DEPARTMENT OF HEALTH

Health-based Water Guidance for PFAS

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City of Hastings City Council Meeting – September 6, 2022

PFAS Disclaimer

PFAS science is a very active area of research.

Information presented today is based on our current understanding.

As more information becomes available in the future our understanding may change.

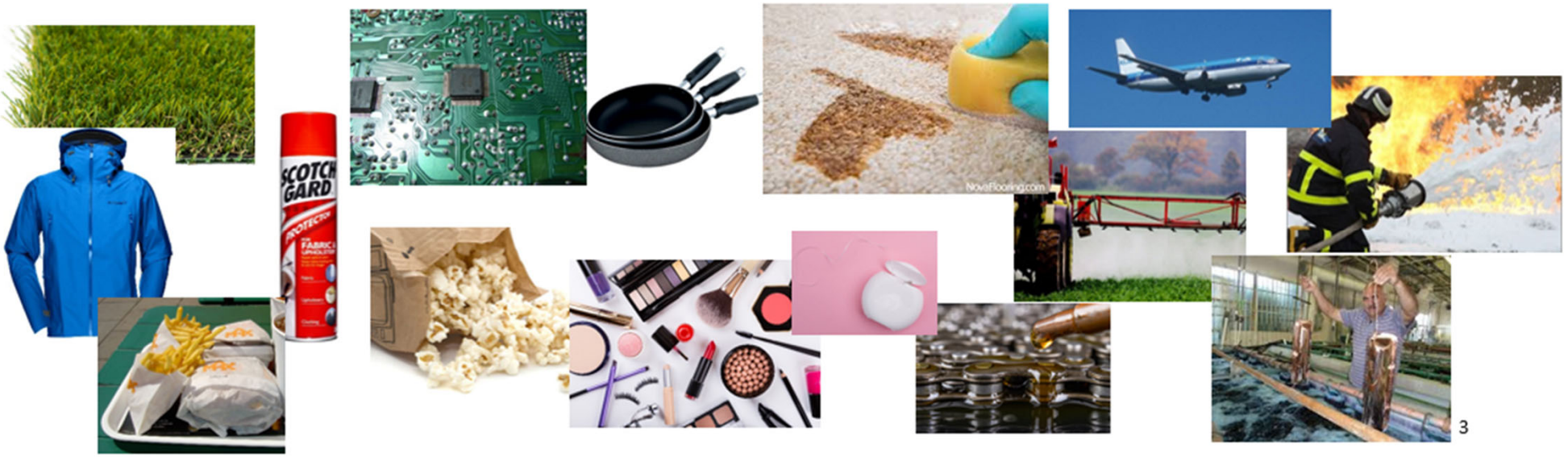
Topics to Cover

- Per- and Polyfluorinated Substances (PFAS)
  - What are they?
  - What are the potential health effects?
  - Why are we concerned?
- How are MDH's PFAS water guidance developed?
  - Why has guidance changed over time?
- Recent release of EPA Health Advisories

Feel free to interrupt with clarifying questions

What Are PFAS?

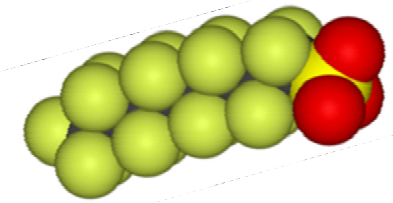
- Large class of surfactants (>5,000) with unique chemical & physical properties that make them (or their breakdown products) extremely persistent
- Used since 1940s in wide range of consumer and industrial applications



ABCs of PFAAs

- **Perfluoroalkyl Acids (PFAAs) – the basic PFAS**
  - Fully fluorinated carbon chain or "tail"
  - Carboxylate (COO^-) or sulfonate (SO_3^-) "head"
- **Perfluorinated = fully fluorinated**
  - Won't degrade in the environment
- **C-F bond unbreakable in the environment**
  - Destruction only at high temperatures and/or high pressure
- **Polyfluorinated = partially fluorinated**
  - May degrade in the environment

4	B	(buta-)
5	Pe	(penta-)
6	Hx	(hexa-)
7	Hp	(hepta-)
8	O	(octa-)
9	N	(nona-)…..



Source: open access image from bing.com

Perfluorooctane sulfonate (PFOS)

Perfluorooctane carboxylate (PFOA)

Source: ITRC (2017) PFAS Naming Conventions and Physical and Chemical Properties factsheet

PFAS general behavior

(based on current knowledge)

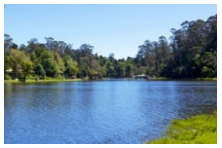
- Chain length and 'head' group help predict general behavior

Faster clearance (less bioaccumulation) **Slower clearance (higher bioaccumulation)**

Short-chain PFCAs				Long-chain PFCAs				
PFBA	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnA	PFDoA
PFBS	PFPeS	PFHxS	PFHpS	PFOS	PFNS	PFDS	PFUnS	PFDoS
Short-chain PFSAs		Long-chain PFSAs						

Source: ITRC (2017) PFAS Naming Conventions and Physical and Chemical Properties factsheet

- Shorter chain and/or carboxylate (PFxxA): relatively more water soluble & less bioaccumulative
  - Surface water, groundwater, drinking water
  - Plants





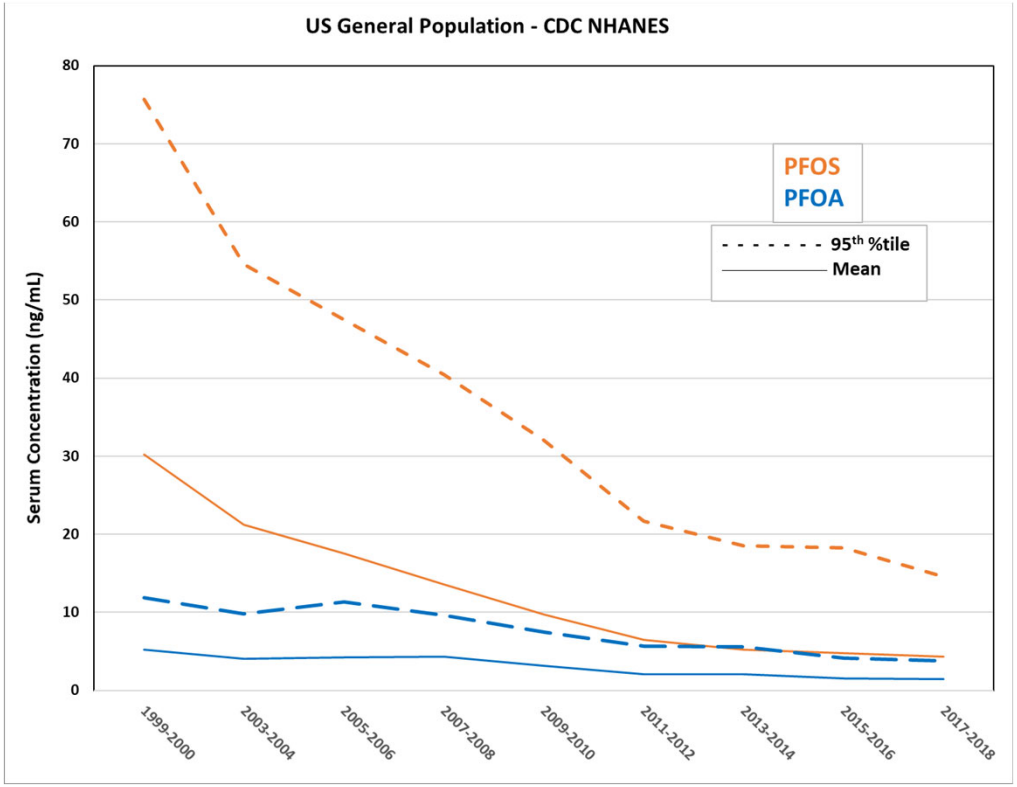
- Longer chain and/or sulfonate (PFxxS): relatively less water soluble & more bioaccumulative
  - Soils & sediments
  - Animals, including humans





National Biomonitoring

- CDC national biomonitoring (>12 years old) finds long-chain PFAS in the serum of virtually everyone sampled
- Levels have decreased over time



PFAS – Potential Health Effects

- Animal (controlled lab studies)
  - Liver effects (energy metabolism, cholesterol, liver enzymes)
  - Immunological effects (suppressed response)
  - Developmental effects (delayed development, lower body weights)
  - Endocrine effects (↓ thyroid hormone levels)
  - Reproductive effects
  - Hematological (blood) effects
  - Neurobehavioral effects
  - Tumors (liver, testicular*, pancreatic*)

*** PFOA**

Sensitive endpoints – effects seen at lower doses

PFAS – Potential Health Effects

- Human (possible links)
  - Immunological effects (↓ vaccination response, especially in children)
  - Liver effects (↑cholesterol & liver enzymes, fatty liver disease)
  - Developmental effects (↓ birth weight)
  - Endocrine effects (thyroid disease)
  - Reproductive effects (↓ fertility)
  - Cardiovascular effects (pregnancy induced hypertension)
  - Cancer* (kidney) (less evidence for breast, liver, & testicular)

Most consistently observed

*** PFOA**

What PFAS Exposures Are of Concern?

- Serum levels are the best measure of exposure
- Levels of concern historically based on controlled lab animal studies but quality and consistency of human data now sufficient to use
- NAS Guidance on PFAS Exposure, Testing and Clinical Follow-Up (July 2022)
  - Recommended PFAS* Serum Levels to Guide Clinical Care
    - < 2 ng/mL – do not expect adverse health effects related to PFAS exposure
    - 2 – 20 ng/mL – potential for adverse effects, especially in sensitive populations
    - >20 ng/mL – increased risk of adverse effects

*includes 7 PFAS: MeFOSAA, PFOA, PFNA, PFUnDA, PFDA, PFHxS, and PFOS

PFAS – Why are we concerned?

PFAS behave <u>differently</u> than other chemicals

- Slowly removed from the human body*
  - Repeated exposure over time results in a build-up in the body

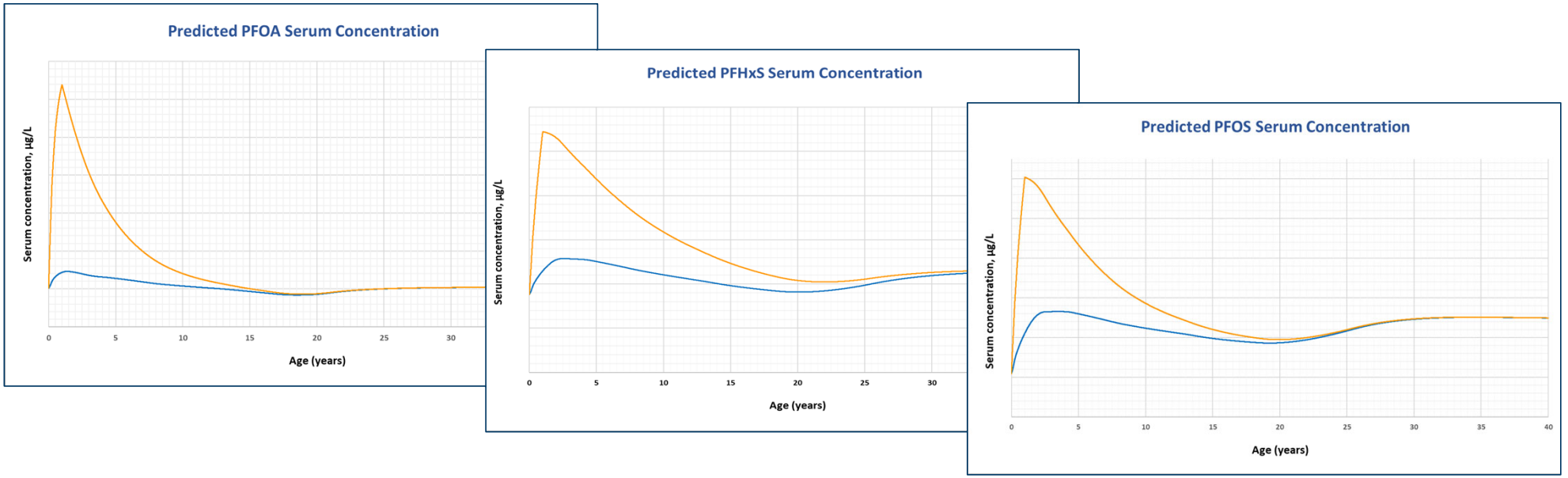
    [parts per trillion (ppt or ng/L) in water can result in parts per billion (ppb or ug/L) in serum]
  - Accumulated levels can be passed on
    - Placental transfer (born with similar levels as mother)
    - Breastmilk transfer (breastmilk concentration > water concentration)

Short chain half-lives measured in days, but longer chain half-lives measured in years

PFAS – Who is of Most Concern?

An infant born to and breastfed by a mother who has long-term exposure to PFAS

Formula Fed
Breast Fed



PFAS – Water Guidance Development

MDH Guidance is based on most susceptible and highly exposed

- Short-chain (little to no bioaccumulation) → formula fed infant
- Long-chain (bioaccumulation) → breast-fed infants born to mothers exposed 10+ yrs.
  - Breastfeeding can be a significant exposure pathway. HOWEVER, breastfeeding has many known health benefits to both mother and infant. MDH recommends breastfeeding for those currently or planning to breastfed.

Basing guidance on the most susceptible and highly exposed provides even greater protection for the general population

Setting MDH Health-Based Water Values

Most Sensitive Health Effects

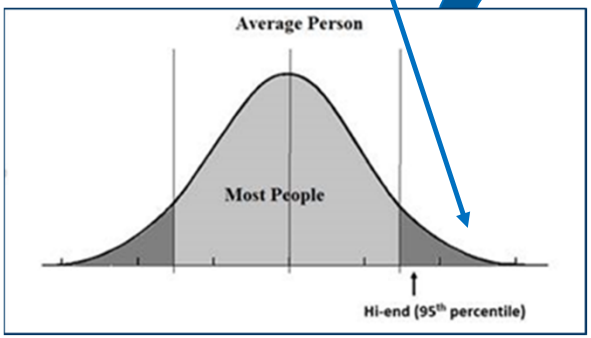
Identify Exposure Level ≠ Health Effects

Add Margins of Safety (100 to 300-fold)

Reference Exposure Level

Short-chain

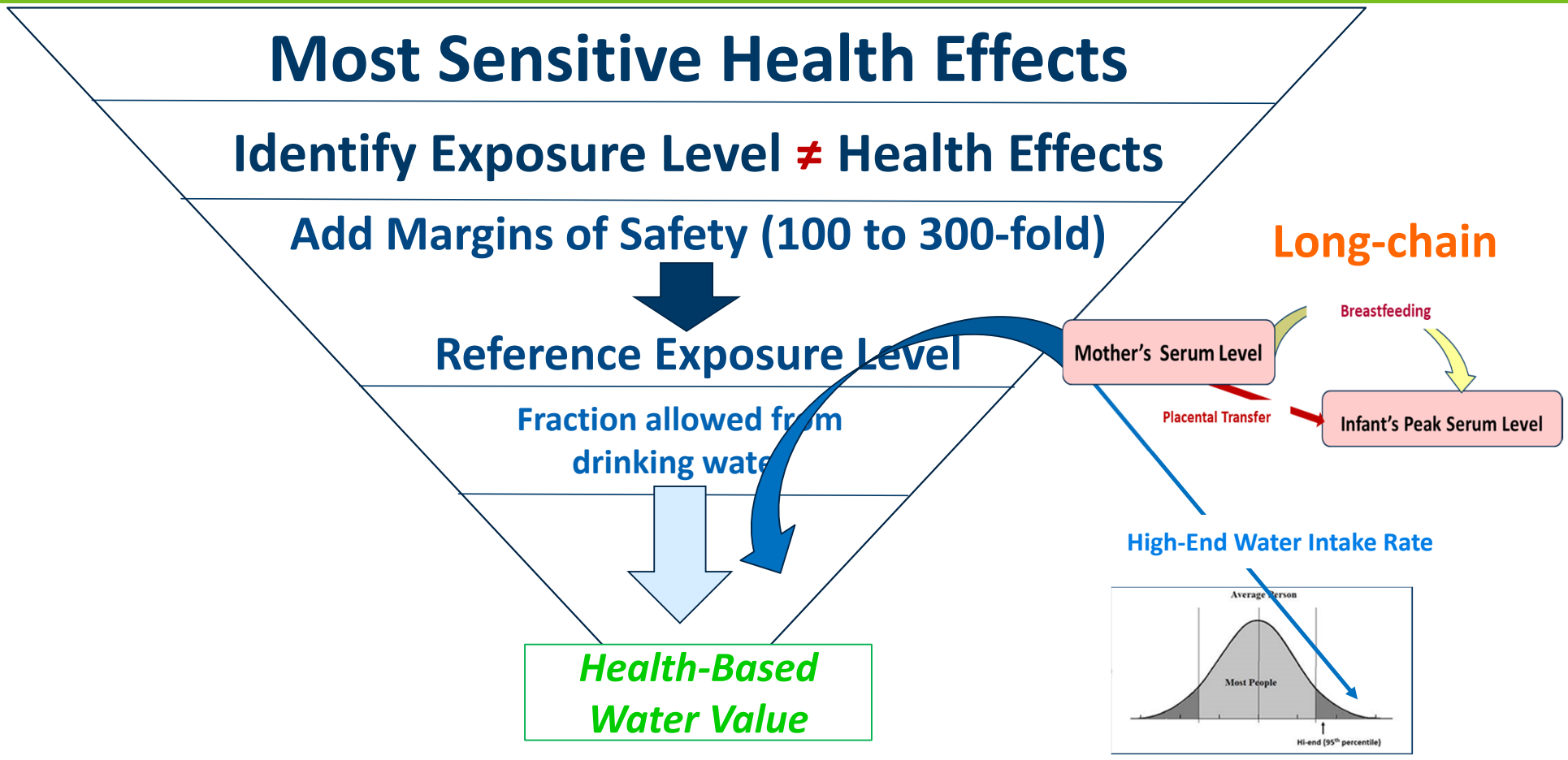
High-End Water Intake Rate for Formula Fed Infants



Fraction allowed from drinking water

Health-Based Water Value

Setting MDH Health-Based Water Values



PFAS – Guidance Changes Over Time

- Very Active Area of Research
- MDH guidance values have been added and updated as new research became available
  - Much slower elimination in humans. Same exposure results in much higher body burdens in humans than laboratory animals
  - Magnitude of maternal to infant transfer
  - *In the works = human health studies with adequate exposure measurements and measured markers of health effects*

	Long-chain (µg/L, ppb)			Short-chain (µg/L, ppb)		
Year	PFOA	PFOS	PFHxS	PFHxA	PFBA	PFBS
2002	7	1				
2006	1	0.6			1	
2007	0.5	0.3			7	
2009	0.3					7
2013			0.3			
2016	0.07	0.07	0.07			
2017	0.035	0.027	0.027			2
2019		0.015	0.047	0.2		0.1
2022						

What level of PFAS in drinking water is safe?

PFAS always occur in mixtures. Exposure to multiple contaminants can cause effects differently than exposure to a single contaminant.

MDH uses an additivity approach – to evaluate the combined health risk of mixtures.

Calculating a Health Risk Index (HRI)

- Risks for common health endpoint (e.g., liver, thyroid) are added together

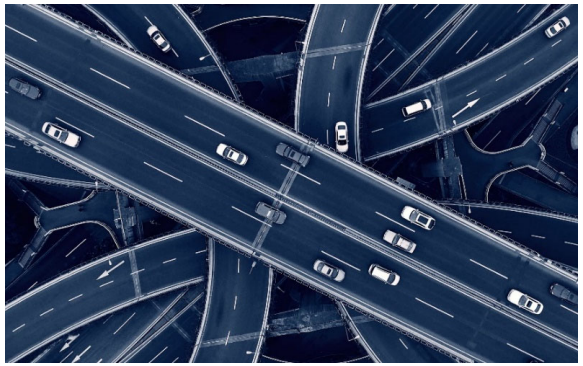
Example:

$$HRI = \frac{PFOA_{conc}}{PFOA_{HBV}} + \frac{PFOS_{conc}}{PFOS_{HBV}} + \frac{PFHxS_{conc}}{PFHxS_{HBV}} + \frac{PFHxA_{conc}}{PFHxA_{HBV}} + \frac{PFBA_{conc}}{PFBA_{HBV}} + \frac{PFBS_{conc}}{PFBS_{HBV}}$$

HRI > 1, considered an exceedance of an allowable health risk level

Recent EPA Health Advisories for PFAS

- On June 15th, 2022 EPA announced new, interim lifetime Health Advisories (HAs) for PFOA and PFOS
  - Final HAs for PFBS and GenX
- States were given one week's notice, but not provided with informational materials for water system operators until 2 days before the release
- Technical documentation was available the day of the release
- A nationwide scramble ensued to understand why EPA issued interim values



Summary of Four PFAS Health Advisories

- EPA is releasing health advisories for four PFAS:
  - **Interim HAs**: PFOA and PFOS
  - **Final HAs**: GenX chemicals (PFOA replacement) and PFBS (PFOS replacement)
- Analytical methods can detect GenX chemicals and PFBS at the HA values but cannot detect PFOA and PFOS at the level of the interim HAs.
- Because of this, EPA recommends that if water systems detect PFOA and PFOS, they take steps such as informing residents, undertaking monitoring, and examining steps to limit exposure.

Chemical	Health Advisory (ppt)	Minimum Reporting Level (MRL)[a] (ppt)
PFOA	0.004 (Interim)	4
PFOS	0.02 (Interim)	4
GenX Chemicals	10 (Final)	5
PFBS	2,000 (Final)	3

1 ppt = 0.001 ppb

[a] Fifth Unregulated Contaminant Monitoring Rule (UCMR 5) MRL is the minimum quantitation level that, with 95 percent confidence, can be achieved by capable analysts at 75 percent or more of the laboratories using a specified analytical method. These MRLs are based on the UCMR 5 requirement to use EPA Analytical Method 533.

What is a Drinking Water Health Advisory?

- Drinking water health advisories:
  - provide information on contaminants that can cause health effects and are known or anticipated to occur in drinking water
  - **are non-enforceable and non-regulatory**
  - include information on analytical methods and treatment
- EPA has developed HAs for ~200 drinking water contaminants.
- An HA level or value is the concentration of a drinking water contaminant for a specific exposure duration, at or below which exposure is not anticipated to lead to adverse human health effects.
  - A **lifetime HA** (such as those EPA recently released) protects all Americans, including sensitive populations and life stages, from adverse health effects resulting from exposure throughout their lives.

Parts per *Quadrillion* - Why so Low?

- Based on draft EPA toxicological summaries for PFOA and PFOS released December 2021
- Key study used by EPA - human epidemiological data that showed a decline in vaccine effectiveness related to the level of PFOA/PFOS in blood
- MDH (and many others) expressed significant concerns about the lack of transparency and standard scientific practice on the part of EPA in the development of the draft toxicological values (*show your work!*)
- Final Science Advisory Board review report to EPA was issued August 22, 2022 and contained many recommendations for improvement in EPA's draft evaluation
- EPA is revising the 2021 draft documents and has indicated that there will be substantive changes. Anticipate second draft end of 2022 or early 2023

PFOA & PFOS - What Next?

- EPA has committed to releasing a draft rule with Maximum Contaminant Level Goals (MCLGs) and Maximum Contaminant Levels (MCLs) by late 2022
- MCLGs are aspirational and strictly health based; for carcinogens they are set at zero
- MCLs – primary regulatory standards for all US public water systems – by factoring in costs and benefits, feasibility, laboratory detection limitations, etc.
- MCLs can also be treatment based – if the MCL is exceeded a specific treatment technique is required
- EPA plans to finalize proposed MCL rule for PFOA and PFOS to be released late 2023

PFOA & PFOS - What is MDH Doing Next?

- In addition to US EPA, California EPA and the European Union conducted independent in-depth analyses of health effects data, including human epidemiological data
- MDH Health Risk Assessment staff, with support from the Environmental Epidemiology Unit, are reviewing the EPA, CA and EU documents and most recent publications
  - Objective - determine if a similar approach, specifically human epidemiology data, can be used to revise Minnesota's Health Based Values for PFOA and PFOS
  - Goal is to complete review and have new Health Based Guidance by early 2023

Additional Resources

PFAS homepage

https://www.health.state.mn.us/communities/environment/hazardous/topics/pfcs.html

- PFAS Activities in Minnesota
- PFAS and Health, including resources for clinicians
- PFAS and Home Treatment of Water
- PFAS and Fish
- Links to Other Agency Resources (MPCA, US EPA)

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Thank you – Questions?

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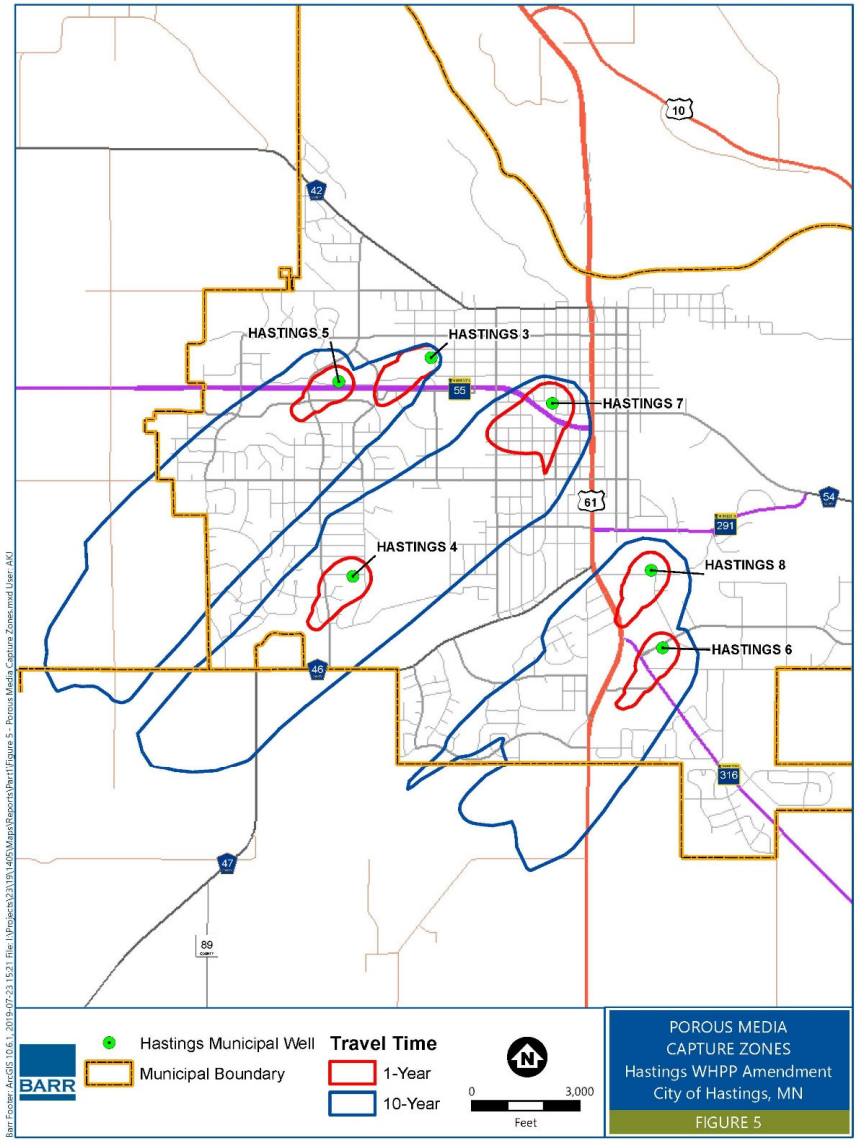
City of Hastings PFAS Summary

Ryan Stempski | City of Hastings

September 6, 2022

TOPICS TO COVER

- City Well Locations
- City of Hastings PFAS Results
- Questions


HASTINGS 5
HASTINGS 3
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HASTINGS 8
HASTINGS 6
10
42
55
61
54
291
46
316
47
89
Hastings Municipal Well
Municipal Boundary
Travel Time
1-Year
10-Year
0
3,000
Feet
BARR
POROUS MEDIA
CAPTURE ZONES
Hastings WHPP Amendment
City of Hastings, MN
FIGURE 5

Hastings PFAS Results

PFAS Health Risk Index (HRI) Calculation results

7 records selected.

Selection Criteria:

PWSID(s): **1190012**

Sample Date Range: **7/1/2022** to **8/1/2022**

(click a column heading to sort)

PWSID	Sample Point ID	PWS Name	Facility Name	Sample Location Description	Sample ID	Collection Date/Time	PFOS ug / L	PFOA ug / L	PFBS ug / L	PFBA ug / L	PFHxS ug / L	PFHxA ug / L	HRI	HRI Classification
1190012	E08	Hastings	TREATMENT PLANT #1	Treatment Plant	22G1723-06	7/25/2022 10:15:00 AM	.00089	.013	.0026	.29	.0028	.0084	0.60	0.5 ≤ HRI ≤ 1
1190012	S03	Hastings	Well #3	Well 3	22G1723-07	7/25/2022 10:25:00 AM	.0011	.011	.0023	.3	.0029	.0074	0.55	0.5 ≤ HRI ≤ 1
1190012	S04	Hastings	Well #4	Well 4	22G1723-03	7/25/2022 10:00:00 AM	.00024	.0026	.00063	.2	.00082	.0027	0.16	0.0 < HRI < 0.5
1190012	S05	Hastings	Well #5	Well 5	22G1723-05	7/25/2022 10:10:00 AM	.00095	.013	.0026	.28	.0026	.008	0.60	0.5 ≤ HRI ≤ 1
1190012	S06	Hastings	Well #6	Well 6	22G1723-02	7/25/2022 9:50:00 AM	.00087	.0052	.00099	.14	.00089	.0025	0.27	0.0 < HRI < 0.5
1190012	S07	Hastings	Well #7	Well 7	22G1723-08	7/25/2022 10:30:00 AM	.004	.0069	.0016	.13	.0029	.0046	0.58	0.5 ≤ HRI ≤ 1
1190012	S08	Hastings	Well #8	Well 8	22G1723-01	7/25/2022 9:40:00 AM	.0024	.02	.0017	.14	.0025	.0037	0.84	0.5 ≤ HRI ≤ 1

Source: MN Dep't. of Health - 8/30/2022

Next Steps for Hastings

- Testing of PFAS will continue by MDH in coordination with the City
- We do anticipate the guidance from MDH to change by early 2023 and we have already started working with State Agencies to address PFAS filtration
- The City is setting up its website to include a PFAS Section to share information going forward
- MDH in partnership with the City will be hosting a PFAS Open House in Hastings for the Public yet this fall (date and location TBD)
- Press Release to be issued by the City

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Thank you – Questions?

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