

# ***State Guidelines for PFAS in Environmental Media***



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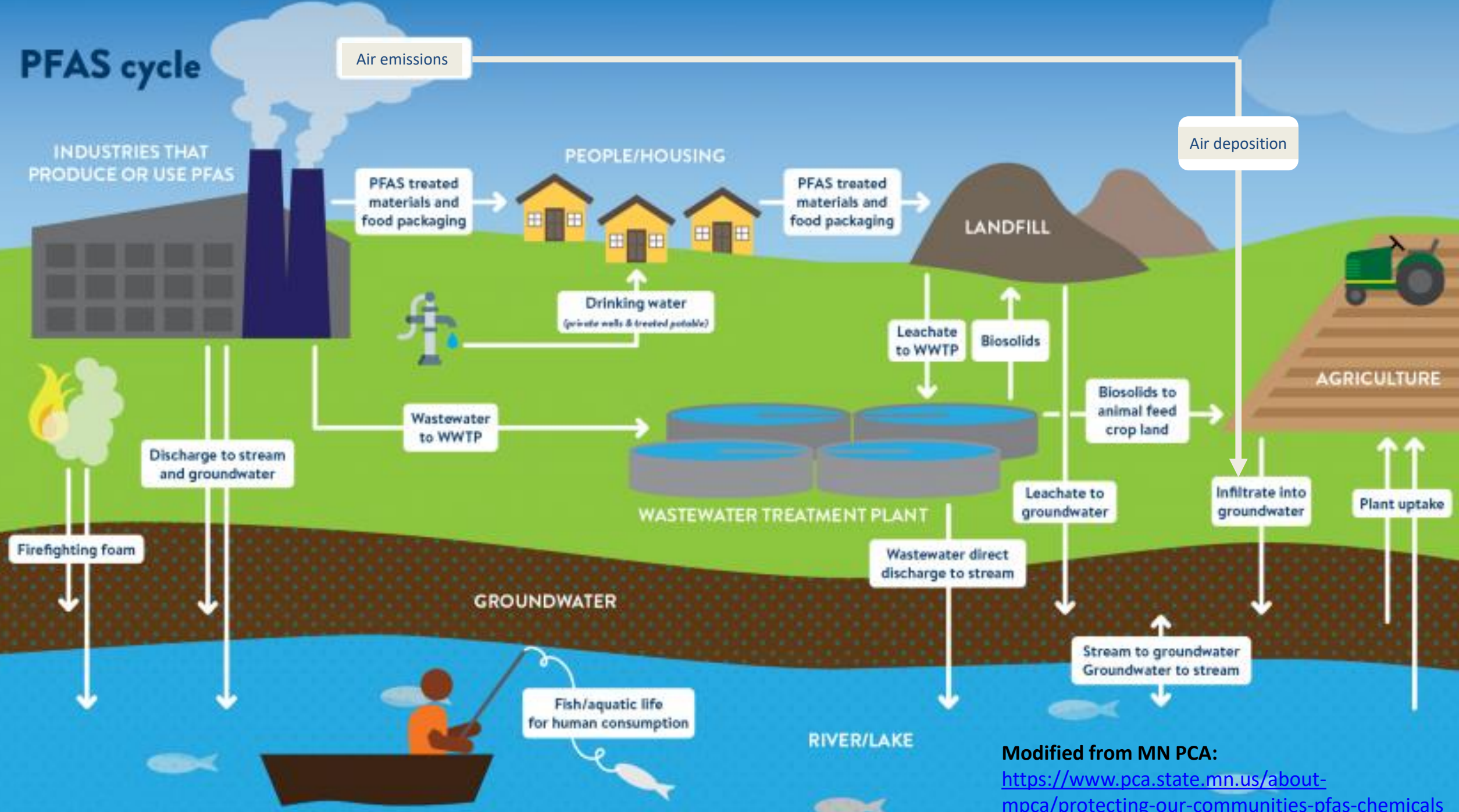
**NJ Department of Environmental Protection**

***Northeast Conference on The Science of PFAS: Public Health & The Environment***

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# PFAS cycle



Modified from MN PCA:  
<https://www.pca.state.mn.us/about-mPCA/protecting-our-communities-pfas-chemicals>

# State PFAS Guidelines



- “Guidelines” include standards (enforceable) and guidance values (non-enforceable).
- In general, state standards:
  - *May address contaminants with no federal standards.*
  - *May be **more stringent, but not less stringent**, than federal standards.*
- Example: State PFAS drinking water standards (Maximum Contaminant Levels; MCLs):
  - *Some states have developed their own MCLs for many years, including for PFAS.*
  - *Additional states that never previously developed MCLs have developed PFAS MCLs.*
  - *Due to **nationwide concerns** about PFAS in drinking water.*
- Other states are required to use USEPA standards or do not currently plan to develop PFAS MCLs.
  - *Most of these states are using the **2016 USEPA Health Advisories** (not enforceable) for PFOA and PFOS as guidance.*

# ***Overview - Human Health Criteria & Guidelines***

- Human health criteria are goals.
- Final guideline (standard or guidance) may need to be set higher than human health criterion due to consideration of other factors such as:
  - *Analytical limitations, available treatment removal technology, and cost or cost-benefit.*
- Factors considered differ among types of guideline (e.g., drinking water, ground water, surface water, soil) and among states (e.g., cost-benefit).
  - *Most (but not all) state PFAS guidelines are set at the health-based goal.*
- Guidelines can also be based on criteria other than for human health (e.g., criteria for protection of aquatic life).
  - *Not discussed in this presentation.*

# Overview - Basis of Human Health Criteria

## Toxicity factors

- Oral:
  - Non-cancer effects - *Reference Dose* (ng/kg/day).
    - Assumes threshold below which toxicity does not occur.
  - Carcinogenic effects - *Cancer Slope (Potency) Factor* (ng/kg/day)<sup>-1</sup>
    - Assumes some risk at any dose (non-threshold assumption).
    - Used along with cancer risk level (e.g., 1 in 1 million, 1 in 100,000).
- Same chemical-specific toxicity factor should be used for all guidelines based on oral exposure, unless there is a policy reason for a difference.
- Inhalation:
  - Non-cancer effects - Reference Concentration (ng/m<sup>3</sup>).
  - Carcinogenic effects - Unit Risk Factor (ng/m<sup>3</sup>)<sup>-1</sup> .
  - Current PFAS inhalation toxicity factors are extrapolated from oral toxicity factors.

## Exposure assumptions

- Specific to exposure pathways for each type of criteria

## ***Examples of Exposure Pathways for PFAS Human Health Criteria***

<b>Medium</b>	<b>Exposure Routes &amp; Assumptions</b>		<b>Comments</b>
<b>Drinking Water; Ground Water* (ng/L)</b>	<b>Drinking water ingestion</b> <i>L water/kg body wt/day</i>		*For ground water that is potentially potable.
<b>Surface Water (ng/L)</b>	<b><i>Freshwater (if designated potable)</i></b>	<b>Drinking water + fish consumption</b>	Fish tissue concentration determined by bioaccumulation/bioconcentration factor (BAF or BCF; <i>L water/kg fish</i> )
	<b><i>Saline water (&amp; fresh water not designated potable)</i></b>	<b>Fish consumption</b> <i>grams fish/kg body wt/day</i>	
<b>Soil (mg/kg)</b>	<b><i>Residential: Child</i></b>	<b>Incidental soil ingestion</b> <i>mg soil/kg body wt/day</i>	
	<b><i>Non-residential: Worker</i></b>		
	<b><i>Impact-to-Groundwater</i></b>	<b>Impact to groundwater</b>	
<b>Air (ng/m<sup>3</sup>)</b>	<b><i>Inhalation</i></b>	<b>Daily inhalation rate</b> <i>m<sup>3</sup>/day</i>	Extrapolated from oral PFAS toxicity factors
<b>Fish and Deer Consumption Advisories (meal frequency)</b>	<b><i>Recreationally caught fish or deer</i></b>	<b>Consumption</b> <i>Meal size (grams/meal)</i>	Examples: once per week; once per month; once per year; do not eat

## ***Example: Human Health Water Criteria for Non-Carcinogens***

**Drinking Water Criterion (ng/L) =**

$$\frac{\text{Reference Dose (ng/kg/day)} \times \text{Body Wt. (kg)} \times \text{Relative Source Contribution (\%)}}{\text{Water Ingestion Rate (L/day)}}$$

**Freshwater Surface Water Criterion (ng/L) =**

$$\frac{\text{Reference Dose (ng/kg/day)} \times \text{Body Wt. (kg)} \times \text{Relative Source Contribution (\%)}}{\text{Water Ingestion Rate (L/day)} + [\text{BCF or BAF (L/kg)} \times \text{Fish Consumption Rate (kg/day)}]}$$

**Saline Water Surface Water Criterion (ng/L) =**

$$\frac{\text{Reference Dose (ng/kg/day)} \times \text{Body Wt. (kg)} \times \text{Relative Source Contribution (\%)}}{\text{BCF or BAF (L/kg)} \times \text{Fish Consumption Rate (kg/day)}}$$

- *In equations above, assumed exposure from fish consumption is much greater than from drinking water for PFAS that are highly bioaccumulative in fish (e.g., PFOS and PFUnDA [C11]).*
- *Specific approaches are needed for BAF determination for PFAS.*
  - *PFAS bioaccumulation is associated with proteins, not lipids as for many other organic contaminants.*

**USEPA & State PFAS Drinking Water Guidelines (ng/L; ppt)**  
*(includes standards and guidance values - proposed, recommended, and final )*

	PFOA	PFOS	PFNA	PFHxS	PFHpA	PFDA	Total?	PFBA	PFHxA	PFBS	GenX
EPA	70	70	---	---	---	---	Yes (2)	---	---	---	---
CA	5.1/10* 0.007**	6.5/40* 1**	---	2***	---	---	No	---	---	500/5000*	---
CT	70	70	70	70	70	---	Yes (5)	---	---	---	---
DE	21	14	---	---	---	---	No	---	---	---	---
IL	2	14	---	140	---	---	No	---	560,000	2100	---
MA, ME, RI	20	20	20	20	20	20	Yes (6)	---	---	2000	---
MD	---	---	---	140	---	---	---	---	---	---	---
MI	8	16	6	51	---	---	No	---	400,000	420	370
MN	35	15	---	47	---	---	No	7000	200	100	---
NH	12	15	11	18	---	---	No	---	---	---	---
NJ	14	13	13	---	---	---	No	---	---	---	---
NY	10	10	---	---	---	---	No	---	---	---	---
NC	---	---	---	---	---	---	---	---	---	---	140
OH	70	70	21	140	---	---	PFOA+PFOS	---	---	2100	21
OR	30	30	30	30	---	---	Yes (4)	---	---	---	---
PA	14	18	---	---	---	---	Total < 17	---	---	---	---
VT	20	20	20	20	20	---	Yes (5)	---	---	---	---
WA	10	15	14	70	---	---	No	---	---	1300	---

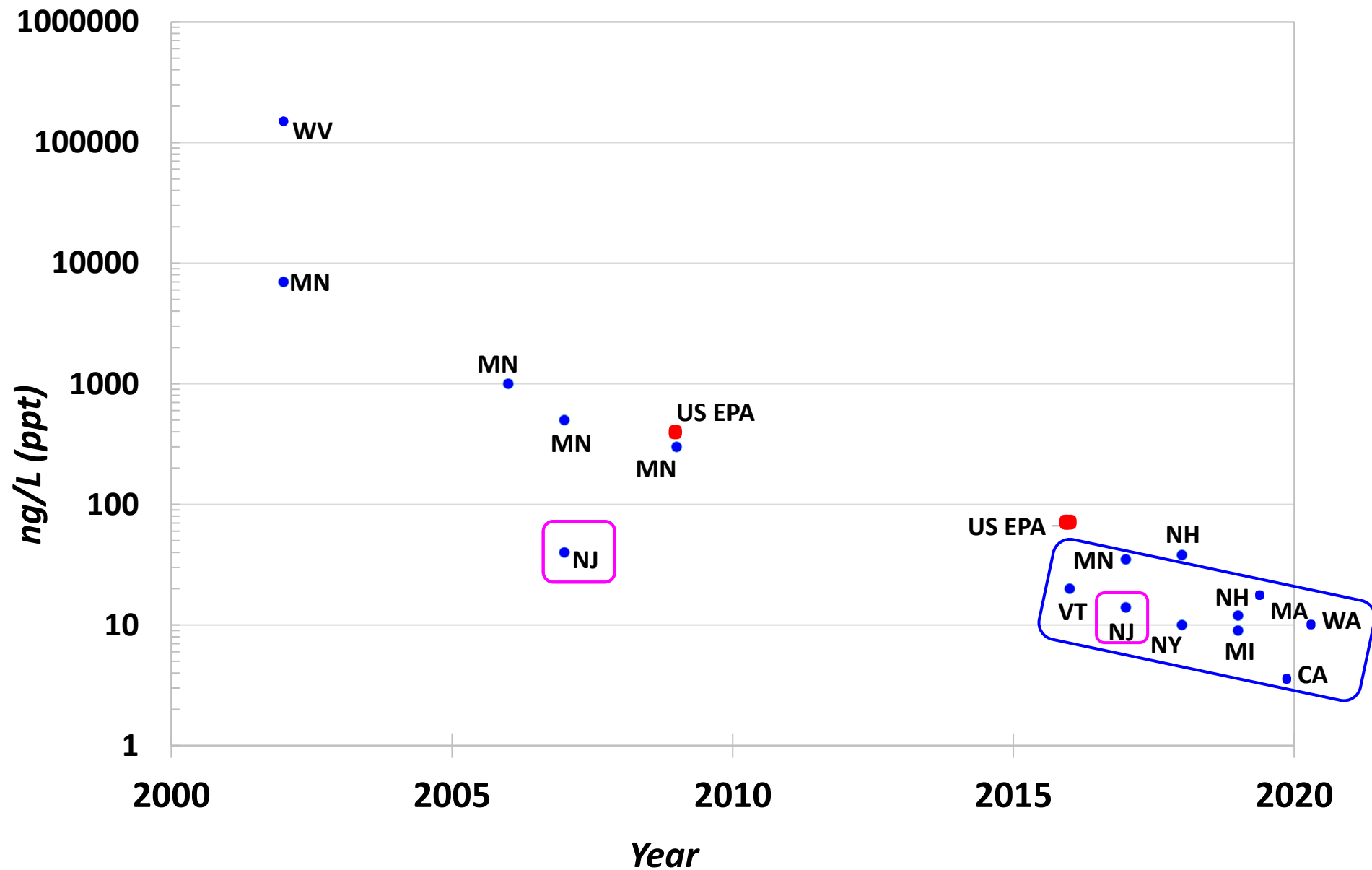
**States not listed generally use USEPA PFOA/PFOS Health Advisories of 70 ng/L as guidance.**

**\*Notification Level/Response Level    \*\* Draft Public Health Goal    \*\*\*Notification Level**



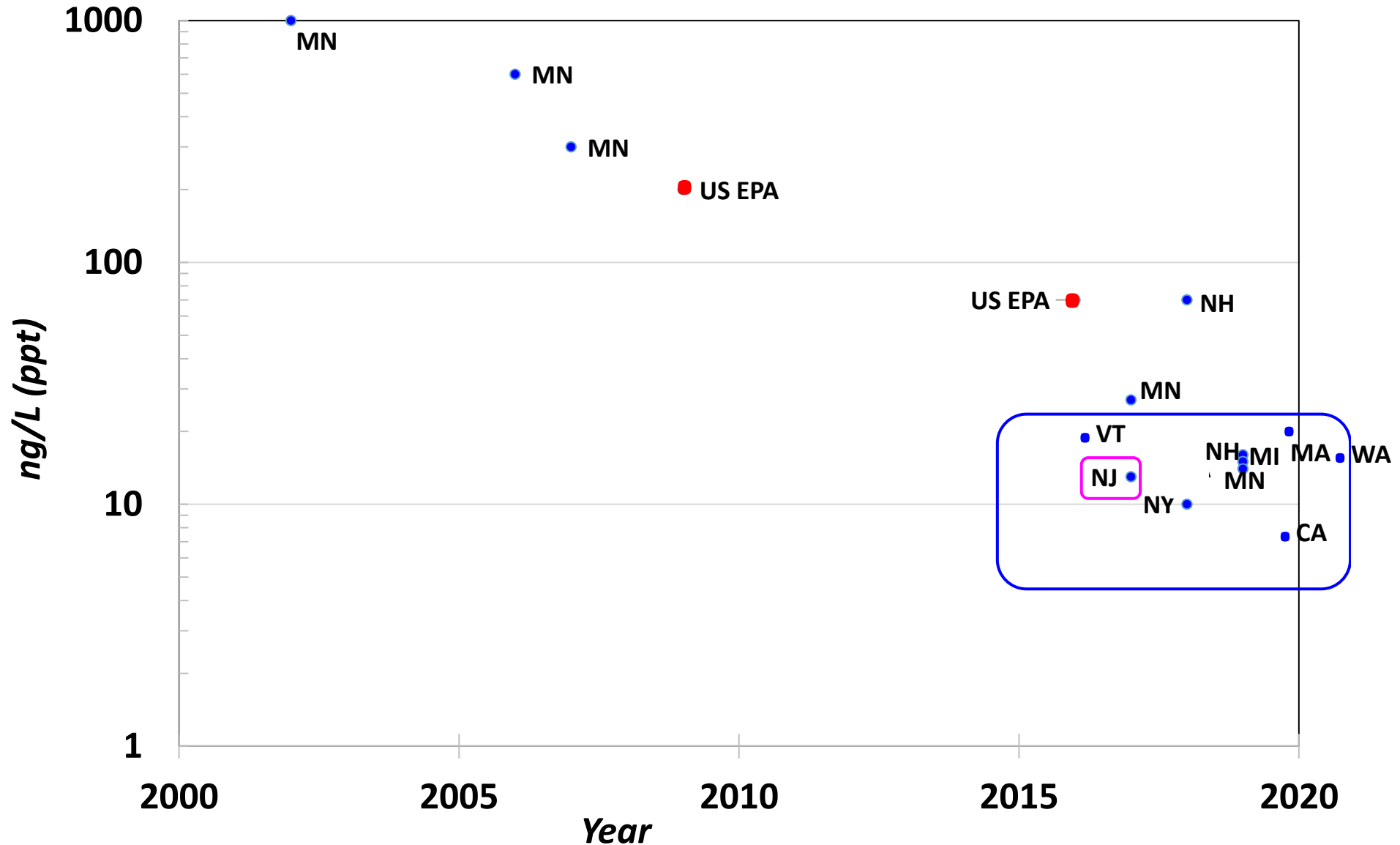
# State & USEPA PFOA Drinking Water Guidelines: 2002-2020

(Note Logarithmic Scale)



# State & USEPA PFOS Drinking Water Guidelines: 2002-2020

(Note Logarithmic Scale)



## ***Why are there differences in human health criteria developed by different agencies?***

- In general, states follow USEPA risk assessment guidance. However....
  - Risk assessment is not a “cookbook” – involves scientific judgement.
  - Scientists who review the same data and use the same risk assessment guidelines may come to different conclusions.

### Toxicity factor:

- Animal or human data as primary basis
- Non-carcinogenic (Reference Dose) or carcinogenic (slope factor) approach
- Choice of critical study and endpoint
- Choice of uncertainty factors used in Reference Dose; cancer risk level for carcinogens
- Human-to-animal extrapolation approach.

### Exposure assumptions:

- Choice of target population to be protected
  - e.g., Default adult, lactating woman, child, breastfed infant
- Relative Source Contribution (for non-carcinogenic water criteria)
  - % of Reference Dose assumed to come from other sources

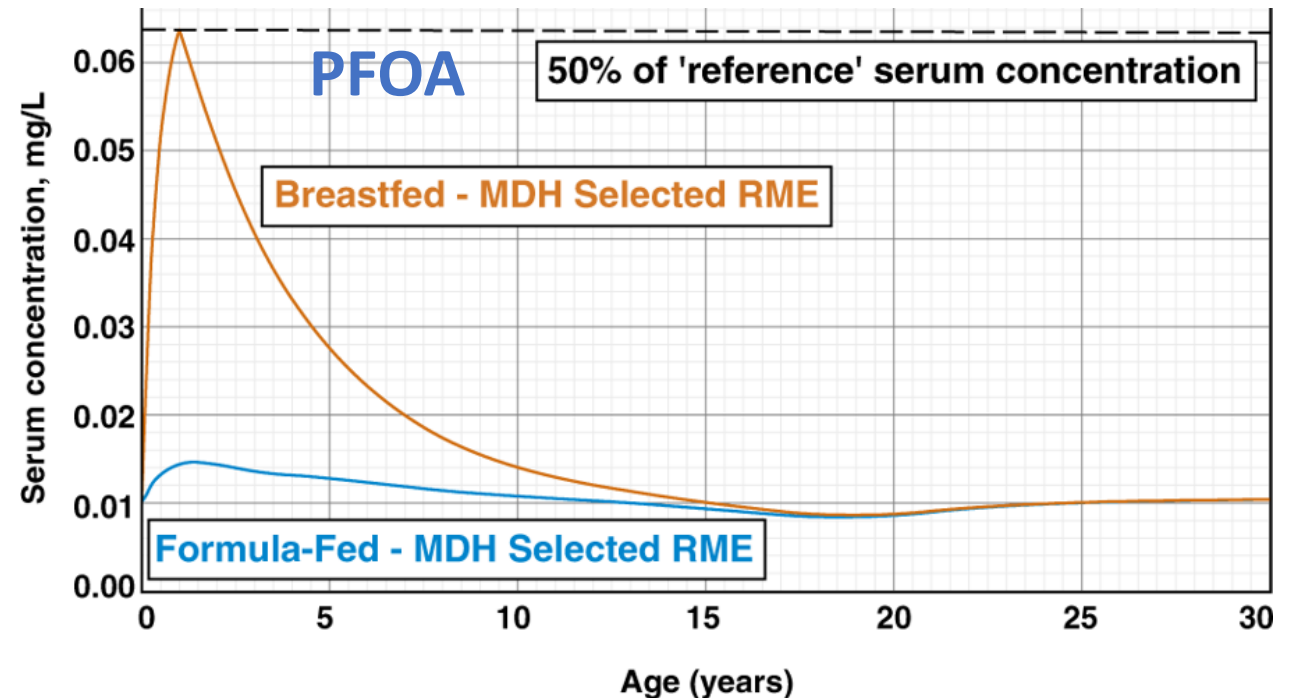
## ***Toxicological Basis: State Reference Doses for PFOS***

	NJ/NY	MI	MN/NH/WA	MA	VT/USEPA
<i><b>Critical Effect</b></i>	↓ antibody response to foreign antigen			Developmental: ↓ body weight in offspring	
<i><b>Species</b></i>	Mouse			Rat	
<i><b>Study</b></i>	Dong 2009		Dong 2011	Luebker 2005	
<i><b>Serum PFOS Metric</b></i>	Measured			Modeled average	
<i><b>Point of Departure</b></i>	NOAEL				
<i><b>Clearance Factor</b></i>	From USEPA HA; based on $t_{1/2}$ of 5.4 years (Olsen 2007)	Based on $t_{1/2}$ of 3.4 years (Li et al., 2017)		From USEPA HA; based on $t_{1/2}$ of 5.4 years (Olsen 2007)	
<i><b>Uncertainty Factors (UFs)</b></i>					
<i><b>Intraspecies UF</b></i>	10				
<i><b>Interspecies UF</b></i>	3				
<i><b>Database UF</b></i>	1	3		1	
<i><b>TOTAL UF</b></i>	30		100		30
<i><b>RfD (ng/kg/day)</b></i>	1.8 or 2*	2.9	3	5	20

\*Difference due to rounding

# Minnesota Dept. of Health Model for Early Life PFAS Drinking Water Exposure (Goeden et al., 2019)

- **Infant** exposures higher than in older individuals.
- From **breast milk** or **formula**:
  - *Higher PFAS levels in breast milk than in mother's drinking water.*
  - *Infants ingest much more fluid per body weight.*
- **Sensitive subpopulation** for developmental & other short-term effects.
- Model considers:
  - *Prenatal exposure from maternal drinking water consumption.*
  - *Breast milk for 1 year.*
  - *Followed by lifetime drinking water exposure.*



## ***PFOA: USEPA & State Reference Doses, Exposure Assumptions & Drinking Water Guidelines\****

	<b>EPA</b>	<b>MA</b>	<b>VT</b>	<b>NJ</b>	<b>MN</b>	<b>MI</b>	<b>WA</b>	<b>NH</b>	<b>NY</b>
<b><i>Reference Dose (ng/kg/day)</i></b>	<b>20</b>	<b>5</b>	<b>20</b>	<b>2</b>	<b>18</b>	<b>3.9</b>	<b>3</b>	<b>6.1</b>	<b>1.5</b>
<b><i>Ingestion Rate or Exposure Model</i></b>	<b>0.054 L/kg/day Lactating woman (80<sup>th</sup> %)</b>	<b>0.175 L/kg/day Infant (0-1 yr; 95<sup>th</sup> %)</b>	<b>0.029 L/kg/day Default adult (upper %)</b>	<b>Modeled:</b> <ul style="list-style-type: none"> <li>• Prenatal exposure.</li> <li>• Breast milk - 1 yr.</li> <li>• Followed by lifetime drinking water exposure.</li> </ul>				<b>Not specified (0.029 - 0.175 L/kg/day considered)</b>	
<b><i>Relative Source Contribution</i></b>	<b>20%</b>				<b>50% (for infants)</b>				<b>60%</b>
<b><i>Guideline (ng/L)</i></b>	<b>70</b>	<b>20</b>	<b>20</b>	<b>14</b>	<b>35</b>	<b>8</b>	<b>10</b>	<b>12</b>	<b>10</b>

\*CA Notification Levels based on cancer risk – exposure assumptions not shown.

# *States May Develop Guidelines for Specific PFAS of Local Concern*

- Some states have developed guidelines for [PFAS of local concern](#).
  - Some of these PFAS later found to be of concern in other states or nationwide.
- Examples:
  - [PFNA](#) (phased-out long chain PFAS):
    - [New Jersey](#) performed first toxicity assessment of PFNA, and then established MCL and ground water standard to address contamination from industrial facility.
    - MCLs later developed by several other states; USEPA toxicity assessment currently underway.
  - [GenX](#) (PFOA replacement):
    - [North Carolina](#) developed first drinking water guideline to address contamination from industrial facility.
    - Guidelines later developed by several other states; USEPA toxicity assessment is final and Health Advisory currently under development.
  - [Chloroperfluoropolyether carboxylates \(CIPFPECAs\)](#):
    - Alternative for PFNA; used and discharged at New Jersey industrial facility.
    - Toxicity studies from contract laboratories provided to NJDEP and made publicly available.
    - [New Jersey](#) recently developed Interim Specific Ground Water Quality Standard to address groundwater contamination.



E C O S

# *Information Sources for State PFAS Guidelines*



- **Environmental Council of the States (ECOS) White Paper: Processes & Considerations for Setting State PFAS Standards**  
[https://www.ecos.org/wp-content/uploads/2022/03/Standards-White-Paper\\_Updated\\_V3\\_2022\\_Final.pdf](https://www.ecos.org/wp-content/uploads/2022/03/Standards-White-Paper_Updated_V3_2022_Final.pdf)
  - Updated annually; 2022 update just posted last week.
  - Provides information on state efforts and considerations for future regulatory activities on PFAS.
  - Includes tables of information on state PFAS standards, advisories, and guidance values for numerous environmental media.
- **Interstate Technical & Regulatory Council (ITRC) [PFAS Water and Soil Values Table Excel file](#)**
  - Updated ~monthly.
  - Includes soil and water values established by USEPA, states, and other nations.



# ***Thank you!***

This PowerPoint will be posted on the conference website.

For questions or additional information:

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