



## Overview of Minnesota PFAS Response

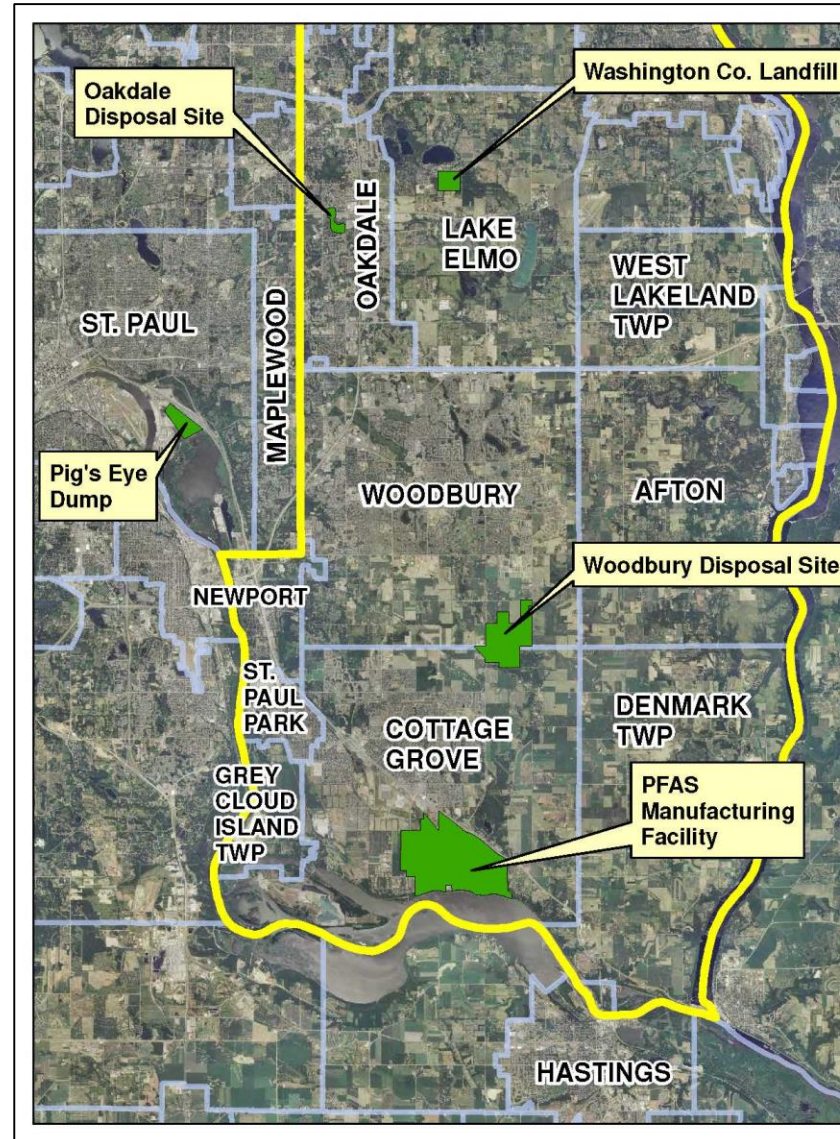
James Kelly, Jessica Nelson, Helen Goeden

November 30, 2018

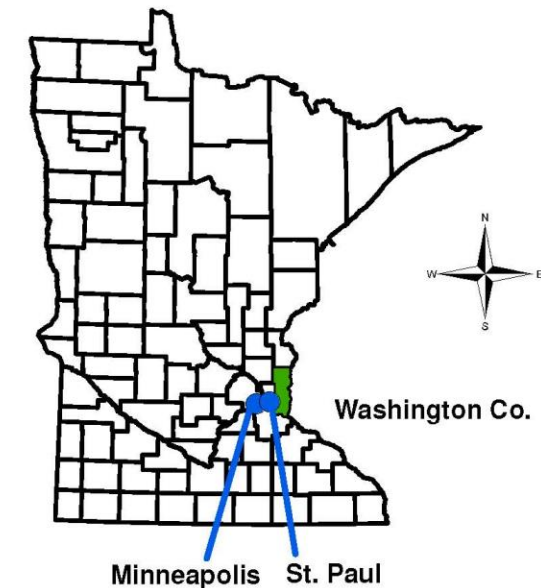
Pennsylvania PFAS Action Team Meeting

# Minnesota's Experience: Early Discovery of PFAS Legacy Sites

- 3M first disclosed PFAS manufacturing activities to state officials in 2002
- Major manufacturing plant, 3 major disposal sites, WWTP sludge disposal at small city landfill
- PFAS activities dated back to the late 1940s
- All sites were in various stages of remediation due to other contaminants



## Location of PFAS Sites in Washington Co., Minnesota



00.51 2 3 4 5 Miles

# Historical Overview of Contamination

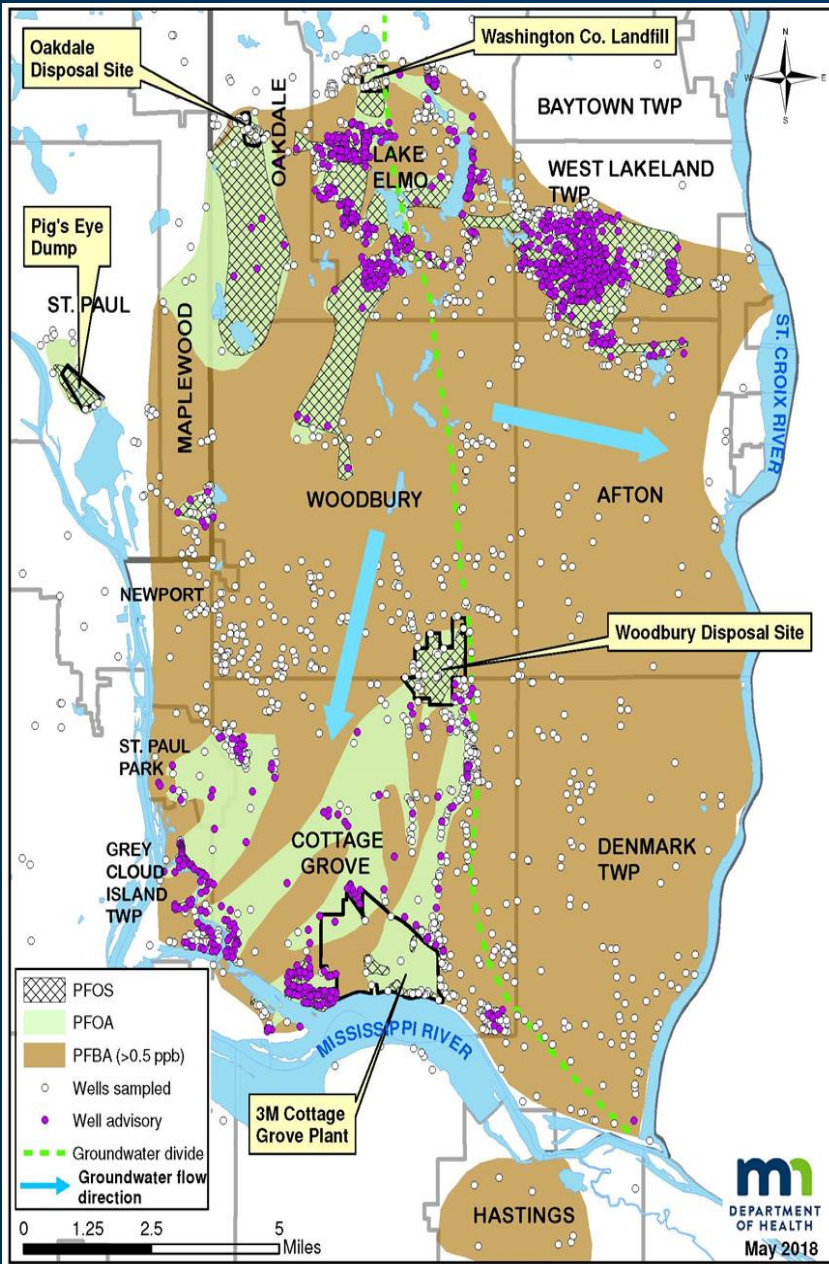
- 2002: PFAS contamination found at water supply at 3M plant; request for development of health-based guidance values for PFOS & PFOA
- 2004: investigation of legacy disposal areas found PFOS & PFOA contamination in drinking water supplies of several suburbs - - initiating an extensive effort to test public & private wells in the area
- 2006: new analytical methods, adding PFBA, PFPeA, PFHxA, PFBS & PFHxS. Resulted in uncovering much larger area of contamination
- 2007 – 2017: derived/revised guidance values for PFBA, PFBS, PFOA & PFOS; used PFOS as a surrogate for PFHxS



## Historical Overview (con't)

### To date:

- Multiple public water supplies and >3,000 private wells have been sampled
- 5 public water systems have wells > current guidance
- > 1,000 private wells > current guidance
- East Metro plume covers > 150 square miles, affecting drinking water of >140,000 Minnesotans (“Megaplume”)
- Remedial actions at PFAS disposal sites; including complete excavation and re-burial of waste
- Carbon filtration installed at affected public water systems, residents with contaminated private wells provided whole-house carbon filtration or moved to city water
- Statewide evaluations of other potential sources (e.g. fire-training facilities, chrome plating operations, WWTP)



# Responding to Community Concerns

- Water Filtration Testing
  - Very little information at first
  - Laboratory and field testing confirmed viability of GAC, reverse osmosis, and small consumer units
- Garden Produce Study
  - Identified uptake of PFAS in produce grown in gardens irrigated with PFAS contaminated water
  - Primarily PFBA
  - Below levels of health concern

(Scher et al., 2018, Chemosphere, v. 196)



# Legal Activities

- Consent Decree between MPCA and 3M in 2007 guides investigation, remediation and response activities at legacy sites
- Minnesota AG filed Natural Resource Damages lawsuit in 2010
- Lawsuit settled in February of 2018 for \$850 Million to focus on drinking water and natural resource improvements
- One to two year process to determine priorities for funding; short-term funds available for immediate actions
- <https://3msettlement.state.mn.us/>

# East Metro PFAS Biomonitoring Projects

- Directed by Minnesota Legislature in 2007 to test blood levels in East Metro communities (MN Statutes 144.995-144.998)
- Focused on adults in 2 communities: municipal water and private well users
- Studies in 2008, 2010, 2014
- Questions addressed
  - Are residents in affected communities having unusual PFAS exposures?
  - Have efforts to reduce drinking water exposure to PFAS worked?
  - Do other factors (such as diet, consumer products, occupation) help explain PFAS levels?

# How biomonitoring studies worked

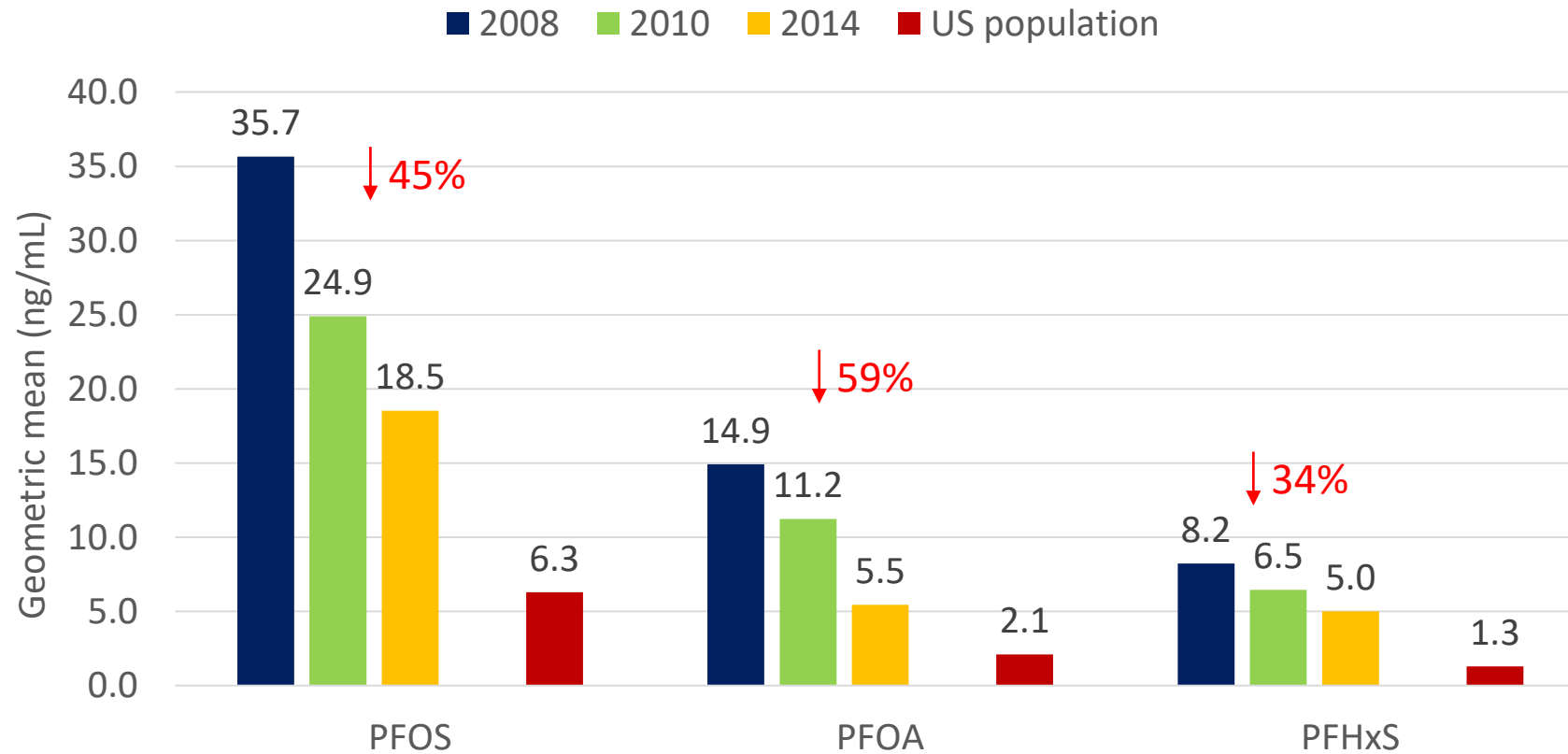
- Participants randomly selected
  - Water utility billing records
  - Lists of people with contaminated private wells
- Contacted participants by mail, asked for informed consent, sent questionnaire
- Gave blood sample at local health clinics
- MDH Public Health Laboratory analyzed blood samples for 7-8 PFAS
- Returned individual and group results to participants

(Landsteiner et al., 2014, Journal of Environmental Health, v. 77)

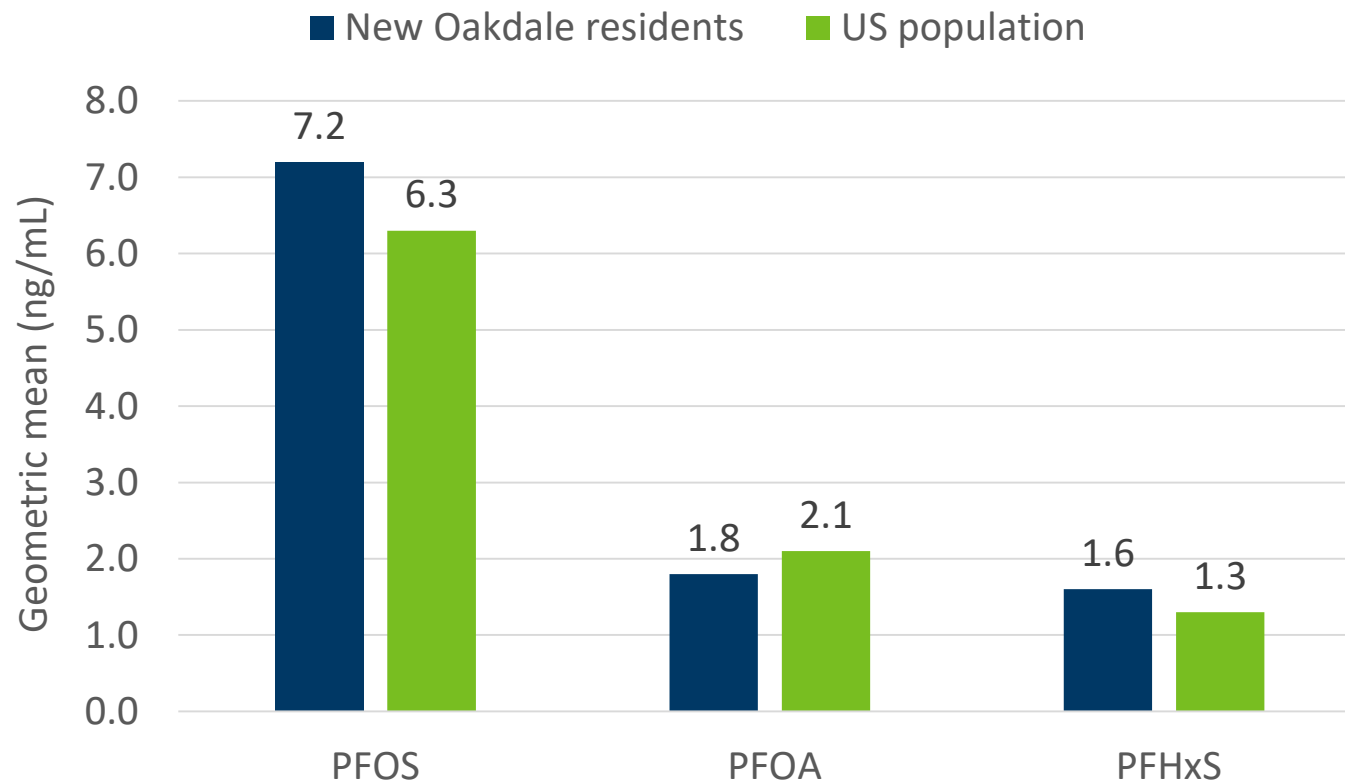




# PFAS blood levels in long-term East Metro Residents (n=149)



# PFAS in New Oakdale Residents (2014, n=156)



# Overview of PFAS Health Effects

- Epidemiology Studies (associations, not causal)
  - Developmental (e.g., ↓ birth weight)
  - Endocrine (e.g., thyroid homeostasis)
  - Immune (e.g., ↓ vaccine response, ulcerative colitis)
  - Kidney (e.g., ↑ uric acid)
  - Liver (e.g., ↑ serum lipids and liver enzymes)
  - Cancer (e.g., testicular, kidney)
- Laboratory Animal Studies (causal)
  - Developmental Effects (e.g., ↓ body weight, delayed puberty & mammary gland development ♀, accelerated puberty ♀, changes in lipid metabolism & liver histology)
  - Endocrine (e.g., ↓ thyroid hormones)
  - Immune (e.g., ↓ immune response, ↓ spleen & thymus weight)
  - Kidney (e.g., ↑ organ weight)
  - Liver (e.g., ↓ cholesterol, ↑ organ weight, evidence of cellular damage)
  - Cancer?

# MDH – 2017 PFAS Water Guidance

PFAS	Health Endpoints <sup>1</sup>	Mean Human Half-life <sup>2</sup> (~5 – 95 <sup>th</sup> percentile range)	Water Guidance (µg/L)	
			2017	Previous
<a href="#"><u>PFBA</u></a>	Liver, Thyroid	3 days (1.2 – 4.6 days)	7	7
<a href="#"><u>PFBS</u></a>	Developmental, Female Repro system, Thyroid	27.7 days (13.1 – 45.7 days)	2	7
PFHxS	(see PFOS)	5.3 years (2.2 – 14.6 years)	(PFOS as surrogate)*	
<a href="#"><u>PFOA</u></a>	Developmental, Immune, Liver, Kidney	2.3 years (1.5 – 7.0 years)	0.035	0.3
<a href="#"><u>PFOS</u></a>	Developmental, Immune, Liver, Thyroid	5.4 years (2.2 – 8.5 years)	0.027*	0.3

<sup>1</sup>Used in additivity (mixtures) assessments

<sup>2</sup>Extreme values removed

\*PFOS currently under re-evaluation and PFHxS under review

More information can be found at: <http://www.health.state.mn.us/divs/eh/risk/guidance/gw/table.html>



# MDH – Water Guidance

## Standard Health-Based Guidance (HBG) is based on:

- Reference Dose (RfD) – represents a dose at which there is little or no risk of health effects (for PFOA and PFOS this dose is best represented by a serum concentration)
- Water Intake Rate – how much water someone drinks per day on a per body weight basis. Chronic intake rates typically used.
- Relative source contribution (RSC) – Multiple sources of exposure can come from water so that total exposure does not exceed the RfD.



Direct ingestion  
exposure only

# Additional Exposure Concerns

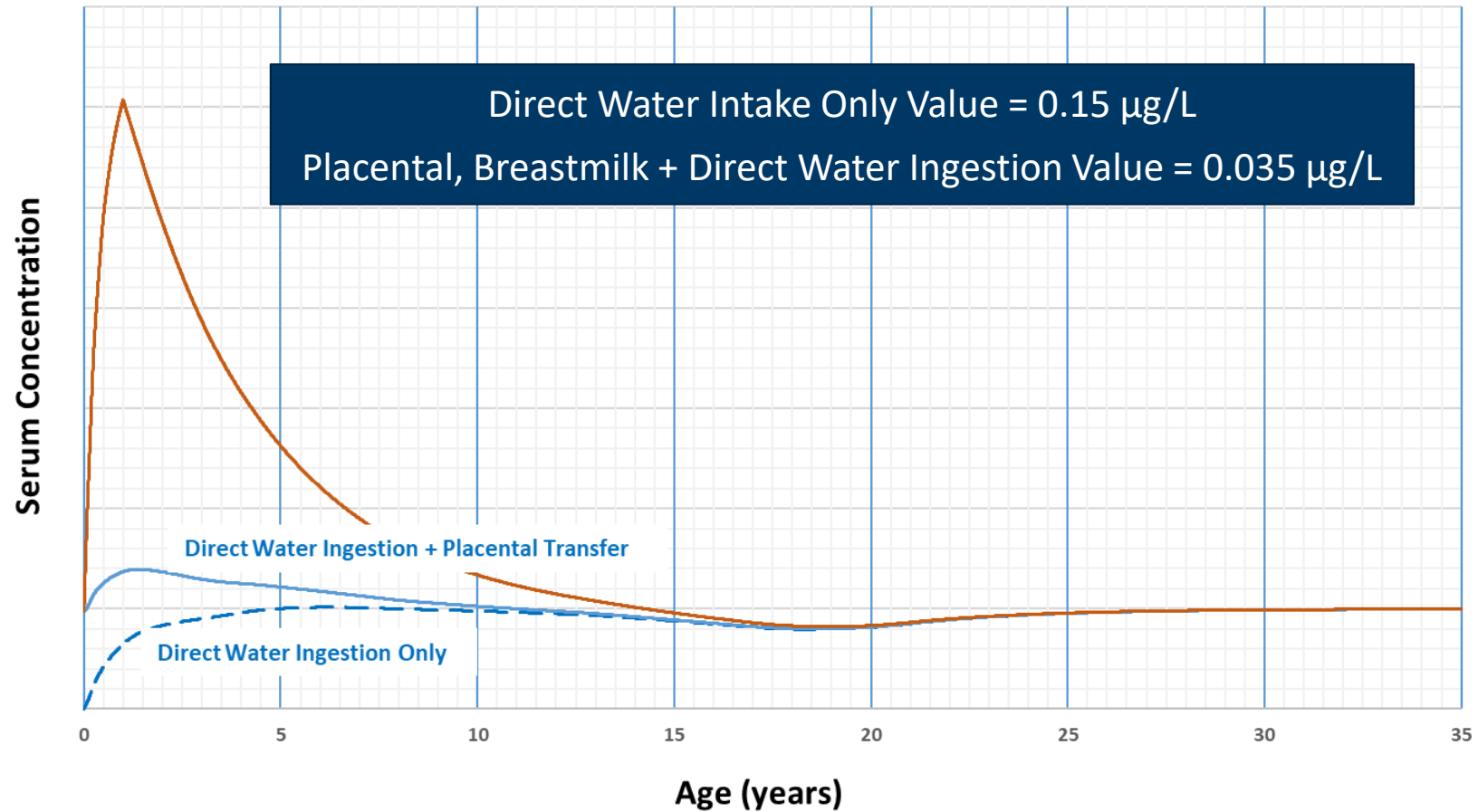
- Impact of Bioaccumulation Potential
  - Long half-life results in exposures, even short duration, to stay in body for years beyond period of external exposure
  - Repeated exposures lead to accumulation (build-up) within the body
  - Water concentrations in ppt result in serum concentrations in ppb
  - Accumulated levels can be transferred to offspring
    - Placental transfer and Breastmilk transfer



- Much higher fluid intake rates in infants & young children

# Additional (indirect) Exposure Concerns

- PFOA



# MDH Guidance Summary

- Based on protection of susceptible & highly exposed populations
- Protective for tap water used for drinking, cooking, showering, and other uses
- Cumulative – additivity assessment of chemicals with similar health endpoints

**Breastfeeding can be a significant exposure pathway for PFHxS, PFOS, and PFOA.**

**However, breastfeeding is important for the short and long term health of both a mother and infant.**

**MDH recommends that women currently breastfeeding, and pregnant women who plan to breastfeed, continue to do so.**



# Conclusions

- Response takes many years (+ 10 years here)
- Response across programs and agencies was crucial, required good coordination
- Significant capacity needed for effective response
  - Just within MDH: Toxicology/risk assessment, hydrogeology/water sampling, health education/communications, lab analysis, biomonitoring/epidemiology
- Can be very concerning for affected communities
- Increase in awareness and data will help future efforts



# Questions?

[James.Kelly@state.mn.us](mailto:James.Kelly@state.mn.us) (651-201-4910)

[Jessica.Nelson@state.mn.us](mailto:Jessica.Nelson@state.mn.us) (651-201-3610)

[Helen.Goeden@state.mn.us](mailto:Helen.Goeden@state.mn.us) (651-201-4904)