



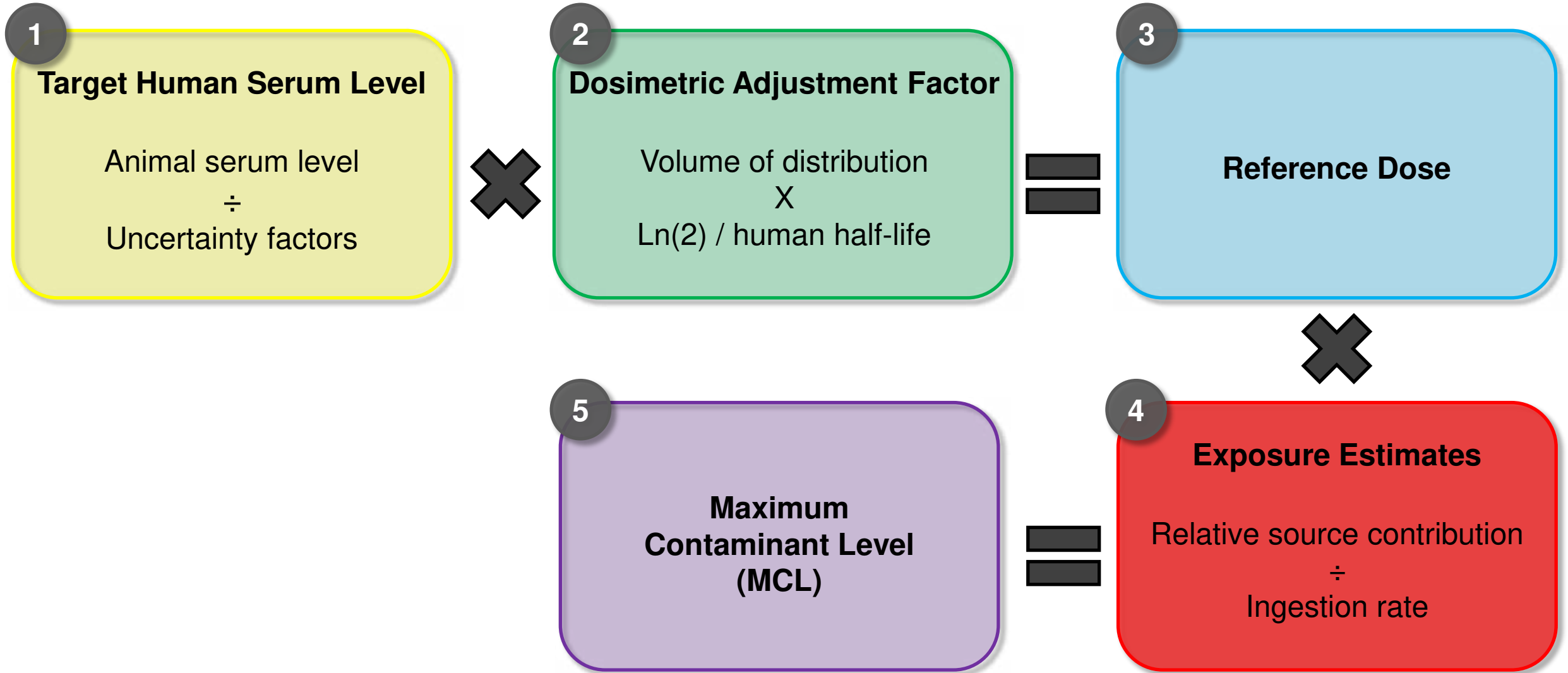
Incorporating New Exposure Model In Drinking Water Calculations

Katherine Pelch, PhD



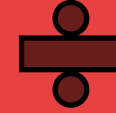
April 24, 2019
CHE-Alaska

Calculating MCLs



Exposure Estimates

Relative source contribution (RSC)



Ingestion rate

RSC

- Proportion of the total daily exposure to a chemical that is attributed to or allocated to tap water
- US EPA guidance on RSC*:
 - Use values between 20%-80% (0.2-0.8)
 - Default to 20% if inadequate data

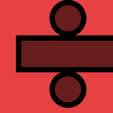
Example RSCs Used

	NJ	NH
PFOA	0.2	0.4
PFOS	0.2	0.5
PFHxS	na	0.5
PFNA	0.5	0.5

*Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000)
<https://www.epa.gov/sites/production/files/2018-10/documents/methodology-wqc-protection-hh-2000.pdf>

Exposure Estimates

Relative source contribution (RSC)



Ingestion rate

Ingestion Rate

- How much water is consumed on a per body weight basis
- We consume different volumes of water at different life stages*
- Infants and children drink more water on a per body weight basis than adults

Ingestion Rates Used

	L/kg/day	Based on:
NJ	0.029	non-pregnant, non-lactating adult
NH	0.055	lactating woman
VT	0.175	first year of life based on combined direct and indirect water intake

*U.S. EPA. Exposure Factors Handbook 2011 Edition (Final Report)
<https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=236252>

These Exposure Estimates Are Inadequate For PFAS

1. Many PFAS are bioaccumulative
2. PFAS cross the placenta
3. PFAS are transferred to infants in breastmilk
4. Infants are particularly vulnerable
 - Highest exposure estimates on a per body weight basis
 - Susceptible to developmental programming



A New Exposure Model For PFAS

Journal of Exposure Science & Environmental Epidemiology
<https://doi.org/10.1038/s41370-018-0110-5>

ARTICLE



A transgenerational toxicokinetic model and its use in derivation of Minnesota PFOA water guidance

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mi DEPARTMENT OF HEALTH

Health Based Guidance for Water
Health Risk Assessment Unit, Environmental Health Division
651-201-4899

Adopted as Rule: August 2018

Toxicological Summary for: Perfluorooctanoate
 CAS: 45285-51-6 (anion)
 335-67-3 (free acid)
 335-66-0 (acid fluoride)
 3825-26-1 (ammonium salt, APFO)
 2395-00-8 (potassium salt)
 335-93-3 (silver salt)
 335-95-5 (sodium salt)

Synonyms: PFOA, Perfluorooctanoic acid

[MDH PFOA HBGV](#)

mi DEPARTMENT OF HEALTH

Health Based Guidance for Water
Health Risk Assessment Unit, Environmental Health Division
651-201-4899

Web Publication Date: May 2017

Toxicological Summary for: Perfluorooctane Sulfonate
 CAS: 45298-90-6 (anion)
 1763-23-1 (acid)
 29081-56-9 (ammonium salt)
 70225-14-8 (diethanolamine salt)
 2795-39-3 (potassium salt)
 29457-72-5 (lithium salt)

Synonyms: PFOS, Perfluorooctane sulfonic acid

[MDH PFOS HBGV](#)

mi DEPARTMENT OF HEALTH

Health Based Guidance for Water
Health Risk Assessment Unit, Environmental Health Division
651-201-4899

Web Publication Date: April 2019

Toxicological Summary for: Perfluorohexane sulfonate
 CAS: 108427-53-8 (anion)
 355-46-4 (acid)
 3871-99-6 (potassium salt)

Synonyms: PFHxS; perfluorohexanesulfonic acid; 1,1,2,2,3,3,4,4,5,5,6,6-tridecafluorohexane-1-sulfonate

[MDH PFHxS HBGV](#)

Two Exposure Scenarios

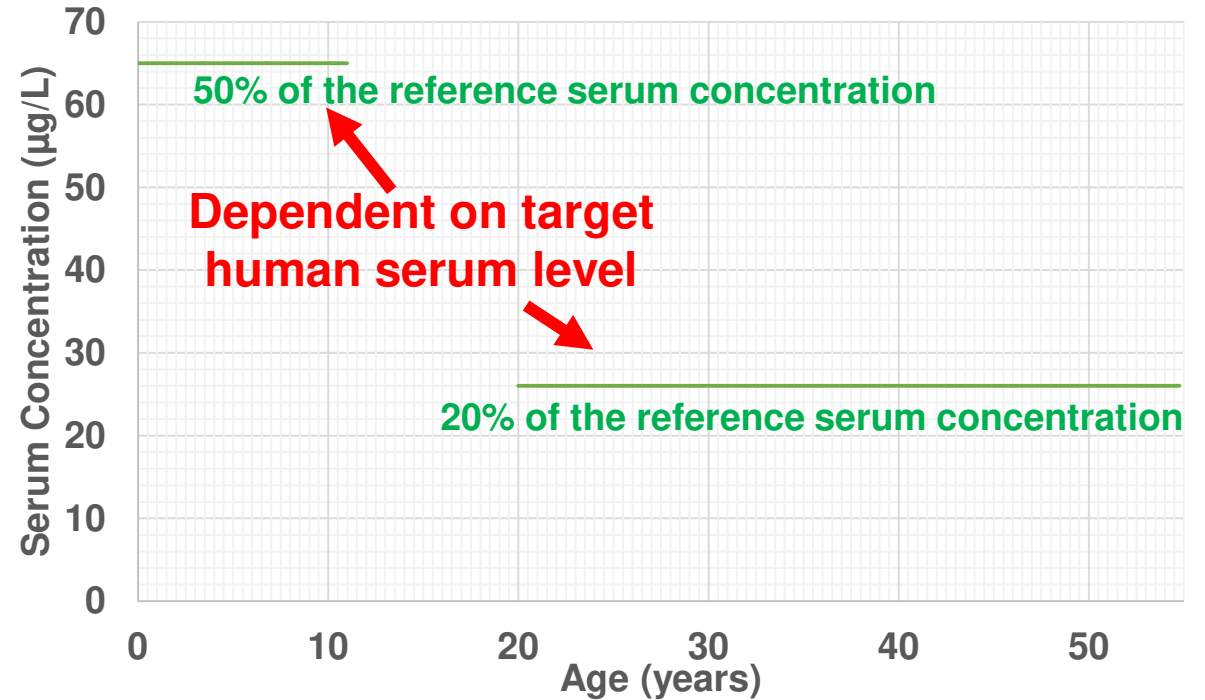
- Infant consumes formula reconstituted with PFAS contaminated water
- Infant exclusively breastfed for 6 months with breastfeeding tapered to zero by 12 months
- BOTH MODELS:
 - PFAS crosses placenta –born with existing body burden
 - Continues drinking PFAS contaminated water throughout life

Using the Model

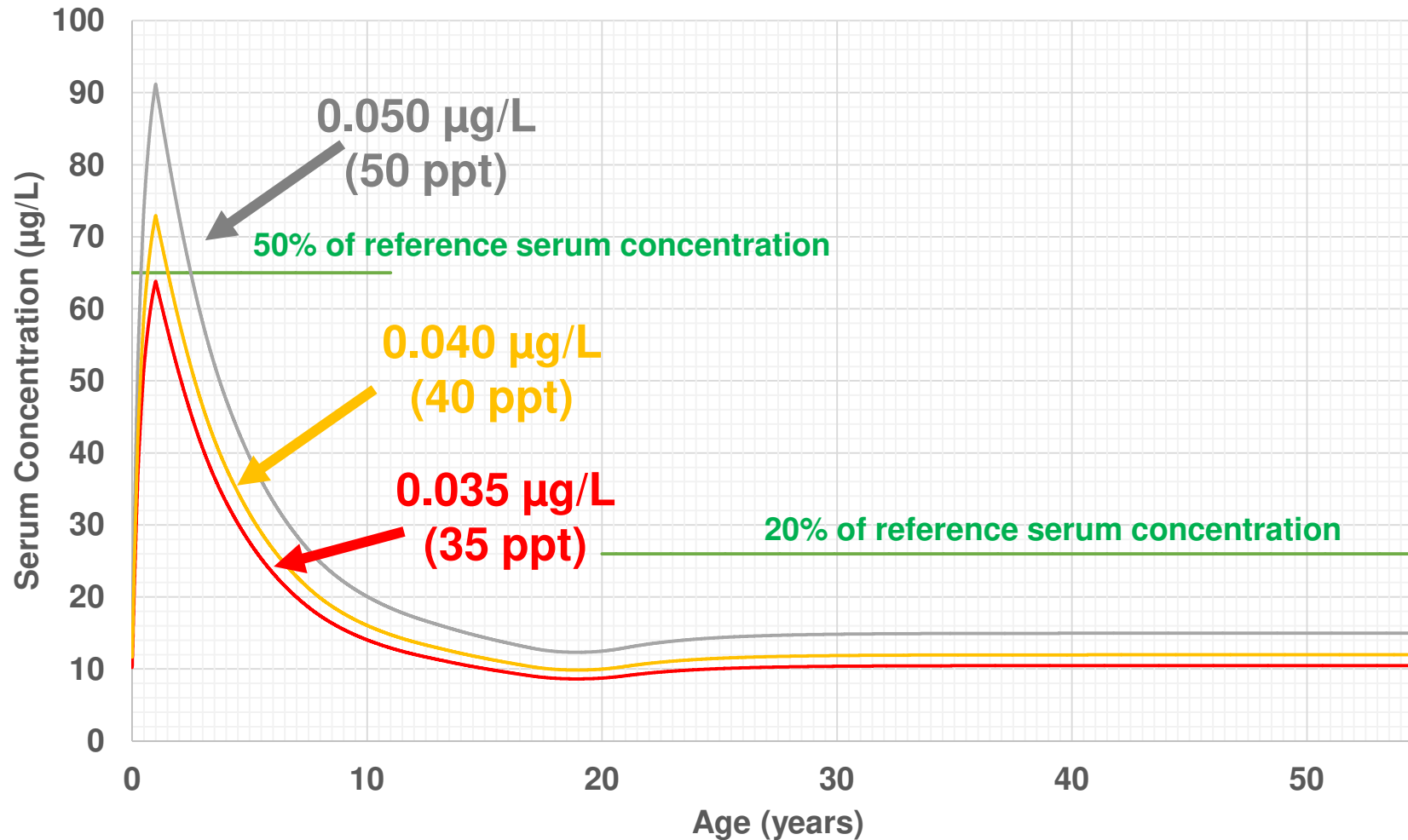
INPUT

- Half life
- Placental transfer ratio
- Breast milk transfer ratio
- Volume of distribution
- Target human serum level

OUTPUT

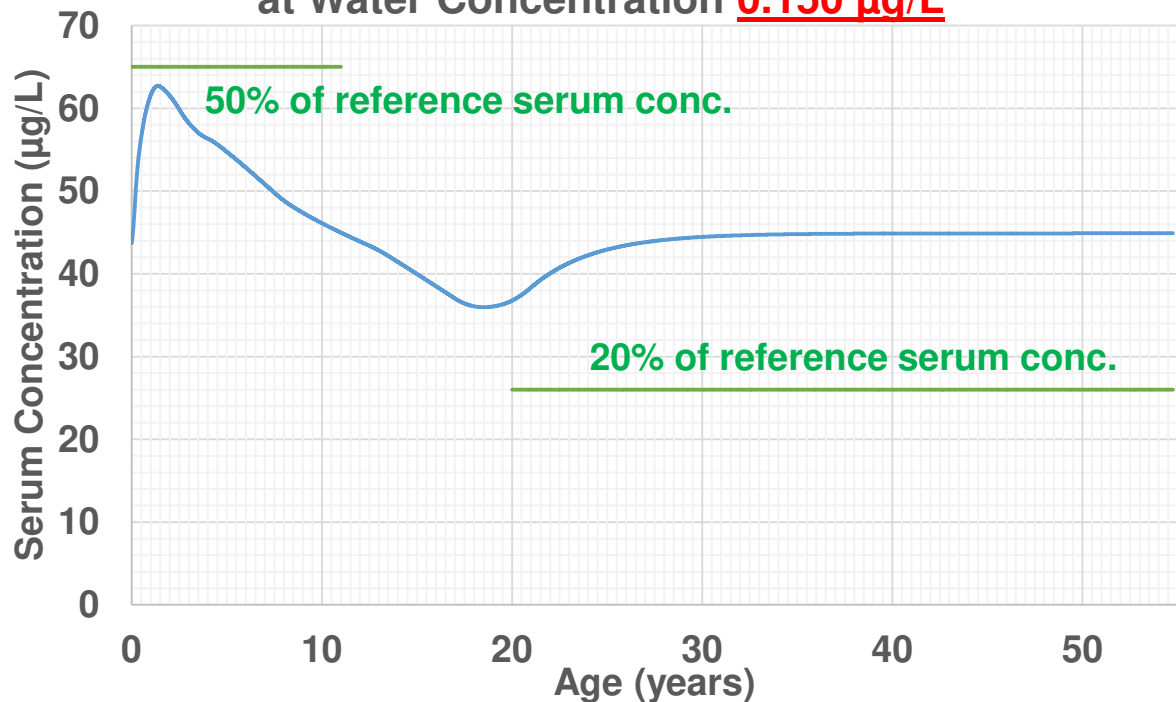


What Are The Predicted Serum Concentrations Over Time Given A Particular Drinking Water Concentration?

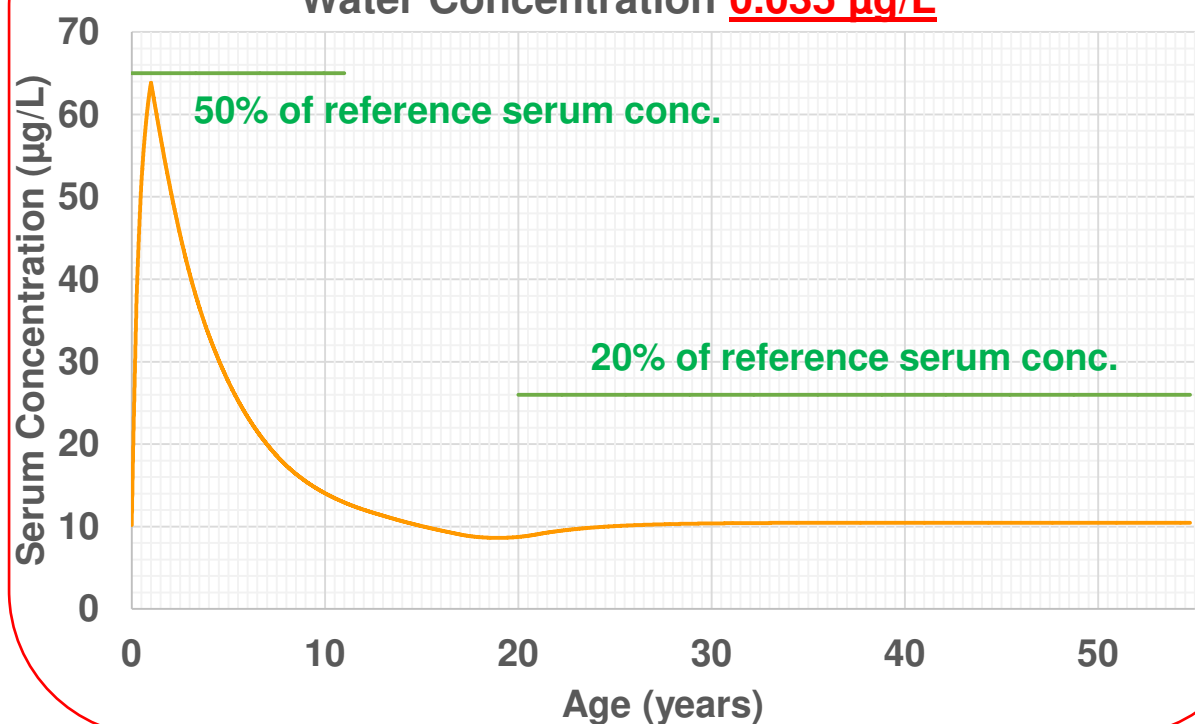


Model Outputs Based on MDH Target Human Serum Level

Formula-fed Infant Scenario PFOA Serum Concentration at Water Concentration 0.150 µg/L



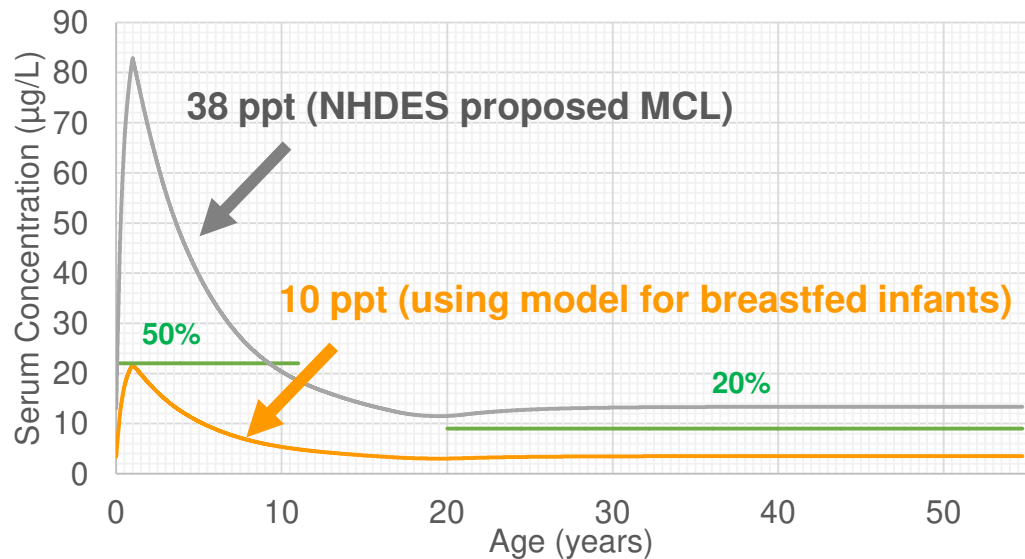
Breastfed Infant Scenario PFOA Serum Concentration at Water Concentration 0.035 µg/L



The drinking water level suggested for formula-fed infants (150 ppt), would not have been protective for breastfed infants, so MDH set a health based guidance value of 35 ppt based on breastfed infants. [MDH PFOA HBGV](#)

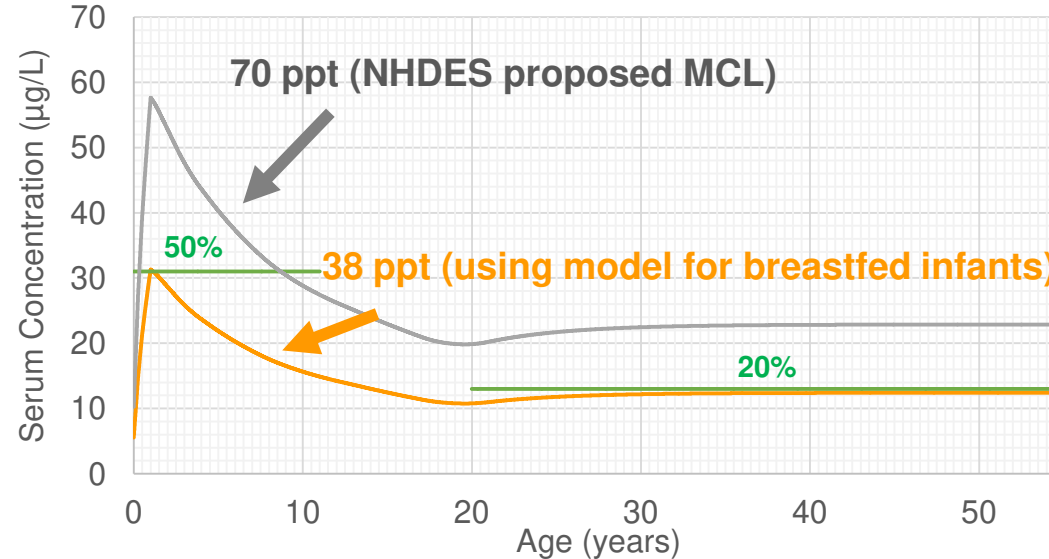
Impacts of Exposure Assumptions in NHDES MCL Calculations

Modeled Serum PFOA Concentrations



>50% for 9 years

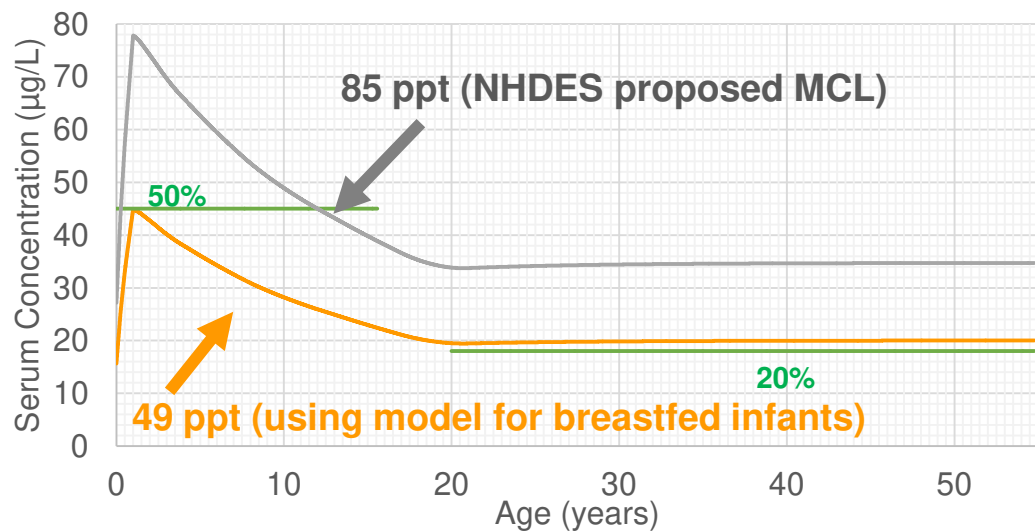
Modeled Serum PFOS Concentrations



>50% for 8.5 years

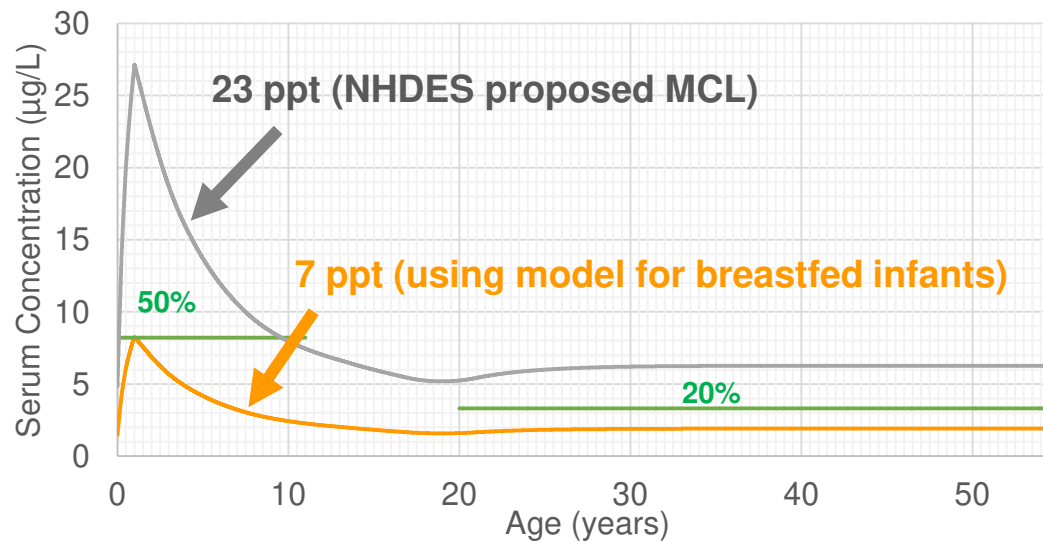
Impacts of Exposure Assumptions in NHDES MCL Calculations

Modeled Serum PFHxS Concentrations



>50% for 11.5 years

Modeled Serum PFNA Concentrations



>50% for 9.5 years

Conclusions

- The new exposure model created by MN Dept. of Health more fully considers the
 - long half life of PFAS
 - ability to cross the placenta and pass through breastmilk.
- The new model is protective of a vulnerable population – infants and children.
- The model predicts that current MCLs proposed by NHDES will not protect children for the first 10 years of their life.



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- Marisla Foundation
- Tides Foundation

View our full comments to NHDES at:

https://endocrinedisruption.org/assets/media/documents/TEDX_NHDES_comments.pdf