



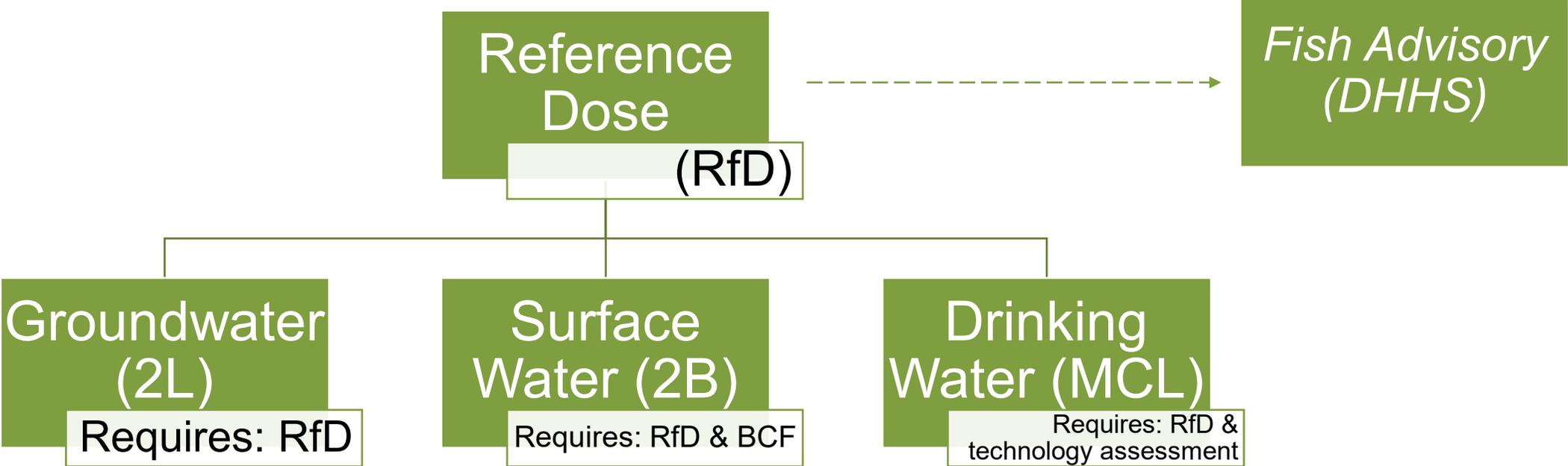
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*Priority PFAS List for North Carolina*

*Frannie Nilsen, PhD  
DEQ Environmental Toxicologist*



# The Important of Reference Doses in NC Standard Development





# *PFAS in North Carolina*

PFBS	PFHxS	PFHpA	PFMOAA	PMPA	PFOS
PFOA	PFO2HxA	PFBA	PEPA	PFO3OA	PFHxA
PFNA	GenX	PFO4DA	PFO5DA	HydroEVE	PFDA
		PFPeA	Nafion BPs		

# PFAS in North Carolina

## EPA PFAS RoadMap Compounds

PFBS

PFHxS

PFOS

PFOA

PFBA

PFHxA

PFNA

GenX

PFDA

## Non-EPA PFAS RoadMap Compounds

PFHpA

PFMOAA

PMPA

PFO2HxA

PEPA

PFO3OA

PFO4DA

PFO5DA

HydroEVE

PFPeA

Nafion BPs

# DEQ's Regulatory Priorities – Chemours PFAS

The Consent Order PFAS Compounds are unique to NC & EPA is not evaluating them.

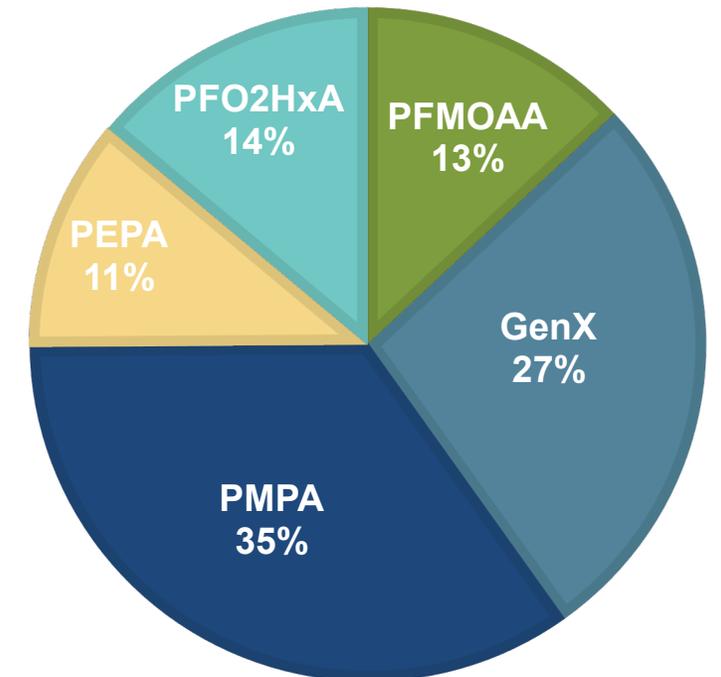
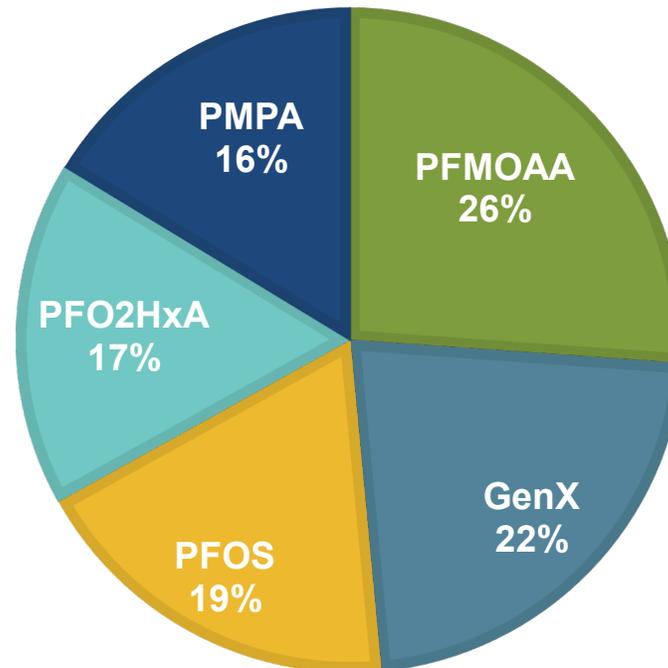
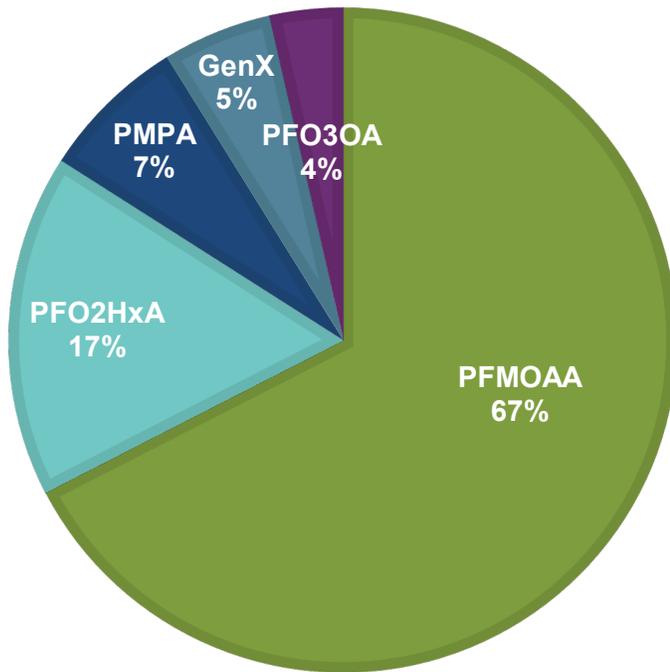
### Top 5 PFAS in Surface water bodies

### Top 5 PFAS in well water

#### HUSKE DAM BOAT RAMP

#### DOWNSTREAM CFR

#### RESIDENTIAL WELL WATER



# PFAS in North Carolina

## Non-EPA PFAS RoadMap Compounds

PFHpA

PFMOAA

PMPA

PFO2HxA

PEPA

PFO3OA

PFO4DA

PFO5DA

HydroEVE

PFPeA

Nafion BPs

# PFAS in North Carolina

**DEQ's Priority PFAS Group 1**

## Non-EPA PFAS RoadMap Compounds

PFHpA	PFMOAA	PMPA
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PFO2HxA	PEPA	PFO3OA
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PFO4DA	PFO5DA	HydroEVE
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PFPeA

Nafion BPs



# *PFAS in North Carolina*

## DEQ's Priority PFAS Group 1

PFMOAA

PMPA

PFO2HxA

PEPA

PFO3OA

# PFAS in North Carolina

## DEQ's Priority PFAS Group 1

PFMOAA

PMPA

PFO2HxA

PEPA

PFO3OA

- These are PFAS that are specific to NC and the waterbodies sampled in the lower Cape Fear region.
- There is not much existing toxicity information for these PFAS.



## Priority PFAS – Group 1

- There is not much existing toxicity information for these PFAS.

PFAS Compound	Exposure Data	Toxicology References	Human Biomonitoring Studies
PFMOAA	DEQ, NCSU	3 (1–3)	2 (2,4,5)
PMPA	DEQ, NCSU	0	1 (7)
PF02HxA	DEQ, NCSU	0	2 (4,7)
PEPA	DEQ, NCSU	0	1 (7)
PFO3OA	DEQ, NCSU	0	2 (4,7)

## *PFMOAA – Toxicology Studies*

Title	Authors	Year
30-Day Immunotoxicity Study of PFMOAA in C57BL/6 Mice	Vance, S.	2019
Novel Perfluoroalkyl Ether Carboxylic Acids (PFECAs) and Sulfonic Acids (PFESAs): Occurrence and Association with Serum Biochemical Parameters in Residents Living Near a Fluorochemical Plant in China.	Yao, J.; Pan, Y.; Sheng, N.; Su, Z.; Guo, Y.; Wang, J.; Dai, J.	2020
Immunotoxicity of Per-and Polyfluoroalkyl Substances: Insights into Short-Chain PFAS Exposure	Woodlief, T.; Vance, S.; Hu, Q.; DeWitt, J	2021

- 2 immunotoxicity studies
- 1 liver and kidney function study

# *PFMOAA – Toxicology Studies*

30-Day Immunotoxicity Study of PFMOAA in C57BL/6 Mice

by

Samuel Vance

## Summary: 30-Day Immunotoxicity Study of PFMOAA in C57BL/6 Mice (Vance 2019)

PFMOAA Doses: 0 mg/kg, 0.00025 mg/kg, 0.025 mg/kg, 2.5 mg/kg; daily oral gavage

### Results:

- Female mice had a peroxisome proliferation response in palmitoyl-CoA (high dose)
- Male mice had increased splenic T cells and NK cells (high dose)
- Male mice had increased thymic helper and cytotoxic T cells (low and mid doses)
- No signs of overt toxicity in either sex over 30-day dose period

### Conclusion:

This is evidence to support public health concerns for PFMOAA as even with a low bioaccumulation potential in humans, high, chronic environmental doses could still lead to adverse health outcomes.



Summary: Immunotoxicity of Per- and Polyfluoroalkyl Substances: Insights into Short-Chain PFAS Exposure (Woodlief et al. 2021)

PFMOAA Doses: 0 mg/kg, 0.00025 mg/kg, 0.025 mg/kg, 2.5 mg/kg; daily oral gavage 30-day exposure

## Results:

- No statistical differences in body, liver, or lymphoid organ weights or peroxisomal enzyme activity or immune cell function were detected
- Differences observed in peroxisome proliferation suggest effects but were not statistically significant.

## Conclusion:

These data suggest that PFMOAA, at the doses administered, has toxicological potential, and requires additional studies to determine their health effects via drinking water exposure.

## PFMOAA – Toxicology Studies

Novel Perfluoroalkyl Ether Carboxylic Acids (PFECAs) and Sulfonic Acids (PFESAs): Occurrence and Association with Serum Biochemical Parameters in Residents Living Near a Fluorochemical Plant in China

Jingzhi Yao, Yitao Pan, Nan Sheng, Zhaoben Su, Yong Guo, Jianshe Wang, and Jiayin Dai\*

**Summary:** Novel Perfluoroalkyl Ether Carboxylic Acids (PFECAs) and Sulfonic Acids (PFESAs): Occurrence and Association with Serum Biochemical Parameters in Residents Living Near a Fluorochemical Plant in China (Yao et al. 2020)

PFMOAA Doses: serum concentration measurements

### Results:

- PFMOAA in serum was higher in males than females
- Higher than expected serum PFMOAA levels were detected (based on very low  $K_{ow}$  value)
- PFMOAA concentration increased with age
- PFMOAA was not associated with changes in liver and kidney function biomarkers or lipid metabolism

### Conclusion:

Results indicate greater PFMOAA accumulation potential than expected and highlight the need for empirical toxicokinetic studies to better understand toxicity.

# *PFMOAA – Toxicology Studies*

## Overall Summary:

### *Human serum measurements*

- PFMOAA accumulates more than expected based on very low  $K_{ow}$  value (measure of adsorption)
- PFMOAA serum concentrations increased with age in humans
- PFMOAA in serum was not associated with changes in liver and kidney function biomarkers or lipid metabolism

### *Mice PFMOAA dosing*

- Increased splenic T cells and NK cells and thymic helper and cytotoxic T cells in males
- A peroxisome proliferation response of palmitoyl-CoA changes in females
- Sex-specific differences in peroxisome proliferation (not statistically significant)

## Overall Conclusion:

This is evidence to support public health concerns for PFMOAA as even with a low bioaccumulation potential in humans, high, chronic environmental doses could still lead to adverse health outcomes

# *Request to the Science Advisory Board*

## 1- Review the PFMOAA studies in detail.

- assess the quality of the studies (low, moderate, high)
  - based on sample sizes, dose regimes, endpoints measured

## ~~2- Determine if there is a consensus across the studies that could be used as a Point of Departure for eventual Reference Dose derivation.~~

- ~~• What is the proposed POD?~~

## 3- Do these studies provide enough scientific support to utilize the POD for deriving a Reference Dose now?

*Thank you*



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