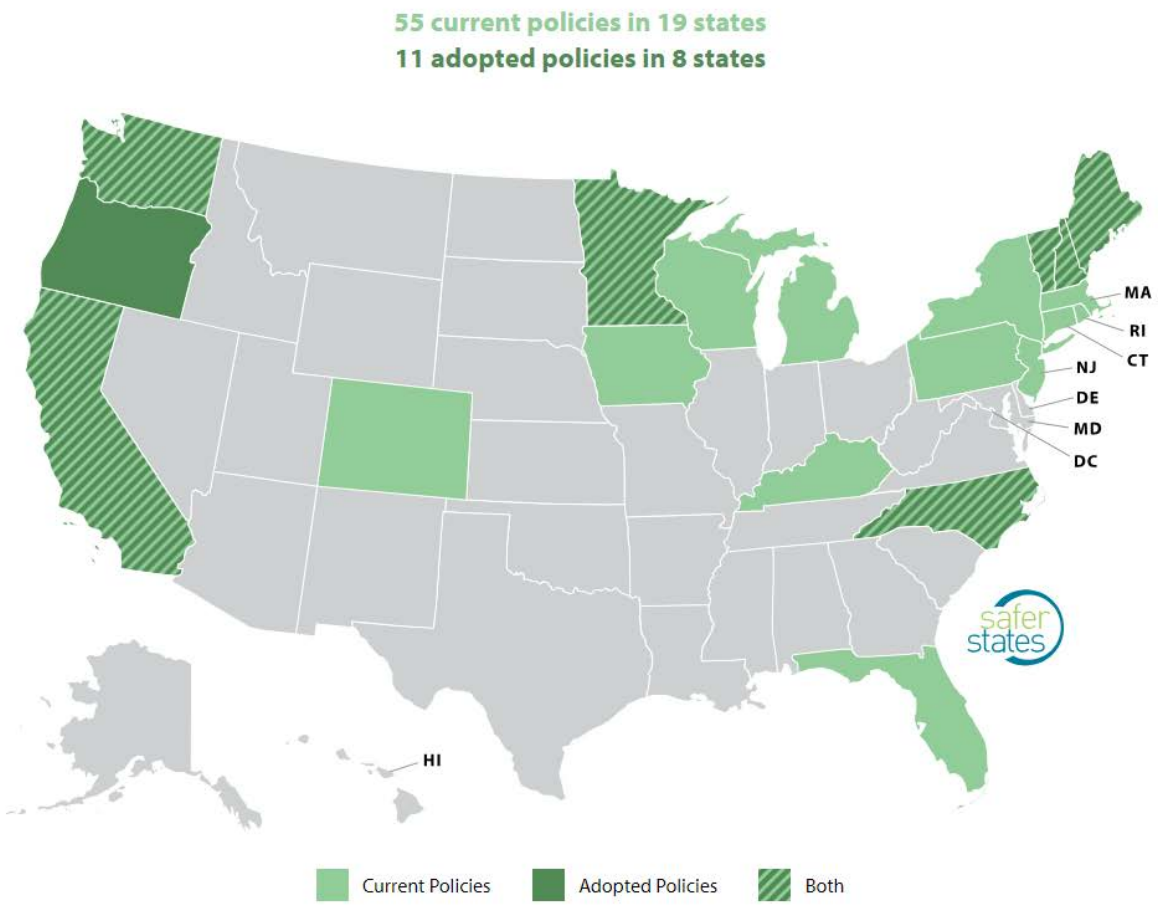
> Intended to provide clear and consistent guidance for federal cleanup programs (CERCLA (“Superfund”))

> Preliminary remediation goals (PRGs) to inform site-specific cleanup levels for PFOA and PFOS contamination of groundwater

PUBLIC COMMENT PERIOD

- EPA seeking comments on all parts of the recommendations
  - Including use of EPA's Lifetime Drinking Water Health Advisory level of 70 ng/L or parts per trillion as the recommended PRG for groundwater
  - Whether higher or lower values would be supported.
- The 45-day public comment period will close on June 10, 2019.

CURRENT STATE PFAS POLICIES



NC: CURRENT BILLS

> **PFAS H 560 / S 655:** Prohibits the manufacture, sale, and use of firefighting foams containing PFAS. Requires firefighter protective equipment containing PFAS to be labeled as such**.**

> **PFAS SB 518:** Establishes a PFAS task force responsible for surveying PFAS contamination in North Carolina, including identifying polluters, conducting biomonitoring studies, establishing maximum health limits for PFAS, and providing clean water to contaminated communities.

> **PFAS S99 :** State budget included funding for university research to monitor for PFAS in rivers, provisions for alternative water supplies for residents near a factory that has contaminated nearby wells, and funding for studies of downstream impacts. (Adopted in 2018)

> **Toxic Chemicals General SB 744:** Authorizes the Department of Environment and Natural Resources to participate in the Interstate Chemicals Clearinghouse. (Adopted in 2014)

NC Health-Based LEvels

- N.C. DHHS used available toxicity information to set a health goal for GenX in drinking water at 140 nanograms per liter (ng/L) or parts per trillion (ppt).
- Health goal is a non-regulatory, non-enforceable level of contamination below which no adverse health effects would be expected over a lifetime of exposure.
- May change as new information becomes available
- EPA looking at 110 ppt

NC PFAS Testing Network Jan 1 2019 Quarterly Progress Report

> **2018 NC Legislature passed SL 2018-5, directing NC Policy Collaboratory to identify expertise, technology and instrumentation to conduct nontargeted analysis for PFAS, including GENX, all public water supply surface water intakes and one public water supply well selected by each municipal water system, to establish a water quality baseline for all sampling sites.**

NC 2018 Act Progress Report

- Created a Plan for sampling of 348 sites in NC
- Started contacting waste water treatment plants for sampling
- Developed analytical methods
- Performed private well risk modeling using samples from tributaries to the Cape Fear River, and date of GenW measurements in 769 private drinking water wells
- Performed PFAS Removal Performance Testing
- Performed preliminary air sampling experiments in Chapel Hill, Fayetteville, Greenville and Wilmington
- Took Rain samples

NC Progress Report (Jan 2019)

- **"Dr. Barlaz spoke at a meeting of the…NC SWANA… and at a private meeting with landfill owners on Nov. 8th to discuss data needs and to build support for sampling"**
- **"He met with a local consultant in the wastewater field to identify candidate landfills"**
- **Conducted alligator and fish studies**
- **Performed first doising study on mise**
- **Performed risk communication**

TEAM FIVE A:NC PFAS TEAM NETWORK

- **Project: to analyze "Novel PFAS Inputs into the Environment (Landfills)**
- **Goal: To estimate the total quantity of PFAs present in leachate that is subsequently discharged to either POTWs or to surface water after on-site treatment at a landfill**

TEAM FIVE A:NC PFAS TEAM NETWORK

> **Specific Aims:**

- Estimate the mass of PFASs discharged to POTWs by characterizing the PFAS fingerprint of MSW landfill leachate
- Estimate the mass of PFASs entering POTWs via municipal wastewater and assess importance of MSW landfills as a source
- Estimate the release of PFASs to surface water downstream of POTWs using published info on attenuation during treatment
- Estimate the release of PFASs from LFs that receive C&D waste and document locations

FLORIDA. KENTUCKY. MICHIGAN.

> **FLORIDA**
  - PFAS SB 1330: Requires reporting of discharges of PFOA and PFOS.
  - PFAS SB 998: Requires entities who discharge PFAS to report discharges to the Department of Environmental Protection

> **KENTUCKY:** SB 104: Prohibits the use of firefighting foam containing PFAS for training purposes.

> **MICHIGAN:** SB 14: Sets Maximum Contaminant Levels for PFOA and PFOS in drinking water of 5 ppt.

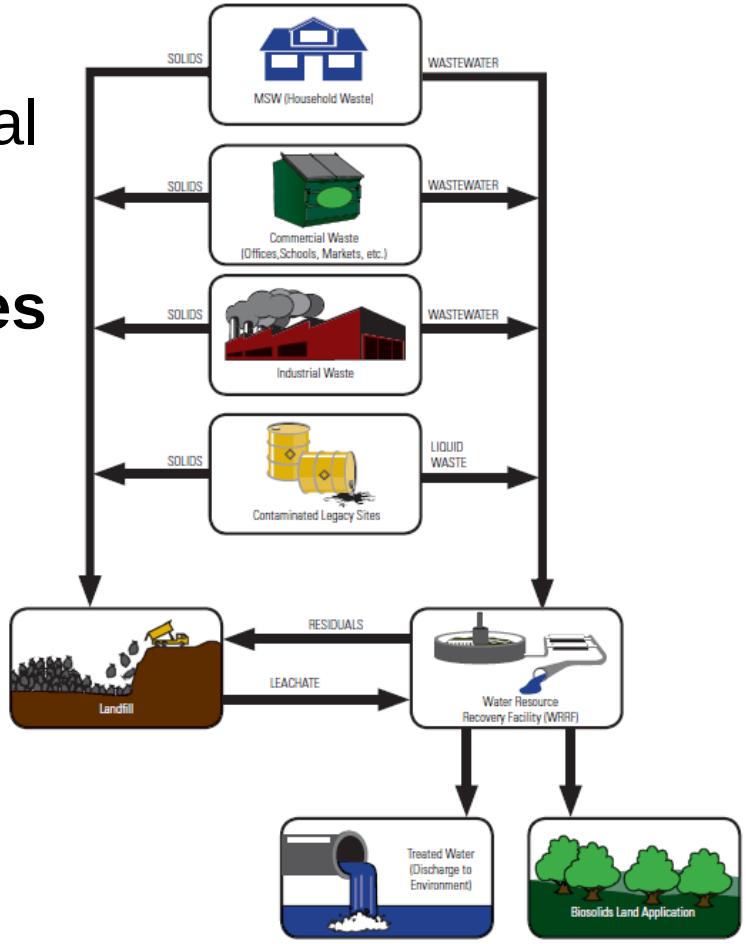
SOURCES of PFAS in WATER

> **Effluent from discharges in POTWs, WWTPs, Etc.**
  - Manufacturers, MSW Landfills,
  - Contaminated sites, commercial waste

> **Biosolids from the above sources**

> **Rain**

> **Groundwater Contamination**



MSW LANDFILL LEACHATE & PFAS

> **STUDIES**

- 2017 LANG
- 2018 HAMID
- 2018 MWRA

LANG 2017 STUDY

> **87 samples from 18 landfills**

> **Findings:**

- PFOA and PFOS concentrations in leachate generally decreasing over time
- Greater rates of decline in humid regions (i.e., precipitation greater than 75 cm/year)
- Humid regions (east coast):
  - More/bigger MSW Landfills
  - contain nearly half the annual volume of solid waste disposed in the US

Hamid 2018 STUDY

> Data from 11 literature sources published between 2004 to 2017,

> PFAS leachate concentrations from landfills in:

- Australia, Canada, China, Denmark, Germany, Norway, Spain , Sweden, and the US

> Dozens of landfills / More than 162 leachate samples

HAMIL 2018 FINDINGS

- **PFOA and PFOS concentrations in landfill leachate vary considerably in different regions of the world**
- **Results affected by Country's**
  - consumer products
  - industrial materials used, produced, & disposed
- **Rate of degradation of PFAS materials to PFOA and PFOS affected by:**
  - age of waste materials
  - climatic conditions to which landfills are subject

Lang and Hamil Findings

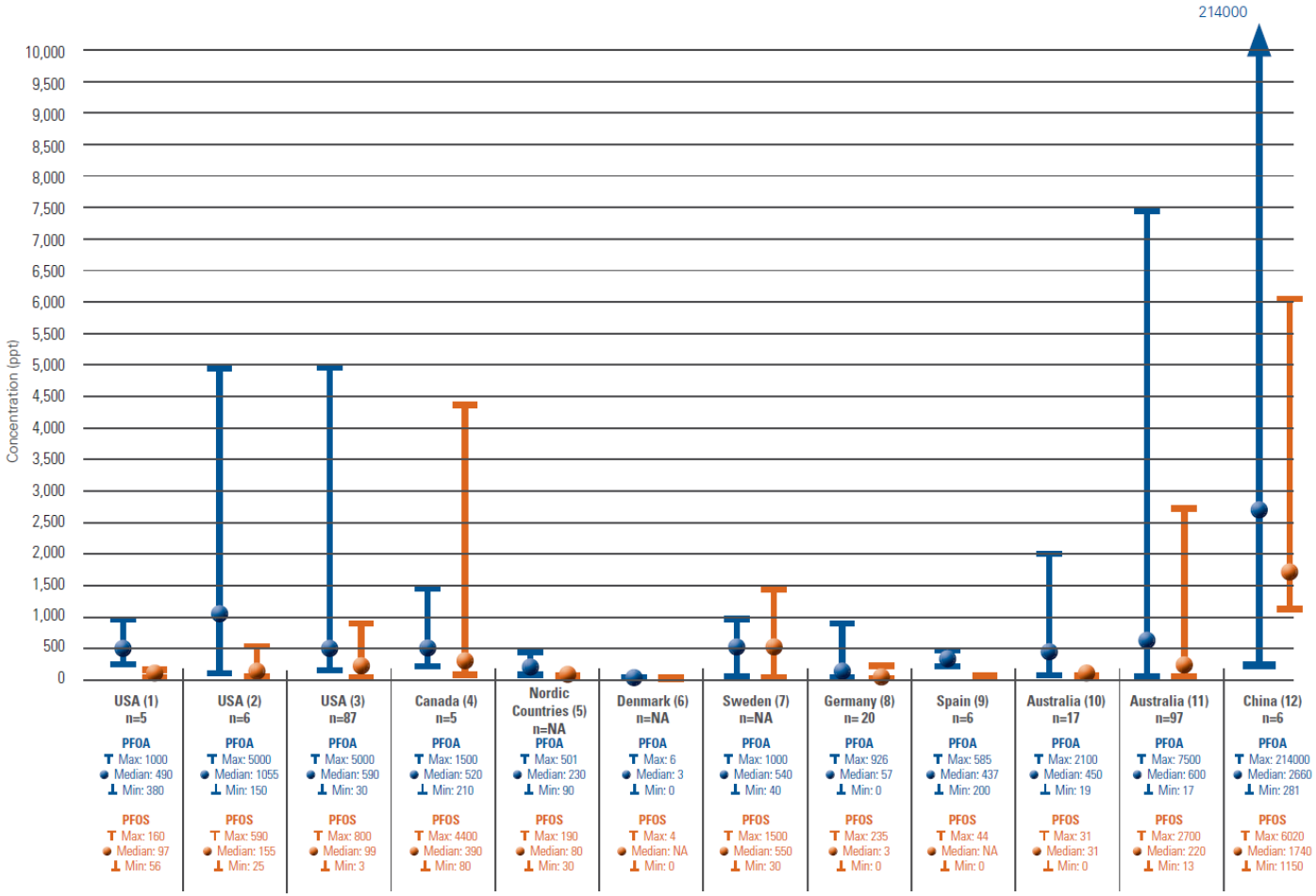
- A wide range of leachate PFOA and PFOS concentrations worldwide
- China's values are much higher than elsewhere
  - Why?
  - Continued production of consumer goods with PFAS
  - Industrial waste associated with related manufacturing processes
- Chinese products are then distributed throughout the world for purchase, including in the US
- Chinese Consumer products end up in US Landfills

MICHIGAN WASTE & RECYCLING ASSN.

1. Michigan surface water contaminated with PFAS
2. 2018: MDEQ asked LFs & WWTPs to test for PFOS and PFOA
3. MWRA commissioned report of 35 of state's 45 landfills
4. LF Data compared with overall discharges from WWTPs
5. Report Conclusions:
   - landfills contribute just a small portion of PFAS released into waterways
   - wastewater from other industrial source ys a larger role

Pfoa & pfos concentrations LF Leachate

Figure 2-1
PFOA & PFOS Concentrations in Landfill Leachate
(Worldwide - Separate Studies)

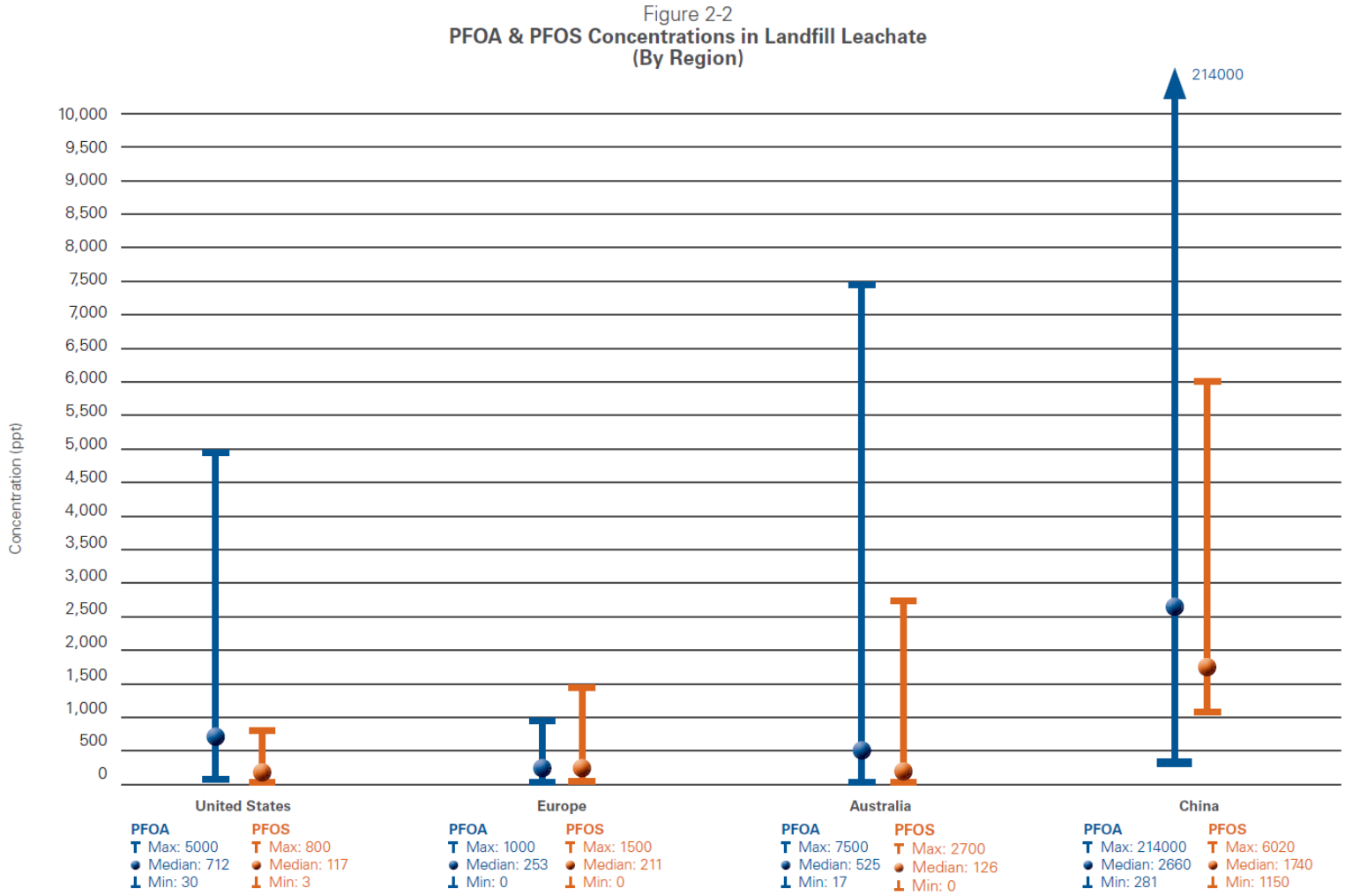


PFOA & PFOS Concentrations in LF Leachate

Table 2.2: Summary of Literature Study - PFOA & PFOS Concentrations in Landfill Leachate

Source Cited	Location/ Region	Sample Size	PFOA			PFOS		
			Detection Frequency %	Concentration Range (ng/l)	Median (ng/l)	Detection Frequency %	Concentration Range (ng/l)	Median (ng/l)
1. Huset, et al (2011)	USA	5	100	380 - 1,000	490	100	56 -160	97
2. Allred, et al (2015)	USA	6	100	150 - 5,000	1,055	100	25 - 590	155
3. Lang, et al (2017)	USA	87	100	30 - 5,000	590	96	3-800	99
4. Benskin, et al (2012)	Canada	5	100	210 - 1,500	520	100	80 - 4,400	390
5. Kallenborn, et al (2004)	Nordic Countries	NA	NA	90-501	230	NA	30 - 190	80
6. Bossi, et al (2008)	Denmark	NA	NA	0 - 6	3	NA	0 - 4	NA
7. Woldegiorgis, et al (2008)	Sweden	NA	NA	40 - 1,000	540	NA	30 - 1,500	550
8. Busch, et al (2010)	Germany	20	95	0 - 926	57	100	0 - 235	3
9. Fuertes, et al (2017)	Spain	6	100	200 - 585	437	17	0 - 44	NA
10. Gullen, et al (2016)	Australia	17	100	19 - 2,100	450	89	0 - 100	31
11. Gullen, et al (2017)	Australia	97	64	17 - 7,500	600	65	13 - 2,700	220
12. Yan, et al (2015)	China	6	100	281 - 214,000	2,260	100	1,150 - 6,020	1,740

Regional Comparison



MWRA REPORT ON PFAS IN LEACHATE

- 35 Landfills
  - Sent @1 million gallons of leachate to wastewater treatment plants
  - Leachate had concentrations of about 0.01 pounds of PFOA and 0.003 pounds of PFOS
- 34 Wastewater Plants
  - Received @1.4 billion gallons/day of waste “influent” from various sources each day.
  - Included @0.09 pounds of PFOA and 0.15 pounds of PFOS

MICHIGAN SURFACE WATER STANDARDS

> 2011 and 2014: Michigan develops surface water standards for PFOS and PFOA

Table 2-1 – Rule 57 Values

Chemicals	HNV (non-drinking water*)	HNV (drinking water**)
PFOS	12 ppt	11 ppt
PFOA	12,000 ppt	420 ppt

HNV: Human Non-cancer Value

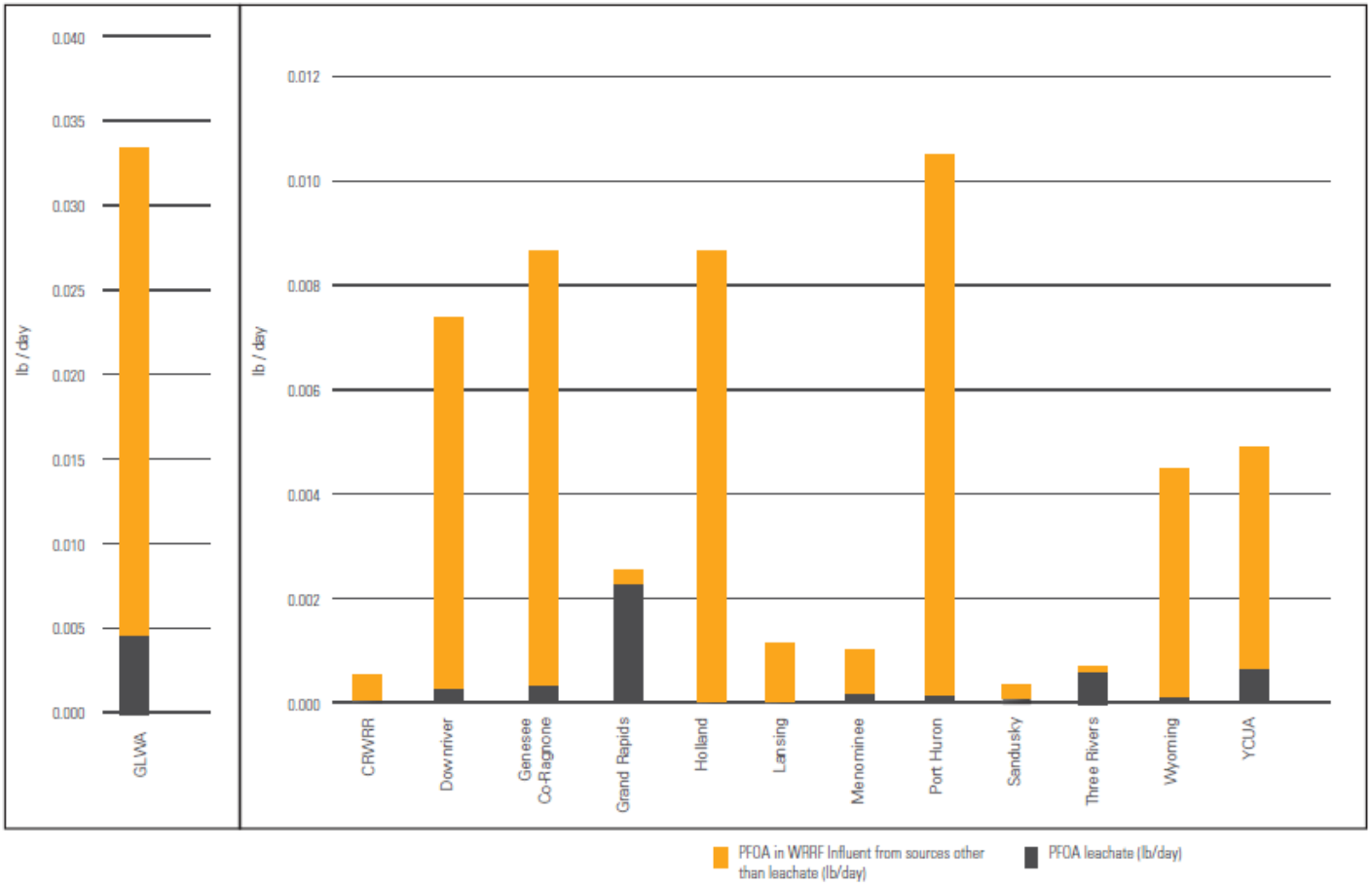
Table 4-2A

Concentrations and Mass of PFOA AND PFOS
Michigan Active Type II Landfills' Leachate

MWRA Participating Landfill Designation	Average Leachate Volume GPD	PFOA (ppt)	PFOS (ppt)	"PFOA Daily Mass (lb/day)"	"PFOS Daily Mass (lb/day)"
Arbor Hills Landfill	98,400	3200	220	0.0026	0.00018
Autumn Hills RDF	54,800	1300	380	0.0006	0.00017
Brent Run Landfill	16,400	540	110	0.0001	0.00002
C&C Expanded Sanitary Landfill	42,000	1300	450	0.0004	0.00015
Carleton Farms Landfill	123,300	1800	250	0.0018	0.00026
Central Sanitary Landfill	30,100	2500	470	0.0006	0.00012
Citizen's Disposal Inc.	32,900	1100	180	0.0003	0.00005
Dafter Sanitary Landfill	16,500	680	130	0.0001	0.00002
Eagle Valley RDF	32,900	490	170	0.0001	0.00005
Glens Sanitary Landfill	3,800	770	210	0.00002	0.00001
Granger Grand River Landfill	64,400	240	160	0.0001	0.00009
Granger Wood Street Landfill	19,200	470	110	0.0001	0.00002
K&W Landfill	17,500	830	170	0.0001	0.00002
Manistee County Landfill	4,700	420	220	0.000016	0.000009
McGill Road Landfill	13,700	760	170	0.0001	0.00002
Michigan Environs Inc. (Menominee)	13,100	1400	100	0.0002	0.00001
Northern Oaks RDF	12,300	1000	220	0.0001	0.00002
Oakland Heights Development	17,800	780	230	0.0001	0.00003
Orchard Hill Sanitary Landfill	12,500	650	110	0.0001	0.00001
Ottawa County Farms Landfill	82,200	1800	530	0.0012	0.0004
People's Landfill	21,900	2500	710	0.0005	0.00013
Pine Tree Acres RDF	74,000	1800	430	0.001	0.0003
Pitsch Sanitary Landfill	15,000	1300	260	0.0002	0.00003
Sauk Trail Hills Landfill	20,500	2800	610	0.0005	0.00010
SC Holdings	16,000	960	410	0.0001	0.00005
Tri-City RDF	9,600	1200	160	0.0001	0.00001
Venice Park RDF MH#20*	32,900	910	190	0.0007	0.0002
Venice Park RDF MH#21*		1500	630		
Vienna Junction Industrial Park Sanitary Landfill	13,700	1300	130	0.0001	0.00001
Waters Landfill	NONE	930	230	NONE	NONE
Westside RDF	60,800	1300	160	0.0007	0.00008
Whitefeather Landfill	NONE	1700	550	NONE	NONE
Woodland Meadows RDF -Van Buren	54,800	2000	510	0.0009	0.00023
Other Active Type II Landfill Leachate Data Obtained from MIWaters		**PFOA (ppt)**	**PFOS (ppt)**	**PFOA Daily Mass (lb/day)**	**PFOS Daily Mass (lb/day)**
Riverview 003* Riverview 004* Riverview 007*	37,400	1900 860 38	270 140 8.5	0.0003	0.00004
South Kent Outfall* South Kent Hauled*	48,000	725 16	960 130	0.0001	0.0002
Smith's Creek Landfill*	32,900	510	120	0.0001	0.00003
	minimum maximum median average n	16 3200 1000 1186 39	9 960 220 287 39	0.000016 0.003 0.0001 0.0004 33	0.000007 0.0004 0.00005 0.0001 33

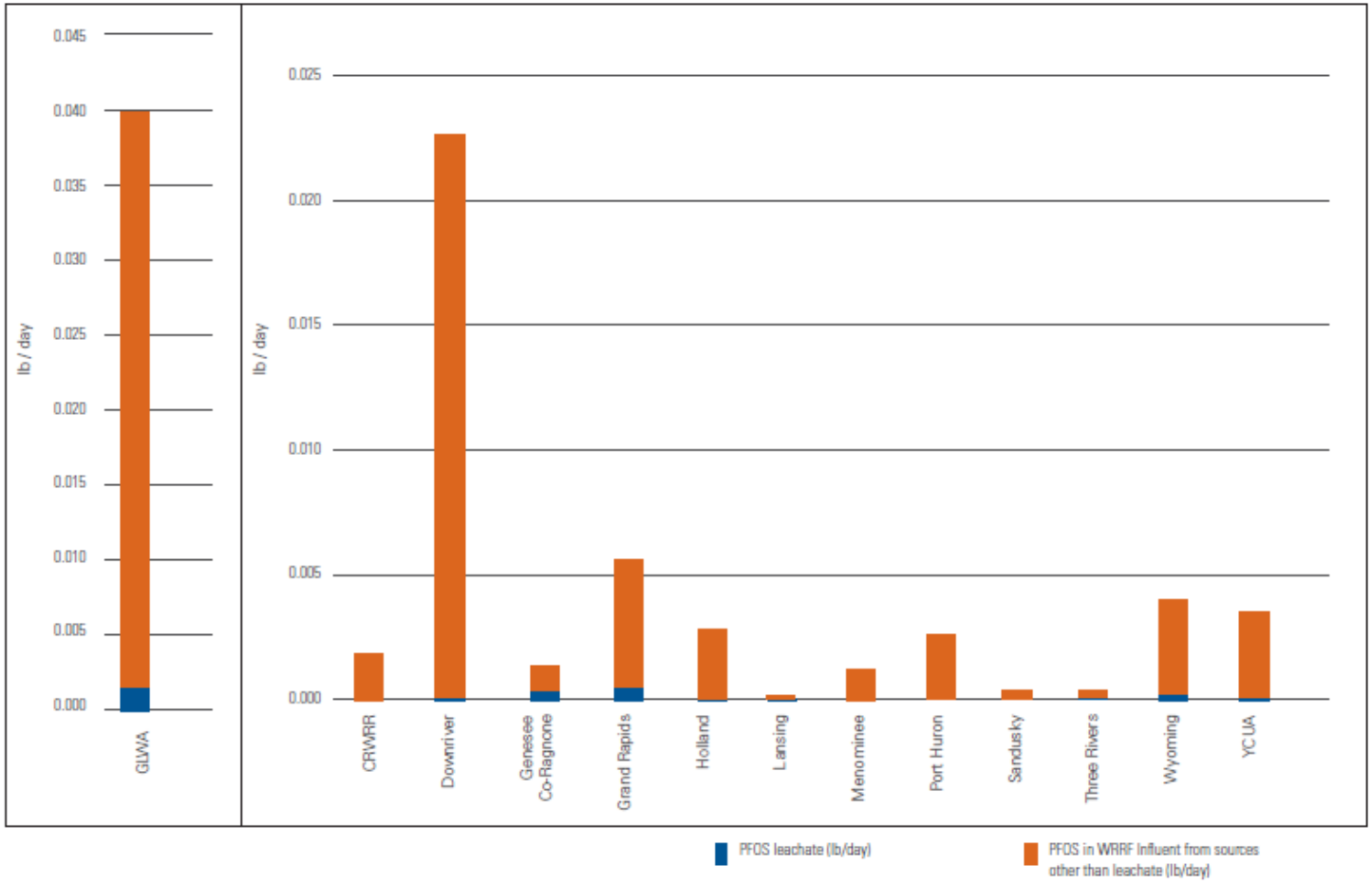
PFOA in Leachate vs Overall Influent

Figure 4-2A
PFOA Mass: Influent Leachate vs. Overall WRRF Influent



PFOS in Leachate vs Overall Influent

Figure 4-2B
PFOS Mass: Influent Leachate vs. Overall WRRF Influent



MWRA REPORT FINDINGS

- **In leachate sampled from MWRA member LFs,**
  - PFOA ranged from 240 to 3,200 ppt
  - PFOS ranged from 100 to 710 ppt
- **In WRRFs that do not accept LF leachate,**
  - PFOA range from non-detect to 17.9 ppt
  - PFOS range from non-detect to 499 ppt (next highest value is 128 ppt)
- **In WRRFs that accept LF leachate,**
  - PFOA range from non-detect to 64.6 ppt
  - PFOS ranges from non-detect to 62.4 ppt

MWRA REPORT FINDINGS

> PFOA levels are well below Michigan's most conservative surface water criteria (420 ppt) at all WRRFs

> PFOS levels are below Michigan's most conservative surface water criteria (11 ppt) at approximately two-thirds of the WRRFs

MWRA REPORT FINDINGS

> Leachate provides relatively minor contribution to overall PFOA and PFOS concentration/mass in most influent because of low leachate discharge volumes;

> Non-leachate sources of PFOA and PFOS significantly contribute to WRRF influent and at higher volumes.

> Influent with no LF leachate contribution show a similar concentration range for PFOA and PFOS as influent that has leachate contribution;

> Although reduction of LF leachate concentrations of PFOA and PFOS to the influent could be beneficial to meeting WQS in the WRRF effluent, impact may be minor since leachate contributes a small volume of PFOS/PFOA overall

NC Landfill Leachate Treatment Testing

- **February 2019: New Hanover County volunteered to bhe the first landfill to participate in NC new LF leachate sampling protocol**
- **Testing their new leachate treatment system (designed by SCS): Reverse Osmosis System**
- **Results released in April: system is effectively filtering out PFAs before discharging in the river**
- **System treats the leachate and recirculates the RO reject water back into the landfill**
- **Tested for 33 PFAS – no detectable levels found**

NWRA: April Issue Brief on PFAS

> MSW LFs may contain low levels of PFAS from common household products

> PFAS mass from leachate represents a relatively minor proportion of the influent at most WWTPs

> Products manufactured outside the US continue to contain PFAS and will continue to be landfilled absent import limits

> Main exposure pathways are not LFs but are:

- Drinking contaminated water
- Eating contaminated food
- Food packaging
- PFAS treated surfaces: carpets
- Dust

SUMMARY

> **EPA is slowly making progress at coming up with a plan to help states:**
  - What and how to test for PFAS
  - Sources of PFAS in the environment
  - Formulate standards relating to drinking water and non-drinking water surface water bodies
  - Formulate human health exposure levels
  - Keep track of PFAS products being manufactured or imported into the US

summary

- **Some states aren't waiting on EPA**
- **Standards are appearing in States where PFAS is contaminating drinking water, creeks and rivers at high levels**
- **Lawsuits are cropping up against manufacturers and will likely spread to other "sources" of PFAS**
- **The Solid Waste Industry needs regional leadership and a plan to address the landfill leachate issue and control the testing and dissemination of information**

QUESTIONS?

Please note: This presentation contains general, condensed summaries of actual legal matters, statutes and opinions for information purposes. It is not meant to be and should not be construed as legal advice. Individuals with particular needs on specific issues should retain the services of competent counsel.