Welcome to the Per- and Polyfluoroalkyl Substances (PFAS) Heartland Community Engagement

EPA Region 7- Leavenworth, Kansas
September 5, 2018

EPA
OFFICE OF GROUND WATER AND DRINKING WATER

PFAS 101: Dr. Marc Mills, EPA Office of Research and Development

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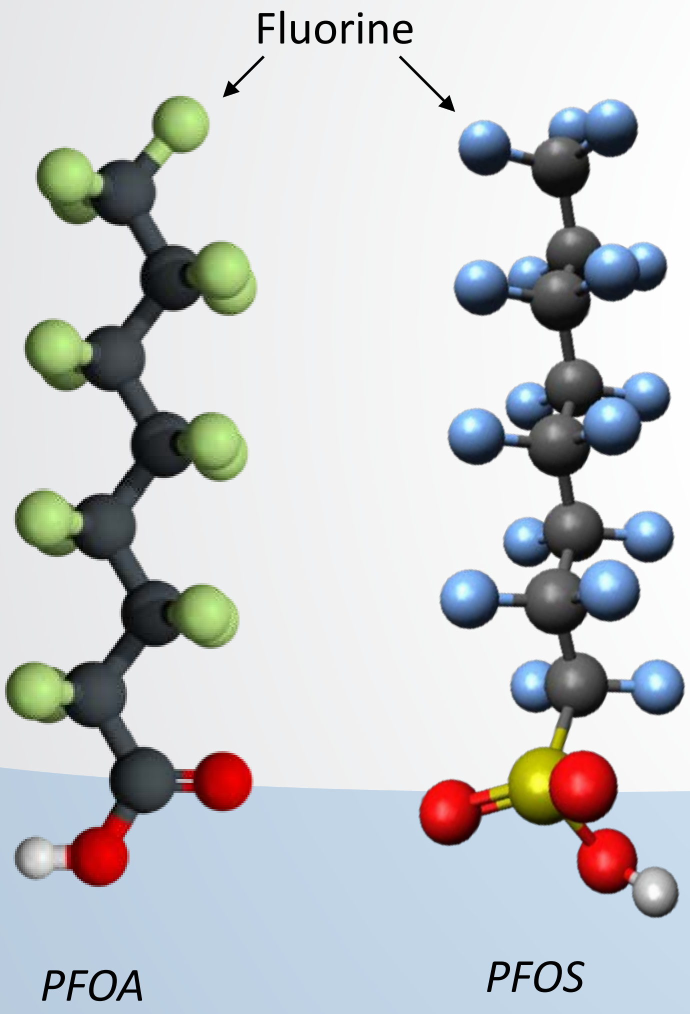
PFAS 101: An Introduction to PFAS and EPA research on PFAS

Presentation to "Per- and Polyfluoroalkyl Substances (PFAS) Heartland Community Engagement Meeting"

Marc A. Mills, Ph. D.

EPA Office of Research and Development

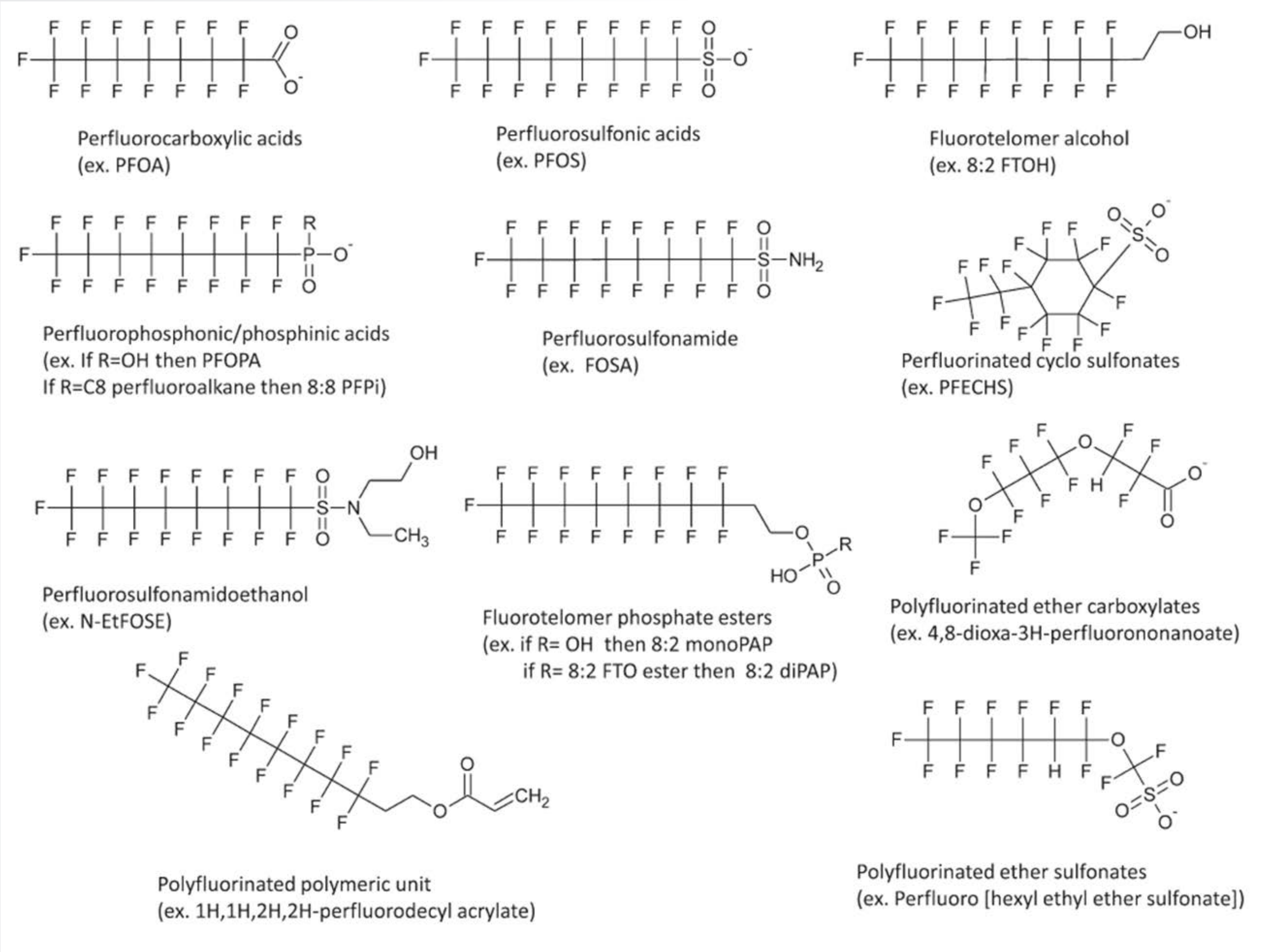
Per- and Polyfluoroalkyl Substances (PFAS)

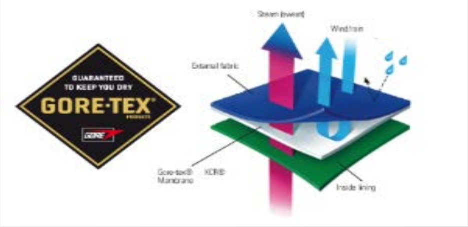


A class of man-made chemicals

- **Chains** of carbon (C) atoms surrounded by fluorine (F) atoms, with different endings
- **Complicated chemistry** – thousands of different variations exist in commerce
- **Widely used** in industrial processes and in consumer products
- **Some** PFAS are known to be **PBT**:
  - **Persistent** in the environment
  - **Bioaccumulative** in organisms
  - **Toxic** at relatively low (ppt) levels

Per- and Polyfluoroalkyl Substances (PFAS)





Slide courtesy of Mark Strynar referencing Lindstrom, Strynar and Libelo, 2011 ES&T

Thousands of Chemicals: More Than Just PFOA and PFOS

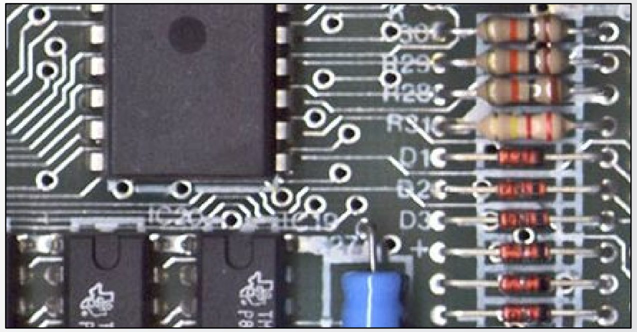
PFAS

- **Non-polymers**
  - **Perfluoroalkyl acids (PFAAs)** $C_nF_{2n+1}R$
    - Perfluoroalkyl carboxylic acids (PFCAs)
    - Perfluoroalkane sulfonic acids (PFSAs)
    - Perfluoroalkyl phosphonic acids (PFPAs)
    - Perfluoroalkyl phosphinic acids (PFPIAs)
  - **Perfluoroalkane sulfonyl fluoride (PASF)** $C_nF_{2n+1}SO_2F$ → **PASF-based derivatives** $C_nF_{2n+1}SO_2$-R, R = NH, $NHCH_2CH_2OH$, etc.
  - **Perfluoroalkyl iodides (PFAIs)** $C_nF_{2n+1}I$ → **Fluorotelomer iodides (FTIs)** $C_nF_{2n+1}CH_2CH_2I$ → **FT-based derivatives** $C_nF_{2n+1}CH_2CH_2$-R, R = NH, $NHCH_2CH_2OH$, etc.
  - **Per- and polyfluoroalkyl ethers (PFPEs)-based derivatives**
    - Polyfluoroalkyl ether carboxylic acids
- **Polymers**
  - **Fluoropolymers**
    - Polytetrafluoroethylene (PTFE)
    - Polyvinylidene fluoride (PVDF)
    - Fluorinated ethylene propylene (FEP)
    - Perfluoroalkoxyl polymer (PFA)
    - Others
  - **Side-chain fluorinated polymers**
    - Fluorinated (meth)acrylate polymers
    - Fluorinated urethane polymers
    - Fluorinated oxetane polymers
  - **Perfluoropolyethers**

Used in Homes, Businesses, & Industry

- Food contact surfaces such as cookware, pizza boxes, fast food wrappers, popcorn bags, etc.
- Polishes, waxes, and paints
- Stain repellants for carpets, clothing, upholstered furniture, etc.
- Cleaning products

- Dust suppression for chrome plating
- Electronics manufacturing
- Oil and mining for enhanced recovery
- Performance chemicals such as hydraulic fluid, fuel additives, etc.



Sources of PFAS in the Environment

- Direct release of PFAS or PFAS products into the environment
  - Use of aqueous film forming foam (AFFF) in training and emergency response
  - Release from industrial facility
- Surfacing (chrome, paper, polymers) facilities
- Landfills and leachates from disposal of consumer and industrial products containing PFAS
- Wastewater treatment effluent and land application of biosolids

Reasons for Concern

- Known or suspected toxicity
- PFAS and/or breakdown products are persistent in the environment
- Bioaccumulation in biota vary greatly across chemicals and species
- Used by a variety of industries
- Found in a variety of consumer products
- Most people have been exposed to PFAS

Known Human Exposure Pathways

- Best documented source is **contaminated drinking water** near industrial production facilities or waste disposal e.g., Cottage Grove, Minnesota; Parkersburg, West Virginia; Dalton, Georgia; Decatur, Alabama; Arnsberg, Germany; Osaka, Japan *Lindstrom et al. 2011, Environ. Sci. & Technol. (45) 8015 – 8021*
- **Food** is also implicated in many studies, especially fish from contaminated waters, items contaminated by food packaging, and breast milk *Fromme et al. 2009, Inter. J. Hyg. & Envr. Heath (212) 239-270; Mogensen et al. 2015 , Environ. Sci. & Technol. (49) 10466 - 10473*
- **House dust** may also be an important route of exposure – especially for children who ingest relatively higher levels of dust via hand-to-mouth activity *Shoeib et al. 2011, Environ. Sci. & Technol. (45) 7999 - 8005*
- **Workplace exposures** significant for some sectors: manufacturing or services making or directly using PFAS, apparel sales, waste treatment *Nilsson et al. 2013 Environ. Sci.: Processes Impacts, 15, 814-822*

Slide Courtesy of Andrew Lindstrom, US EPA

PFAS Health Effects Summary

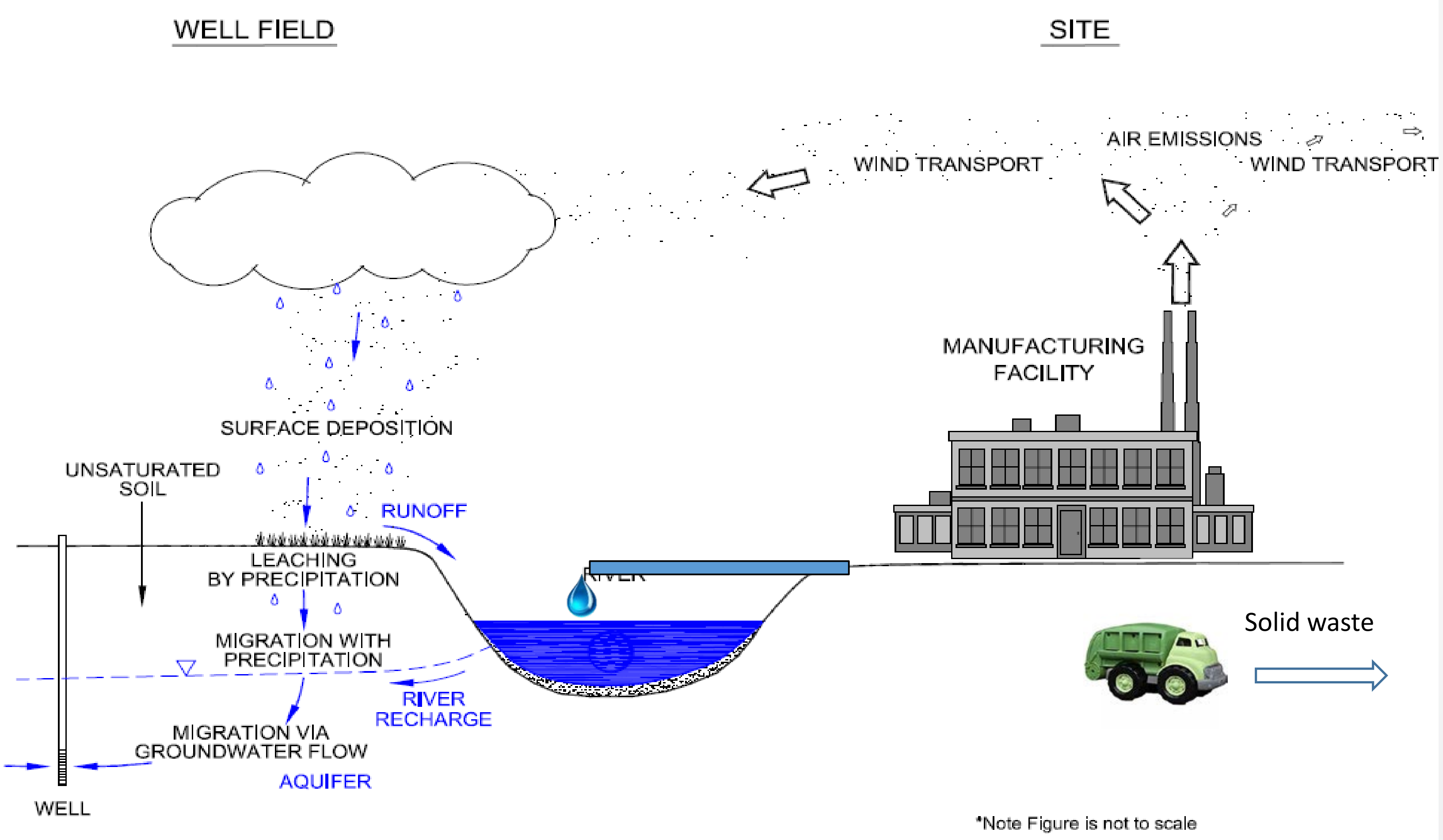
- Animal toxicity
  - Causes liver, immune system, developmental, endocrine, metabolic, and neurobehavioral toxicity.
  - PFOA and PFOS caused tumors in chronic rat studies.

- Human health effects associated with PFC(s) in the general population and/or communities with contaminated drinking water include:

- ↑ cholesterol
- ↑ uric acid
- ↑ liver enzymes
- ↓ birth weight
- ↓ vaccine response
- Thyroid disease
- Osteoarthritis
- Diabetes
- Testicular and kidney cancer
- Pregnancy-induced hypertension
- Ulcerative colitis
- Effects in young adulthood from prenatal exposures
  - *Obesity in young women.*
  - ↓ *sperm count in young men.*

Slide Courtesy of
Andrew Lindstrom, US EPA

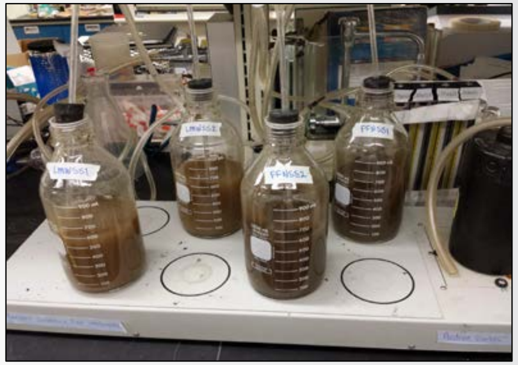
Conceptual Model of PFAS F&T



Adapted from Davis et al. Chemosphere 67 (2007) 2011–2019

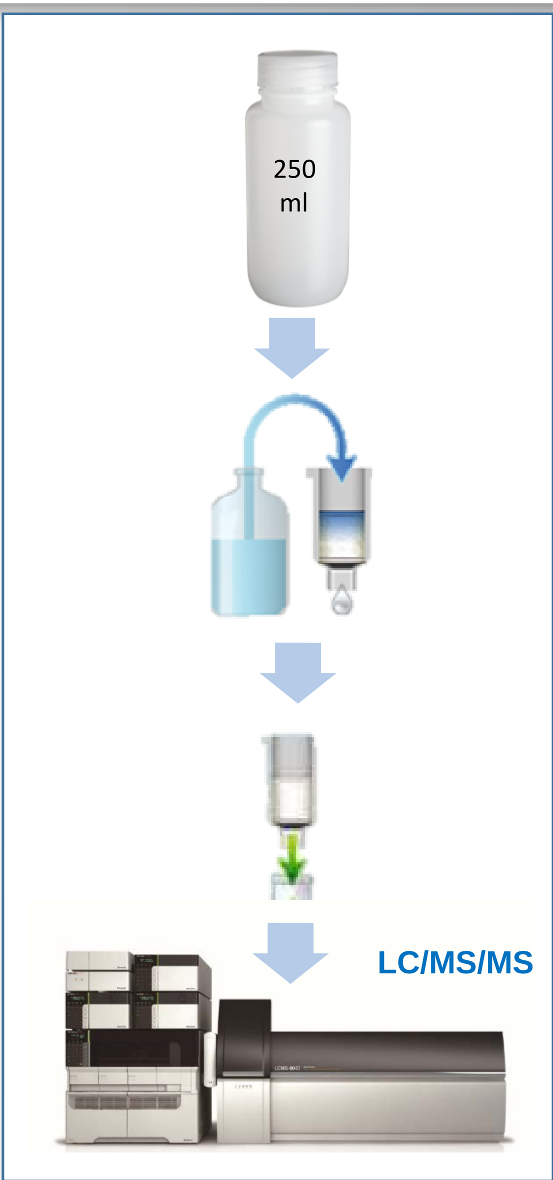
Current PFAS R&D Activities

- **Analytical Methods**
  - Establish validated methods for measuring PFAS in different environmental media
- **Human Health/Toxicity**
  - Develop standard toxicity values (RfD)
  - Apply computational toxicity for screening PFAS universe
- **Exposure**
  - Develop sampling methods to characterize sources and contaminated sites
  - Identify and estimate human exposure to PFAS from different sources
- **Treatment/Remediation**
  - Identify/evaluate methods to treat and remediate drinking water and contaminated sites
- **Technical Assistance to Regions, States, Tribes**



Research: Analytical Methods

- **Problem**: Lack of standardized/validated analytical methods for measuring PFAS
- **Action**: Develop and validate analytical methods for detecting, quantifying PFAS in water, air, and solids
- **Results**:
  - Testing current drinking water method for 6 additional PFAS (20 total, including GenX)
  - Developing and testing method for 24 PFAS in surface water, ground water, and solids
  - Initial development of method for air emission sampling and analysis
  - Continued development of non-targeted methods to discover unknown PFAS
- **Impact**: Stakeholders will have reliable analytical methods to test for known and new PFAS in water, solids, and air

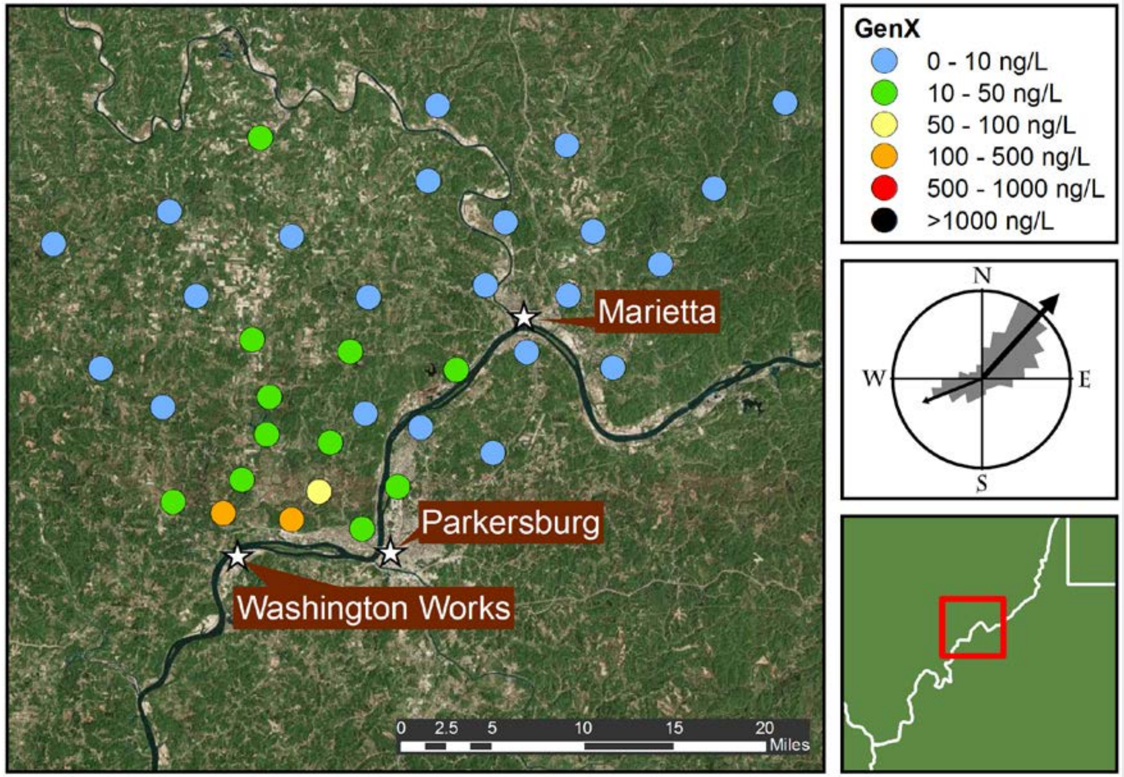


Research: Exposure

- **Problem**: Lack of knowledge on sources, site-specific concentrations, and exposure
- **Action**: Develop and test methods to characterize PFAS sources and exposures
- **Results**:
  - Developing exposure models for identifying, quantifying PFAS exposure pathways and relative source contribution
  - Developing and evaluating sampling and site characterization approaches to identify sources and extent of contamination.
- **Impact**: Stakeholders will be able to assess potential PFAS sources and exposures, and identify key exposure pathways for risk management

Ohio River, Air Transport

- Ohio State student studying PFAS in Ohio River and adjacent watershed
- Collaborated on sampling, analysis
- Found PFAS upstream from source
- Similar findings around facilities in NH, NJ, NC
- Implication of air as PFAS F&T pathway from industrial stacks



Research: Human Health/Toxicity

- **Problem**: Lack of toxicity values for many PFAS compounds
- **Action**:
  - Literature review of published toxicity data for 31 PFAS
  - Conduct assessments, fill gaps through computational toxicology
- **Results**:
  - Literature review complete, ~21 PFAS with some in vivo data to support assessment
  - Toxicity assessment underway for GenX, PFBS
  - Computational assays underway for 75 PFAS representative of PFAS chemical space
- **Impact**: Stakeholders will have PFAS toxicity values to support risk management decisions and risk communication

Research: Drinking Water Treatment

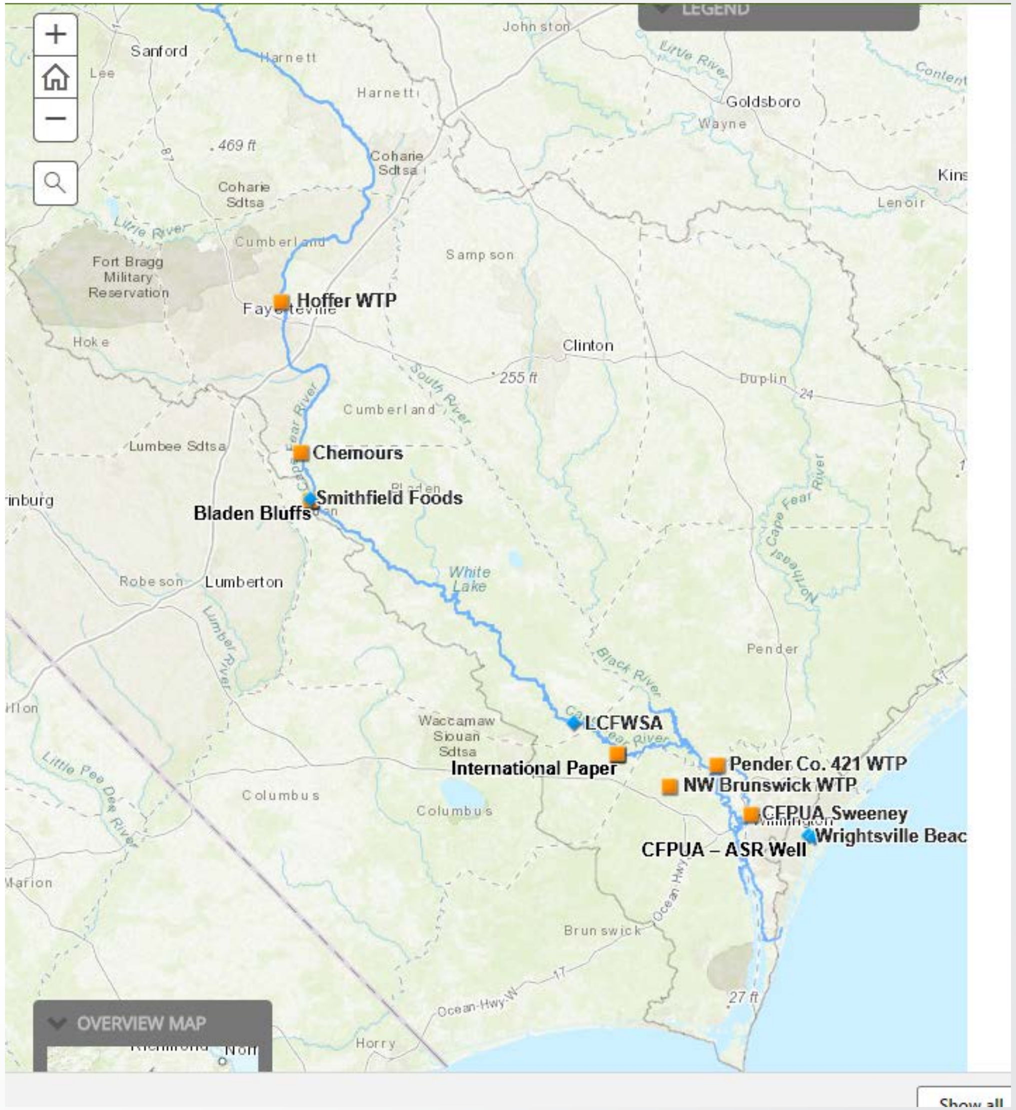
- **Problem**: Need water treatment technology performance and cost for PFAS removal
- **Action**:
  - Review PFAS performance data from available sources (industry, DoD, academia, international)
  - Test commercially available granular activated carbons (GACs) and ion exchange (IE) resins for effectiveness over a range of PFAS under different water quality conditions
  - Evaluate a range of system sizes – large full-scale utility options to home treatment systems

- **Results**:
  - Update EPA's **Drinking Water Treatability Database**, a public database for treatment performance data for regulated and unregulated contaminants
  - Use state-of-the-science models to extrapolate existing treatment studies to other conditions

- **Impact**: Utilities will be able to identify cost effective treatment strategies for removing PFAS from drinking water

Cape Fear River, Water Transport

- In early 2000s, scientists documented PFOA and PFOS in Cape Fear River downstream from chemical plant
- Returned in 2012, found new unknown PFAS compounds
- Eventually identified GenX, Naphion byproducts, others
- State of NC worked with plant to identify, halt flows, significant reduction in river concentration, ongoing monitoring



Research: Contaminated Site Remediation

- **Problem**: PFAS-contaminated sites require remediation and clean up to protect human health and the environment
- **Action**:
  - Characterize sources of PFAS such as fire training and emergency response sites, manufacturing facilities, production facilities, disposal sites
  - Evaluate treatment technologies for remediating PFAS-impacted soils, waters, and sediments
  - Generate performance and cost data with collaborators to develop models and provide tools to determine optimal treatment choices
- **Results**: Tools, data and guidance regarding cost, efficacy, and implementation for remedy selection and performance monitoring
- **Impact**: Responsible officials will know how to reduce risk of PFAS exposure and effects at contaminated sites, and to repurpose sites for beneficial use

Research: Materials Management

- **Problem**: Lack of knowledge regarding end-of-life management (e.g. landfills, incineration) of PFAS-containing consumer and industrial products

- **Action:**
  - Characterize various end-of-life disposal streams (e.g. municipal, industrial, manufacturing, landfills, incinerators, recycled waste streams) contributing PFAS to the environment
  - Evaluate efficacy of current and advanced waste management technologies (e.g. landfilling, thermal treatment, composting, stabilization) to manage PFAS at end-of-life disposal
  - Evaluate performance and cost data with collaborators to manage these materials and manage PFAS releases to the environment

- **Results**: Provide technologies, data and tools to manage these end of use streams

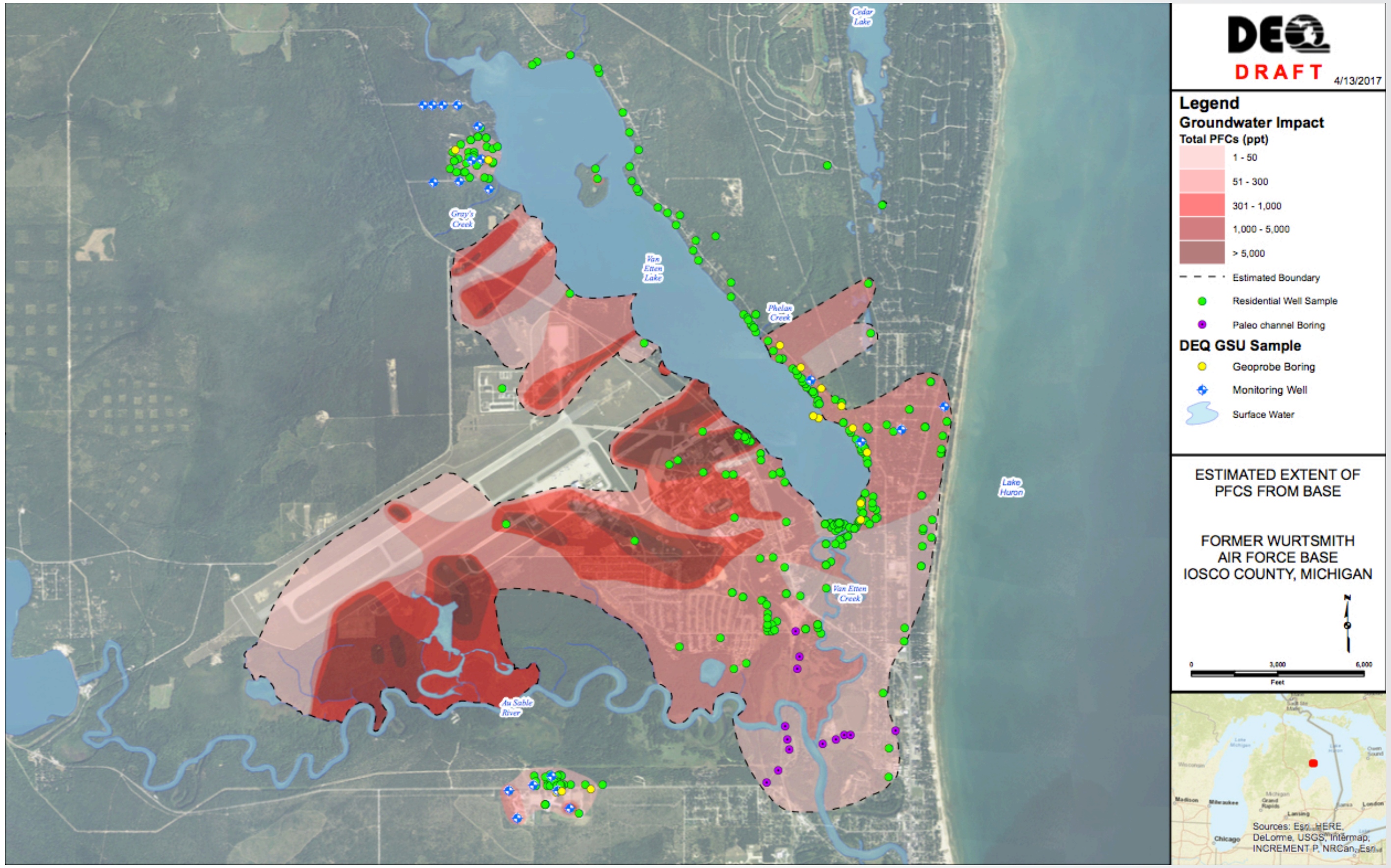
- **Impact**: Responsible officials will be able to manage effectively end-of-life disposal of PFAS-containing products

Technical Assistance for States, Tribes and Communities

- **Problem**: State, tribes and communities sometimes lack full capabilities for managing PFAS risk
- **Action:**
  - Make EPA technical staff available to consult on PFAS issues
  - Utilize applied research at impacted sites to develop new research solutions while also providing technical support to site managers
  - Summarize reoccurring or common support requests to share lessons learned from technical support activities
- **Results**: Many examples of past and ongoing technical assistance
  - **Cape Fear River, NC** – Significant reductions in PFAS in source and finished drinking water
  - **Manchester, NH** – Collaboration on air and water sampling
  - **Newport, RI** – Review and support to DOD PFAS sampling at Naval Station Newport
- **Impact**: Enable states, tribes and communities to 'take action on PFAS'

Van Etten Lake, Groundwater Transport

- Known contamination from AFFF use at (former) Wurtsmith AFB, Michigan
- Impacting local DW wells, recreational lake, eventually Lake Huron
- Instances of foam reforming on lake surfaces



Research Grants

Practical Methods to Analyze and Treat Emerging Contaminants (PFAS) in Solid Waste, Landfills, Wastewater/Leachates, Soils, and Groundwater to Protect Human Health and the Environment

U.S. Environmental Protection Agency
National Center for Environmental Research
Science to Achieve Results (STAR) Program

Solicitation Opening Date: August 17, 2018
Solicitation Closing Date: October 2, 2018

Key Knowledge Gaps

Release

Leachate

Surrounding Environmental Media

Wastewater Treatment Plant (WWTP)

Transformation

Mitigation

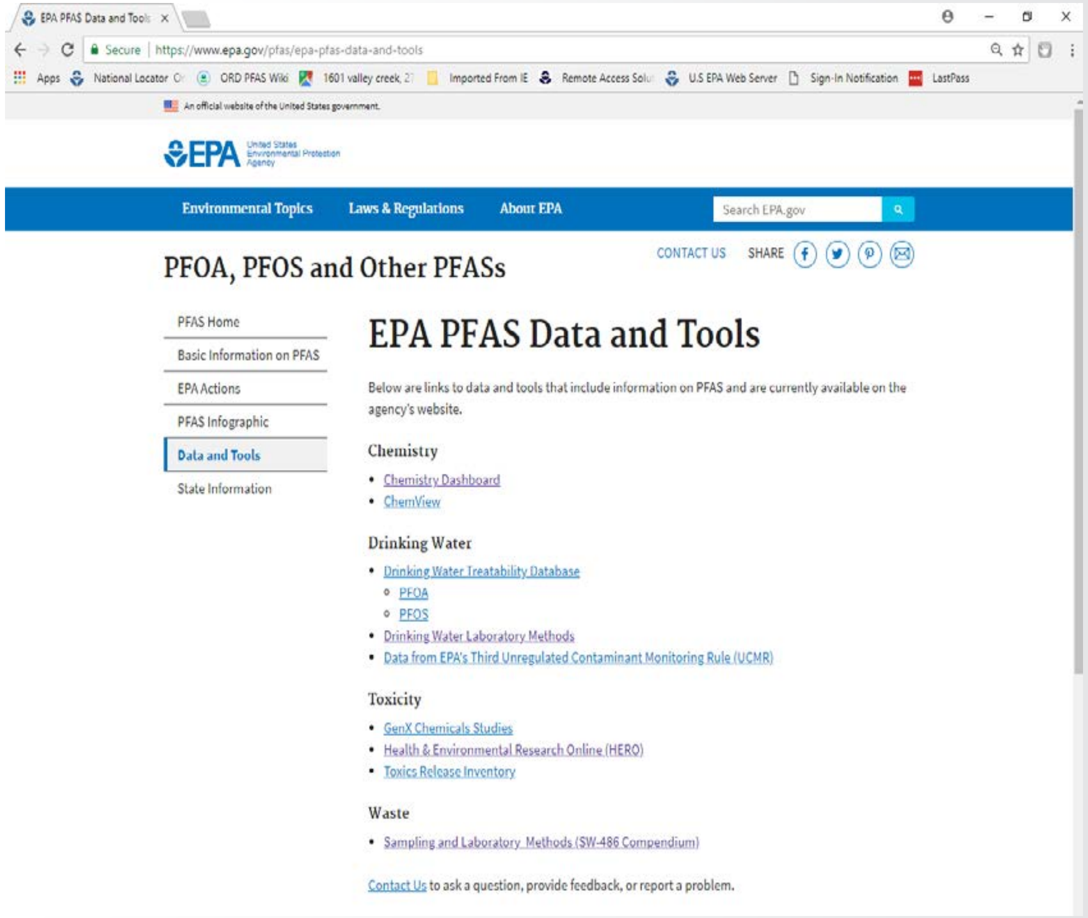
Treatment

Containment

EPA PFAS Data and Tools

Links to data and tools that include information related to PFAS and are available on EPA's website:

https://www.epa.gov/pfas/epa-pfas-data-and-tools



Interstate Technology Regulatory Council (ITRC)

Outstanding set of PFAS overview primers on variety of topics – naming conventions, history and use, regulations, fate and transport, remediation, etc. (English and Spanish)

https://pfas-1.itrcweb.org/

For More Information

Andrew Gillespie, PhD
Associate Director,
National Exposure Research Laboratory
ORD Executive Lead for PFAS R&D

US EPA Office of Research and Development

gillespie.andrew@epa.gov
919.541.3655

Marc A. Mills, PhD
National Risk Management Research Laboratory

US EPA Office of Research and Development

mills.marc@epa.gov
513.569.7322

PFAS 101: Mary Mindrup, Chief of the Drinking Water Management Branch, EPA Region 7

EPA Region 7- Leavenworth, Kansas
September 5, 2018

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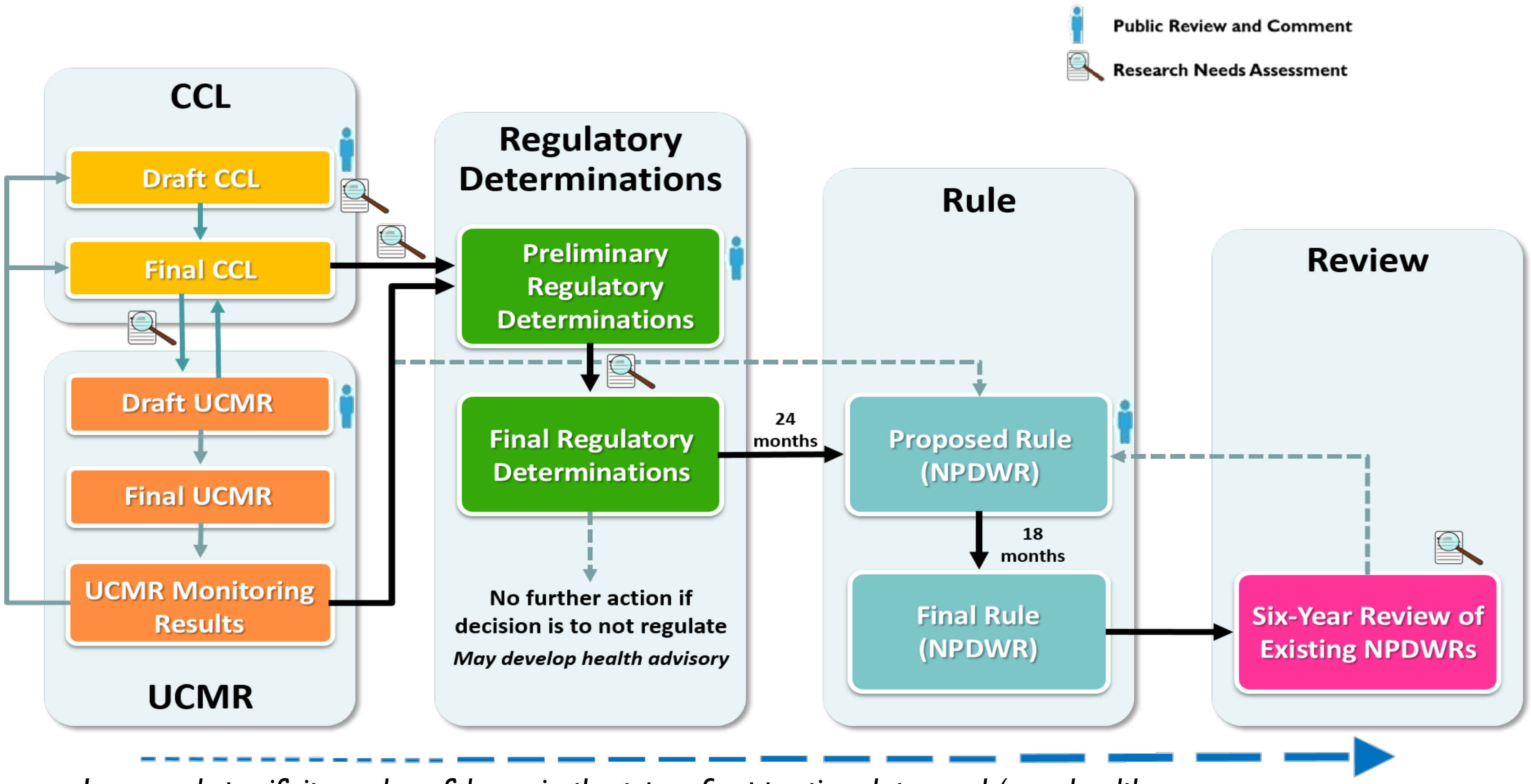
General Flow of SDWA Regulatory Processes



Increased specificity and confidence in the type of supporting data used (e.g. , health, occurrence, treatment) is needed at each stage.

Public Water Systems by State with One or More UCMR3 Samples above Health Advisory for PFOA/PFOS

Stakeholder Perspectives: Dianne Barton, National Tribal Toxics Council Chair

EPA Region 7- Leavenworth, Kansas
September 5, 2018

OFFICE OF GROUND WATER AND DRINKING WATER

Leavenworth PFAS Community Engagement – 9/5/18

Unique Risks to Tribal Resources and People

Dianne Barton - National Tribal Toxics Council

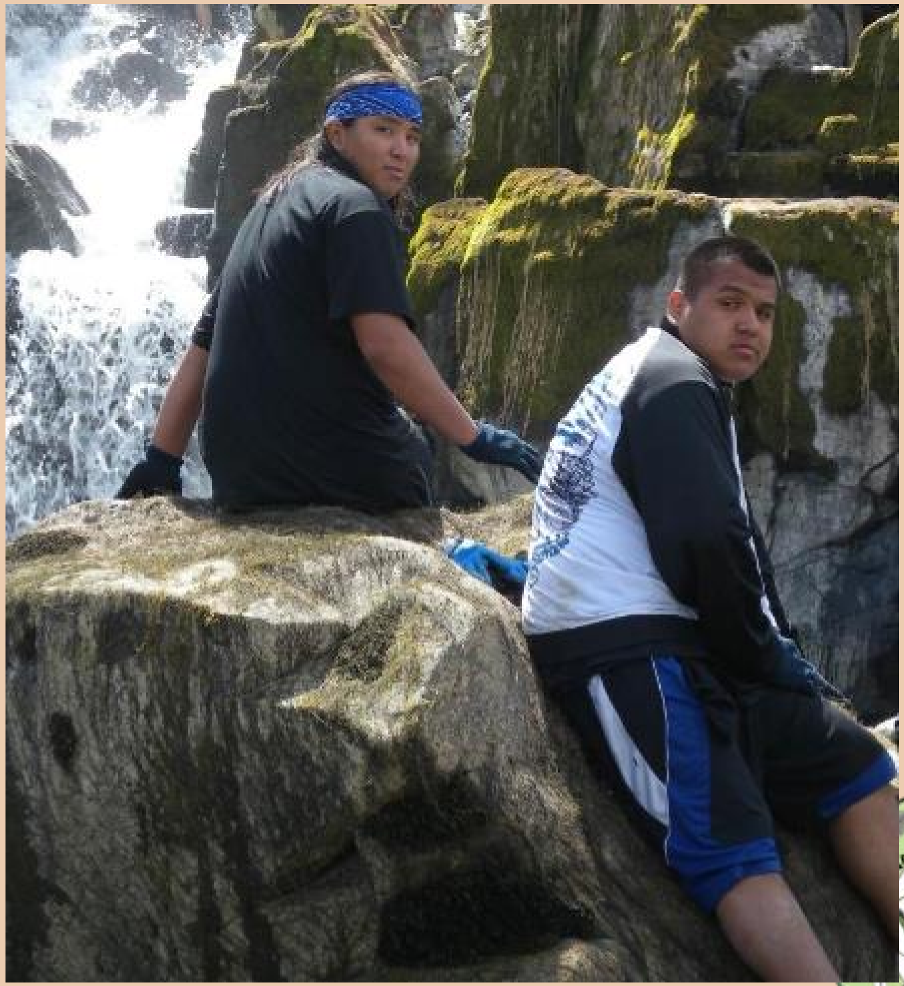
National Tribal Toxics Council

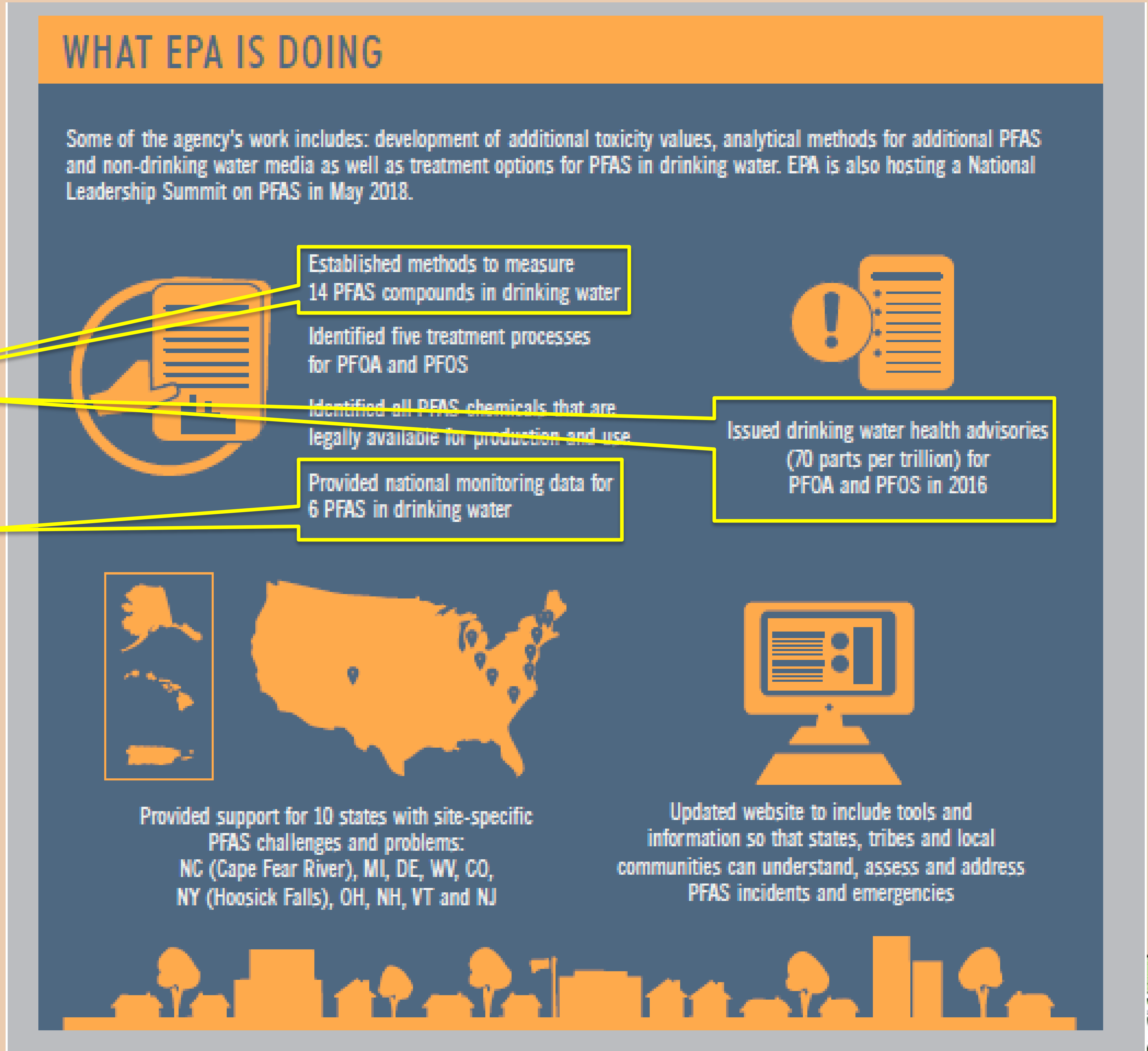
- An EPA Tribal Partnership Group started in 2012 with Office of Pollution Prevention and Toxics (OPPT).
- Advocate for tribal scenarios for Toxic Substances and Control Act (TSCA) chemical risk evaluations

NTTC Members

Concerns with Perfluorinated Compounds

- Because of our lifeways, Tribes are more impacted by environmental toxics than any other group in the U.S.
- Primary focus of efforts on PFAS are on drinking water supplies





Focus on drinking water exposures

Addressing Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA)

Maureen Sullivan

Deputy Assistant Secretary of Defense
(Environment, Safety & Occupational Health)

EPA PFAS Summit
May 2018

PFAS National Leadership Summit May 2018

- **DoD has identified 24 drinking water systems, where DoD is the water supplier, which tested above the LHA**
  - DoD is following the EPA advisory recommended actions to include taking wells off line and providing alternative drinking water
  - These actions break the exposure pathway

DoD actions "break the exposure pathway"

Groundwater Sampling

- **DoD follows a comprehensive approach to identify installations where DoD stored and/or used AFFF and suspect a release is impacting drinking water**
  - As of August 2017, DoD identified 401 active and BRAC installations in the United States with at least one area where there is a known or suspected release of PFOS/PFOA
- **DoD is following the CERCLA process to address these suspected releases**
  - First step is to identify the source(s) of a known or suspected release
  - Then identify if there is an exposure through drinking water
  - If there is exposure, DoD priority is to cut off drinking water exposure
  - Once exposure pathway is broken, the site is prioritized and will follow the CERCLA process to fully investigate the release and determine the appropriate cleanup actions based on risk
- **The DoD Components are conducting additional investigations, which include sampling groundwater**

PFAS in Plant and Animal Food Sources

JOURNAL OF FOOD AND DRUG ANALYSIS 26 (2018) 994–1004

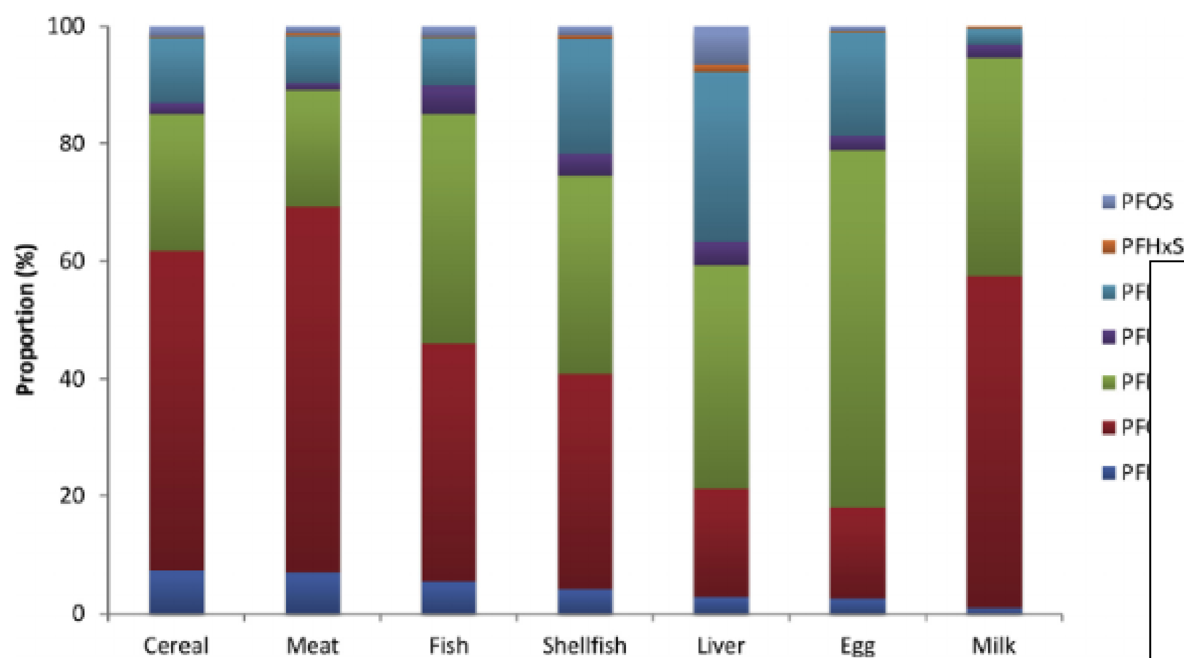


Fig. 1 — The proportion of each perfluoroalkyl substance (PFAS) by food categories. PFDA: perfluorodeca
perfluorododecanoic acid, PFHxA: perfluorohexanoic acid, PFHxS: perfluorohexane sulfonate, PFOA: perf
PFOS: perfluorooctane sulfonate, PFUnDA: perfluoroundecanoic acid.

Chen et al., 2018, Concentrations of perfluoroalkyl substances in foods and the dietary exposure among Taiwan general population and pregnant women

efsa European Food Safety Authority

Perfluoroalkylated substances in food

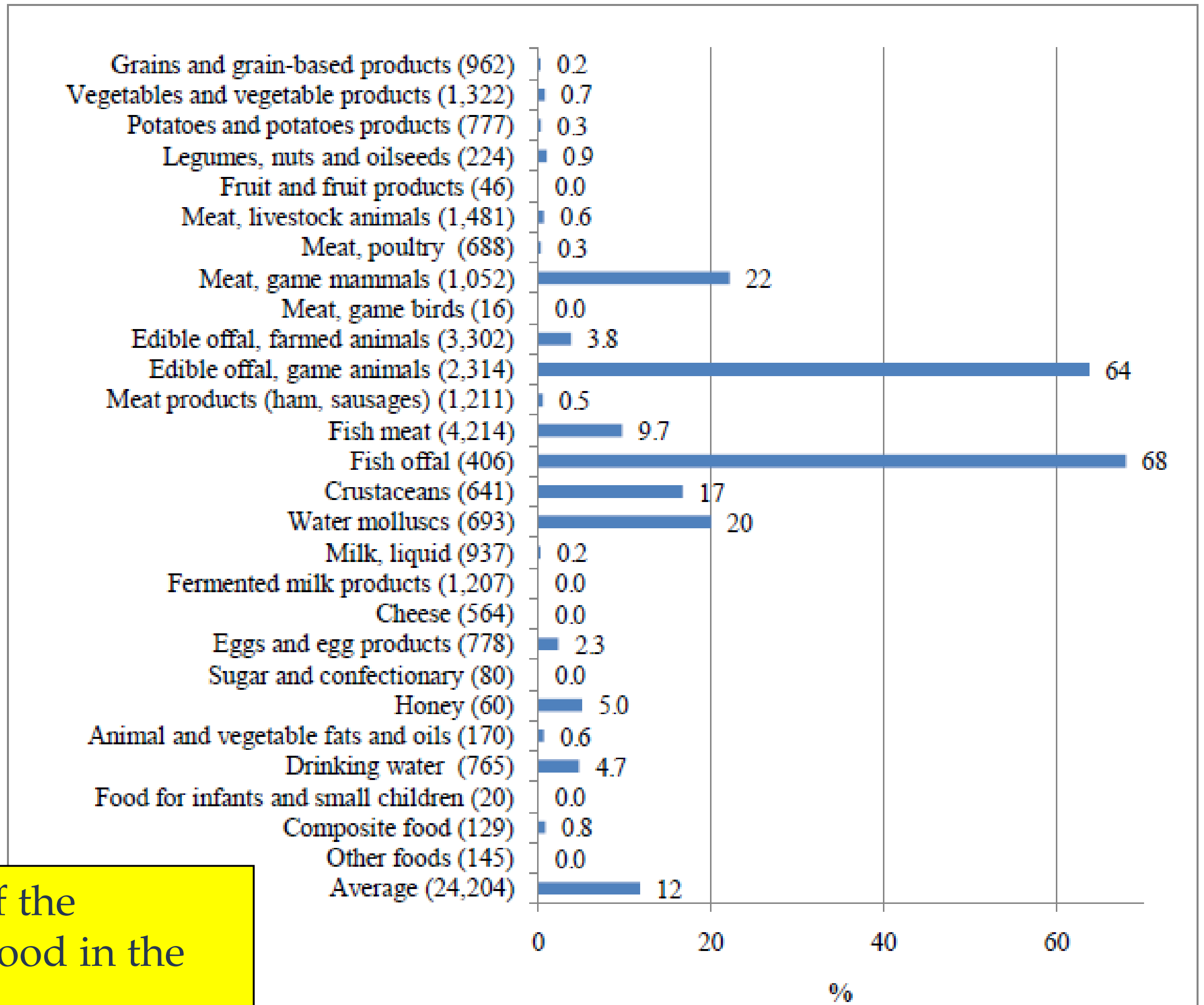


Figure 7: Frequency of results above the LOD or LOQ for the individual PFASs across food groups (n = 24,240).

European Food Safety Authority, 2016, Results of the monitoring of perfluoroalkylated substances in food in the period 2000 - 2009

PFAS Concentration in Freshwater Fish Fillet – Washington Ecology

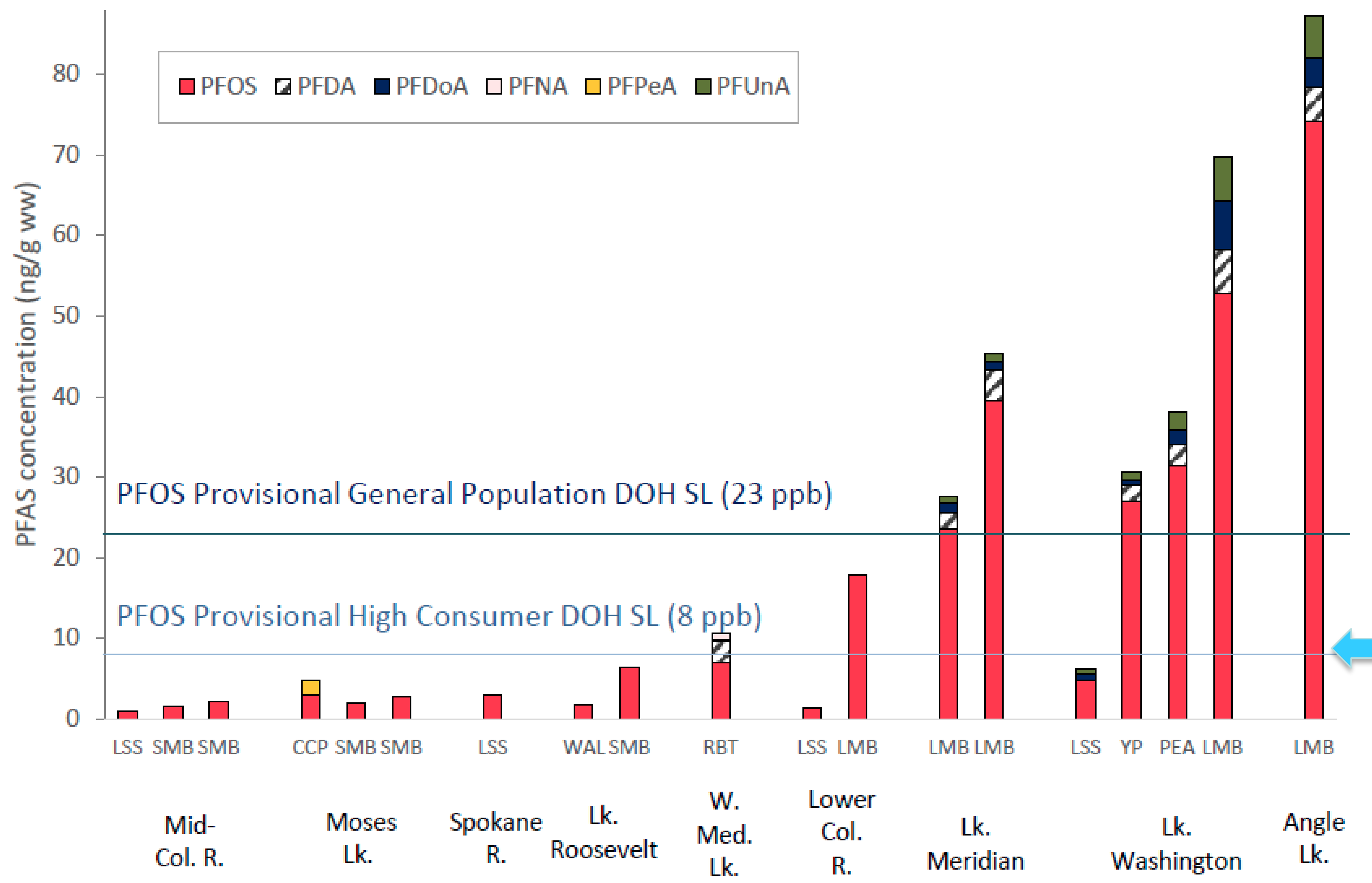


Figure 4. PFAS Concentrations of Freshwater Fish Fillet Samples by Site (ng/g ww).

Results below quantitation limits were excluded from figure.
DOH SL = Department of Health Screening Level (applies to PFOS only).
LSS = largescale sucker; SMB = smallmouth bass; CCP = common carp; WAL = walleye; RBT = rainbow trout; LMB = largemouth bass; YP = yellow perch; PEA = peamouth.

Tribal Consumption
175 grams/day

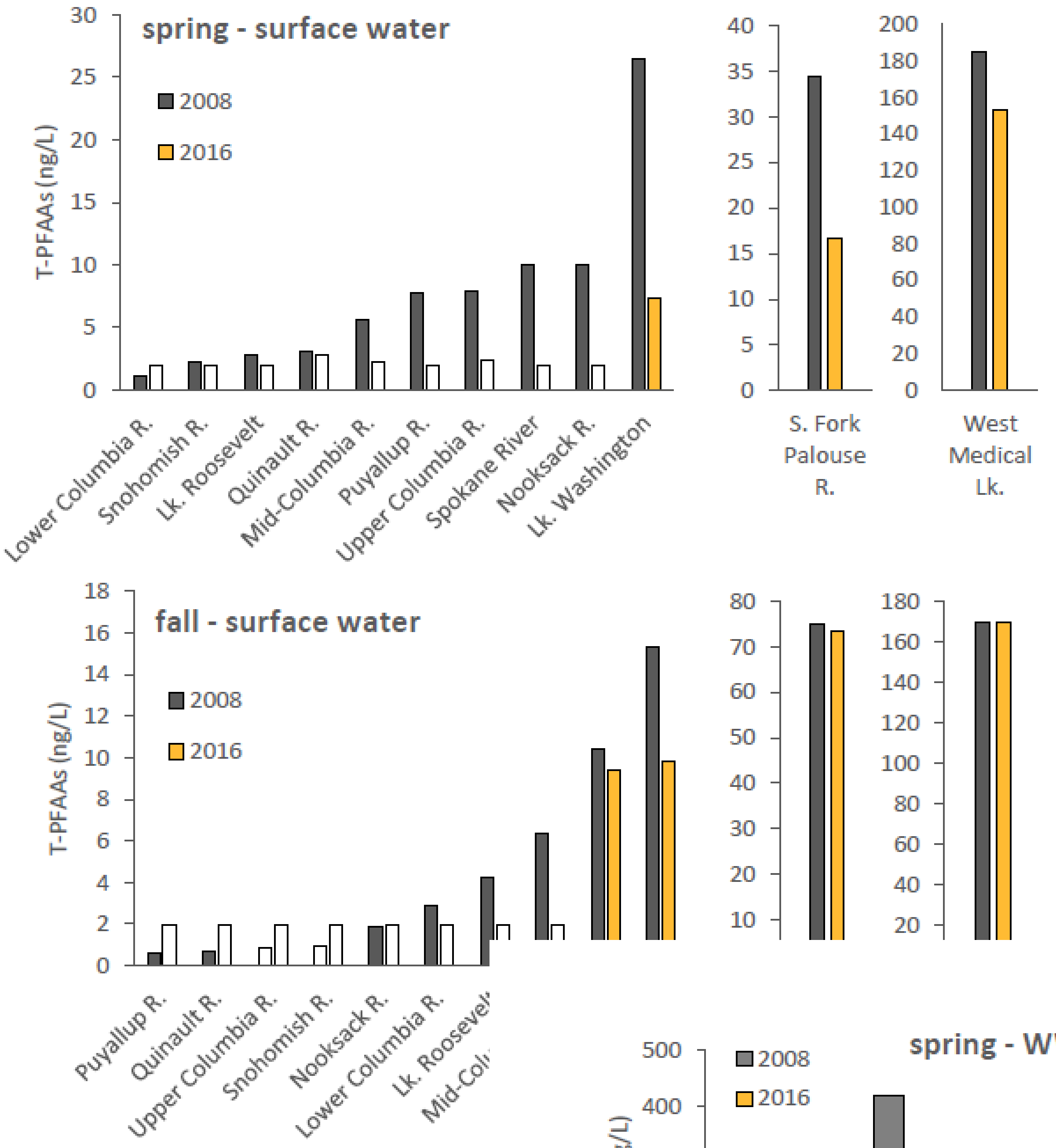


Figure 7. T-PFAAs Concentratic
(yellow bars).

White bars indicate PFASs were not
Note the different Y axes for South F

Washington Ecology monitoring results show decreases between 2008-2016 in WWTP and surface waters

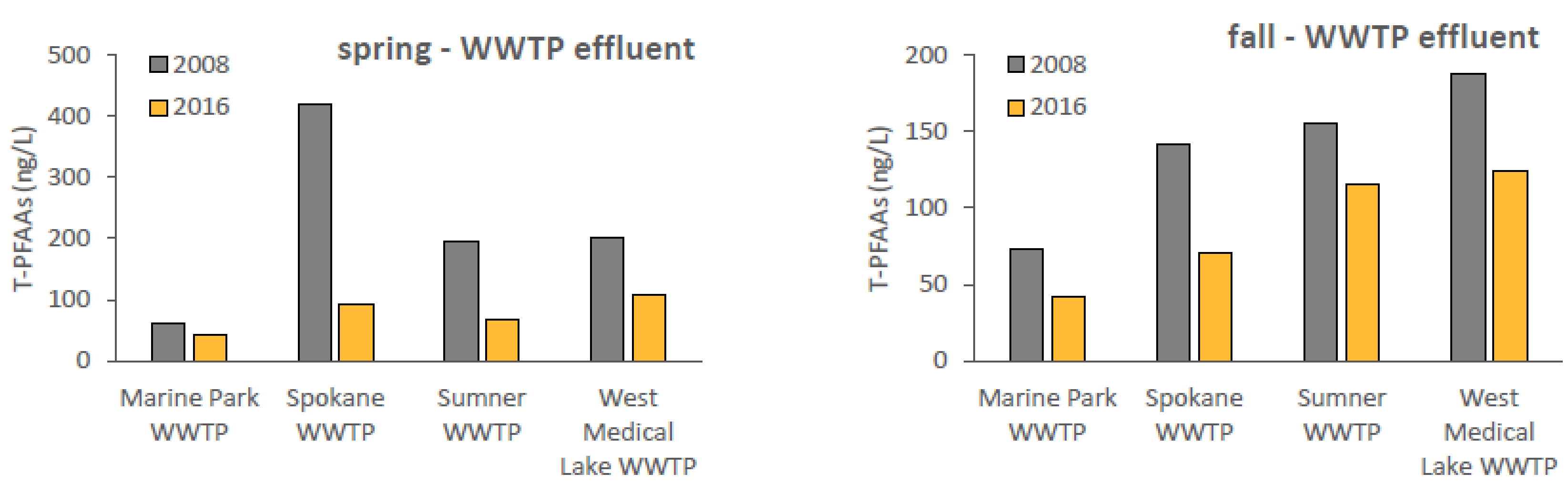


Figure 8. T-PFAA Concentrations in WWTP Effluent Collected in 2008 (grey bars) and 2016 (orange bars).

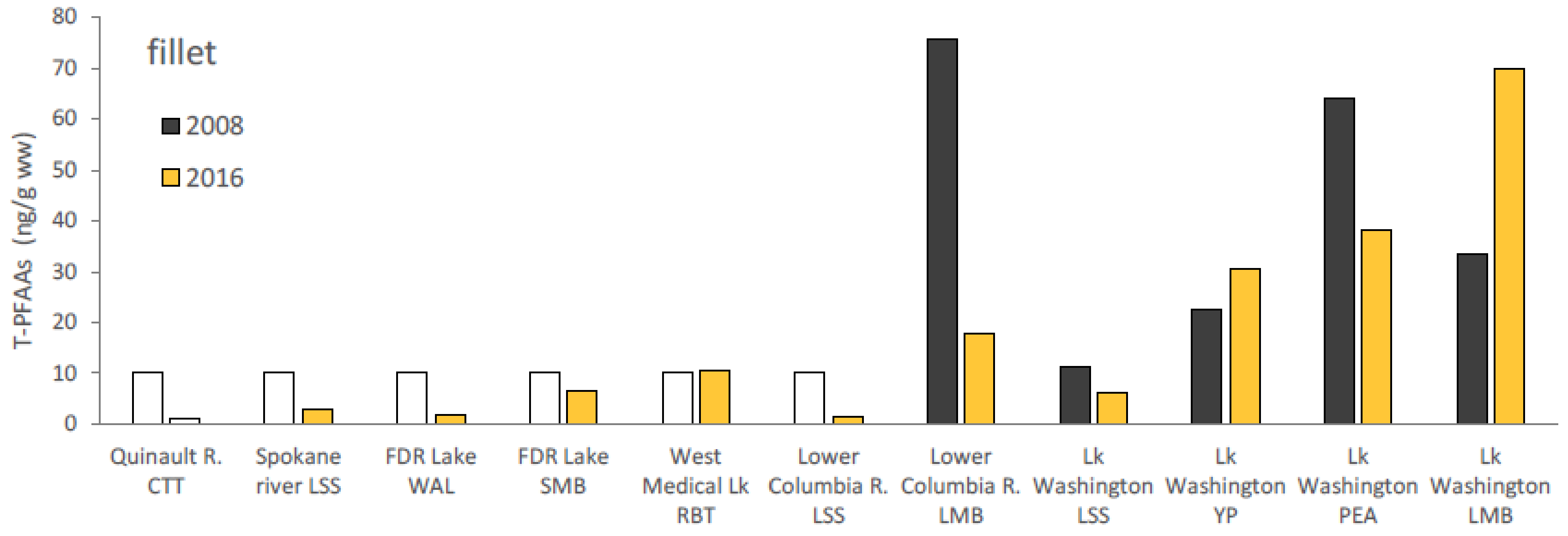


Figure 10. T-PFAA Concentrations in Freshwater Fish Fillet Tissue Collected in 2008 (grey bars) and 2016 (yellow bars).

White bars indicate PFASs were not detected at that concentration.

Washington Ecology monitoring results indicate that PFAS concentrations can persist in fish tissue and top level predators

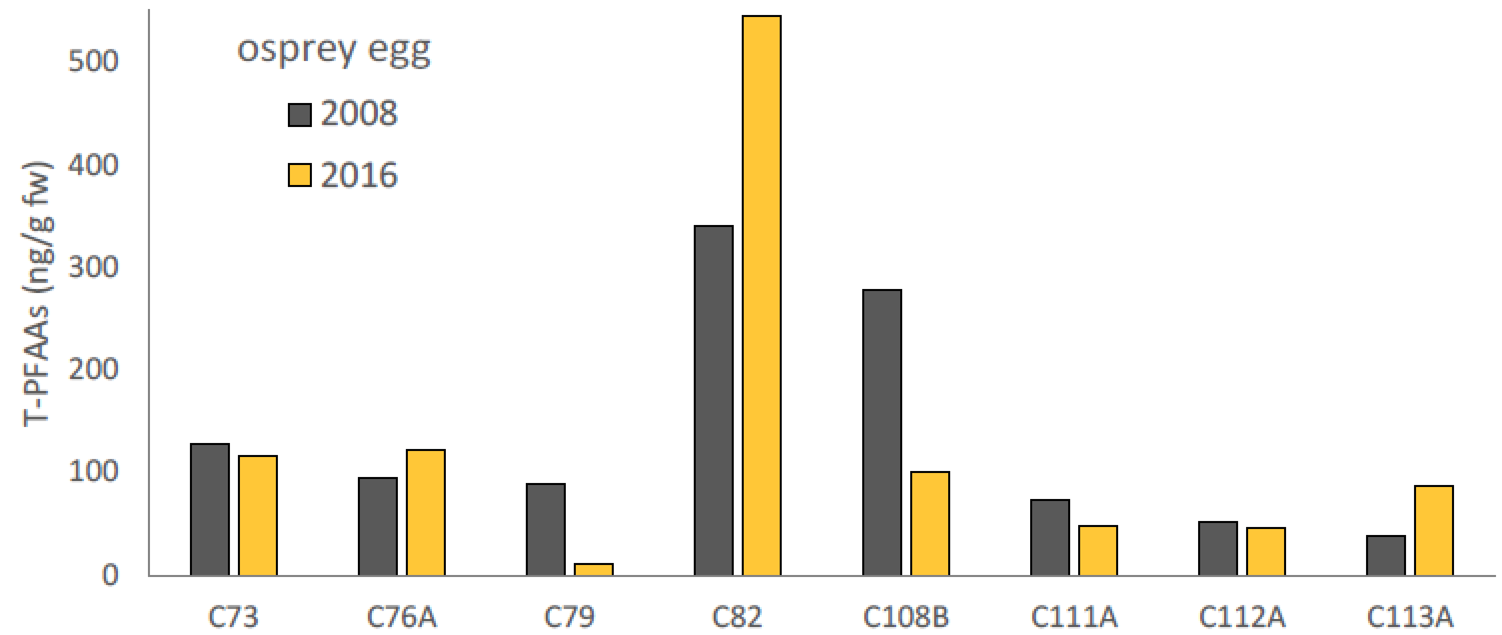
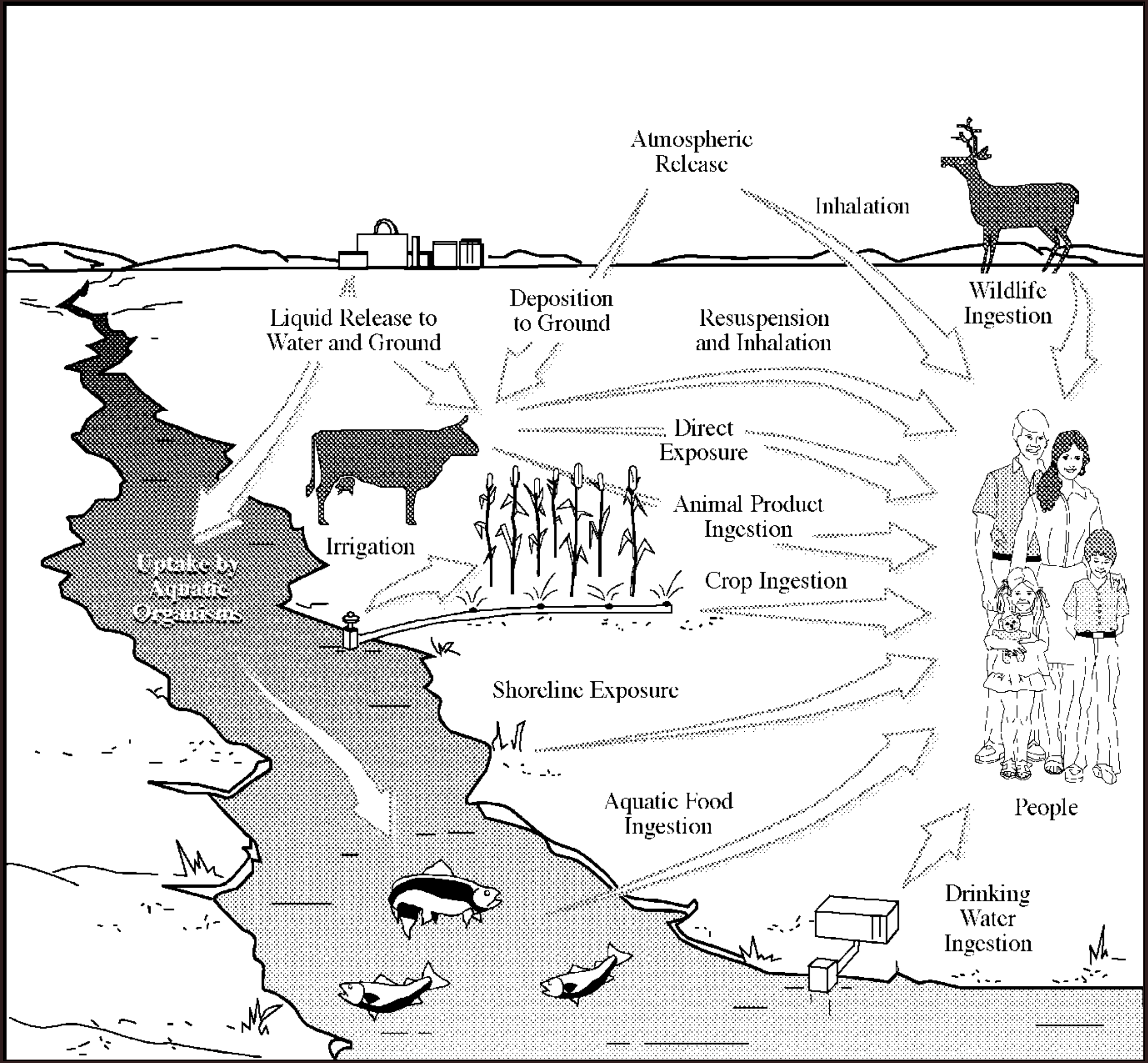


Figure 12. T-PFAA Concentrations in Osprey Eggs Collected from the Lower Columbia River in 2008 (grey bars) and 2016 (yellow bars).

Typical Conceptual Model of Exposure to Conaminants in the Environment



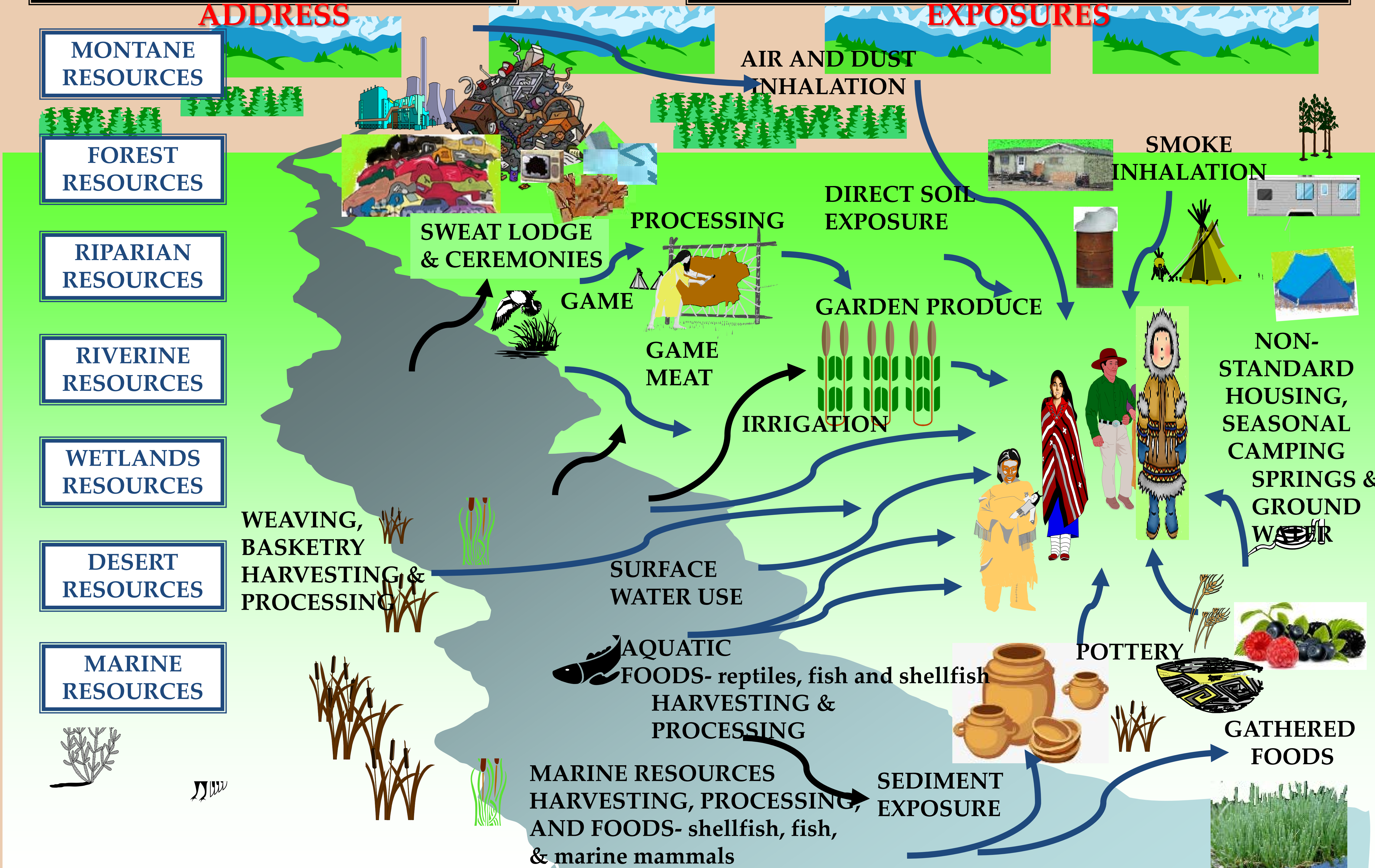
Looks Outdoorsy

Actually Suburban/ Recreational Exposures

Harris & Harper

RESOURCES VARIED AND NOT LINKED TO HOME ADDRESS

CULTURAL ACTIVITIES MAY INCREASE BOTH DIRECT AND INDIRECT EXPOSURES



Harper & Harris 2006 (with modifications by NTTC 2018)

Understanding Tribal Exposure to Toxics


June 2015

Understanding Tribal Exposures to Toxics

Clockwise from top left: Weaving and Maple Bark Workshops - Karuk and Yurok Tribes; Fish Processing - Yurok Tribe; Tulle Harvesting; Fish Processing - Bad River Band of Lake Superior; Clam Harvesting - Coeur d'Alene Tribe; Duckabush Clam Harvest - Port Gamble S'Klallam; Clam Harvesting - Lower Elwha Tribe; Cedar Bark Harvesting - Lower Elwha Tribe

This Report has been developed under the direction of the National Tribal Toxics Council as a first step to identifying the state of toxics affecting tribes.

To provide feedback to NTTC, contact us at www.tribaltoxics.org

Federal Trust Responsibility

The US Environmental Protection Agency (EPA) is responsible, in concert with Tribes, for ensuring that federal environmental laws are carried out on Tribal lands and that the Tribal government is not degraded. In November 1984, the EPA published its agency policy for the development and implementation of tribal environmental protection programs. The EPA Indian Policy provides the guidance necessary for the administration of environmental protection on Indian lands. This Policy was reaffirmed in the current administration by then-EPA Administrator Lisa Jackson in 2009 and is consistent with President Obama's Executive Order on Government-to-Government relationships when working to "protect the land, air, and water in Indian country."

- Delivered to EPA Administrators in 2015 and 2018.
- Requests that EPA institutionalize a process to consider tribal exposure in risk assessments
- Tribes are a sensitive subpopulation for environmental exposures

www.tribaltoxics.org

Cultural Practices for Harvesting Food Resources



- Net Pulling
- Fish Processing

Continued Close Relationship to the Environment

- Harvesting Wapato, Acorns, Clams, Nettles

Coeur d'Alene Tribe

Yurok Tribe

- Sand-bar Willow Harvesting

- Tule Harvesting

- Roots and Berries

- Weaving Plants and Bark

- Multi-generational cultural practices

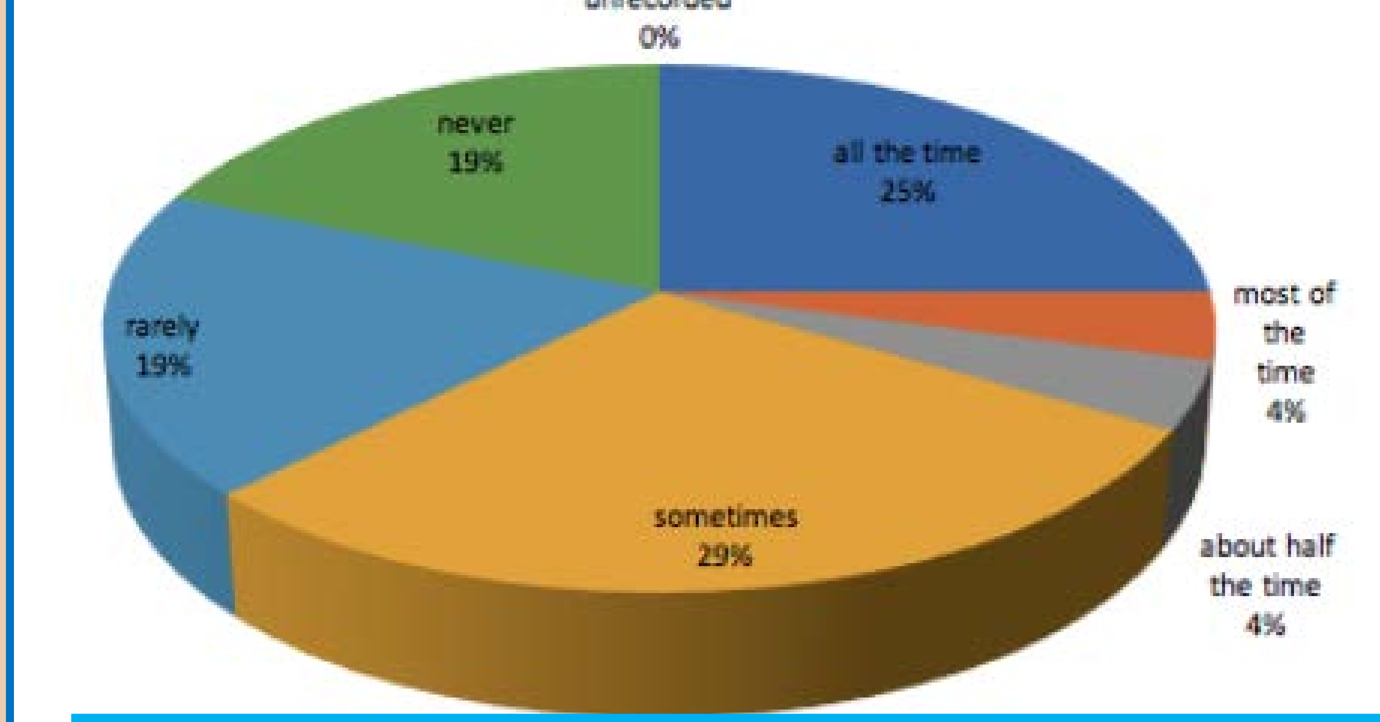
Growing up S'Klallam

Surveys Document Higher than Average Consumption of Fish by Tribal People

"The rates of tribal members consumption across gender, age groups, persons who live on versus off-reservation, fish consumers only, seasons, nursing mothers, fishers, and non-fishers range from 6 to 11 times higher than the national estimate used by USEPA."

(quote from CRITFC, 1994)

Solid Waste Disposal Issues



Burning Waste at Class III Landfills

March 2017

d Burn Unit

constructed out of local materials. Important design aspects that need e ease of emptying the ash and size of unit based on population its should include spark arrestors, provide good air flow, and keep ed during the burn. Locally-constructed burn units are generally hercially made units; however, they have a much lower life

tructed Burn Box

Burn Box constructed from an Old Fuel Tank

All the chemicals in the smoke!

21

Table 9
Emissions from barrel burning of household waste (mg/kg material burned)

Class	Compound	Emissions
VOCs (1)	1,3-Butadiene	141.25
	2-Butanone	38.75
	Benzene	979.75
	Chloromethane	163.25
	Ethylbenzene	181.75
	m,p-Xylene	21.75
	Methylenechloride	17.00
	o-Xylene	16.25
	Styrene	527.50
	Toluene	372.00
SVOCs (1)	2,4,6-Trichlorophenol	0.19
	2,4-Dichlorophenol[a]	0.24
	2,4-Dimethylphenol[a]	17.58
	2,6-Dichlorophenol[a]	0.04
	2-Chlorophenol[a]	0.95
	2-Methylnaphthalene[a]	8.53
	2-Cresol	24.59

Table 9 (*continued*)

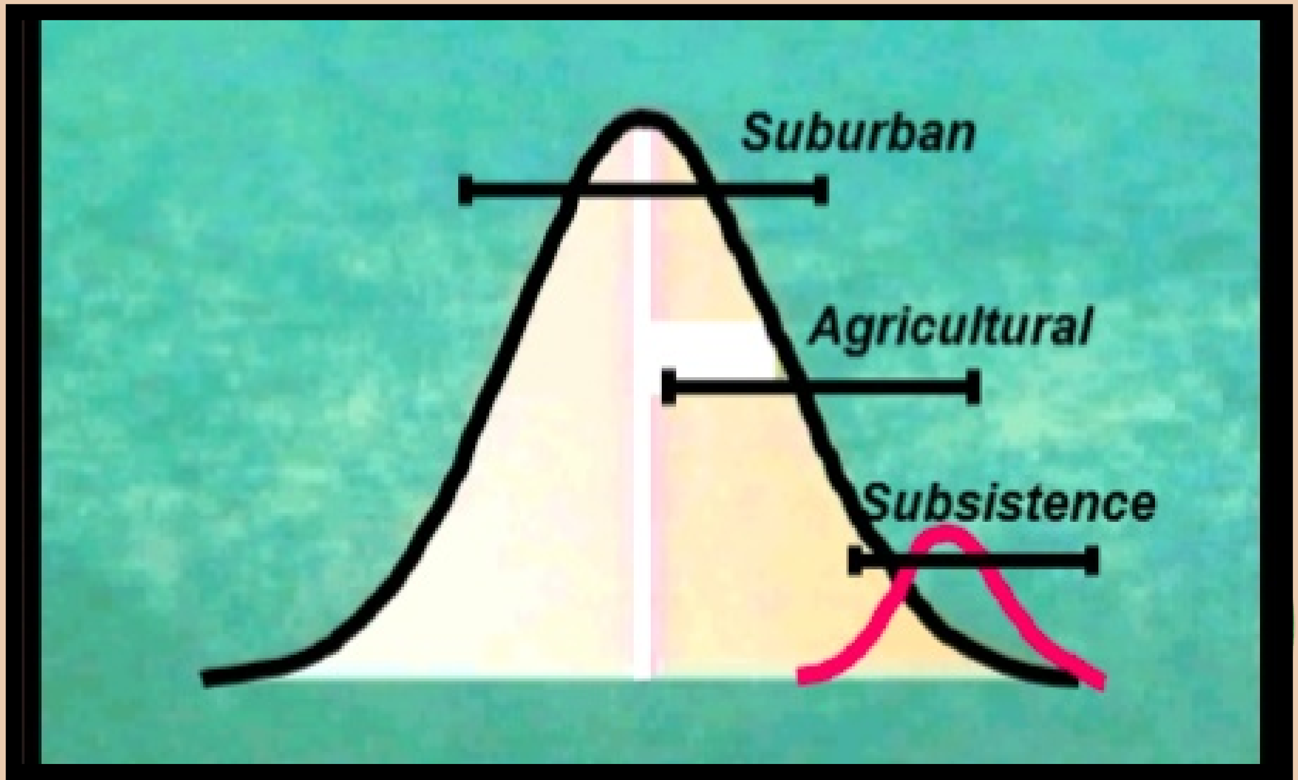
Class	Compound	Emissions
	Phenanthrene	5.33
	Pyrene	3.18
Carbonyls (1)	Acetaldehyde	428.40
	Acetone[a]	253.75
	Acrolein	26.65
	Benzaldehyde	152.03
	Butyraldehyde[a]	1.80
	Crotonaldehyde[a]	33.53
	Formaldehyde	443.65
	Isovaleraldehyde[a]	10.20
	p-Tolualdehyde[a]	5.85
	Propionaldehyde	112.60
PCDDs/Fs and PCBs (2)	Total PCDDs/Fs	5.80×10^{-3}
	TEQ PCDDs/Fs	7.68×10^{-5}
	Total PCBs	1.26×10^{-1}
	TEQ PCBs	1.34×10^{-6}

Source. (1) Ref. [34]. (2) Ref. [37].
[a] Compound of interest not on HAP list.

Indian Country & Existing Health Disparities

High-End of General Population Exposure is not Protective of a Sensitive Subpopulation

- 2010 Exposure Assessment of PBDE
  - "**unusually high exposures at the high end of the general population**" – susceptible sub-population
  - 95th percentile 291 ng/g versus mean 31 ng/g in adults – "**even the highest dust concentrations might not be able to explain**"
  - "**suggests the possibility that there are other exposures not identified in this assessment**"



Tribal lifestyles are not just the extreme tail of a general population exposure range

State Fish Consumption Advisories for PFAS

JULY 20, 2018 | 01:31 PM
UPDATED: JULY 21, 2018 | 8:41 AM

New Jersey issues first advisories for consumption of fish containing PFAS chemicals

State scientists recommend health limits for 12 species

Jon Hurdle

Members of the Lewis Fishery family count and identify fish that were caught in a seine fishing net during the Shad Festival in Lambertville, N.J., Sunday, April 30, 2006. New Jersey Department of Environmental Protection has issued its first PFAS related fish advisories. The family of chemicals is linked to some cancers.

Fish advisories issued for Michigan lakes, river impacted by PFAS contamination

Updated Mar 16, 2018; Posted Mar 15, 2018

Exposure Assessments

Exposure to polybrominated diphenyl ethers and perfluoroalkyl substances in a remote population of Alaska Natives☆

CrossMark

Samuel Byrne [a,*], Samarys Seguinot-Medina [b], Pamela Miller [b], Vi Waghiyi [b], Frank A. von Hippel [c], C. Loren Buck [c], David O. Carpenter [d]

[a] *Department of Environmental Studies, 104 Memorial Hall, St. Lawrence University, Canton, NY 13617, USA*
[b] *Alaska Community Action on Toxics, Anchorage, AK 99503, USA*
[c] *Department of Biological Sciences and Center for Bioengineering Innovation, Northern Arizona University, Flagstaff, AZ 86011, USA*
[d] *Institute for Health and the Environment, University at Albany, Albany, NY 12144, USA*

A R T I C L E I N F O

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A B S T R A C T

Background: Many Alaska Native communities rely on a traditional marine diet that contains persistent organic pollutants (POPs). The indoor environment is also a source of POPs. Polybrominated diphenyl ethers (PBDEs) and perfluoroalkyl substances (PFASs) are present both in the traditional diet and the home indoor environment.
Objectives: We assessed exposure to PBDEs and PFASs among residents of two remote Alaska Native

There is a need for exposure assessments of PFAS that specifically considers tribal lifeways and resources in order to protect all sensitive subpopulations


RESOURCES VARIED AND NOT LINKED TO HOME ADDRESS
CULTURAL ACTIVITIES MAY INCREASE BOTH DIRECT AND INDIRECT EXPOSURES
MONTANE RESOURCES
FOREST RESOURCES
RIPARIAN RESOURCES
RIVERINE RESOURCES
WETLANDS RESOURCES
DESERT RESOURCES
MARINE RESOURCES
AIR AND DUST INHALATION
SMOKE INHALATION
DIRECT SOIL EXPOSURE
PROCESSING
SWEAT LODGE & CEREMONIES
GAME
GARDEN PRODUCE
GAME MEAT
IRRIGATION
NON-STANDARD HOUSING, SEASONAL CAMPING
SPRINGS & GROUND WATER
WEAVING, BASKETRY HARVESTING & PROCESSING
SURFACE WATER USE
AQUATIC FOODS- reptiles, fish and shellfish HARVESTING & PROCESSING
POTTERY
GATHERED FOODS
MARINE RESOURCES HARVESTING, PROCESSING AND FOODS- shellfish, fish, & marine mammals
SEDIMENT EXPOSURE
Harper & Harris 2006 (with modifications by NTTC 2018)

Stakeholder Perspectives: Dr. Bill Cibulas, *Acting Director, Division of Toxicology and Human Health Sciences, Agency for Toxic Substances and Disease Registry*

EPA Region 7- Leavenworth, Kansas
September 5, 2018

OFFICE OF GROUND WATER
AND DRINKING WATER

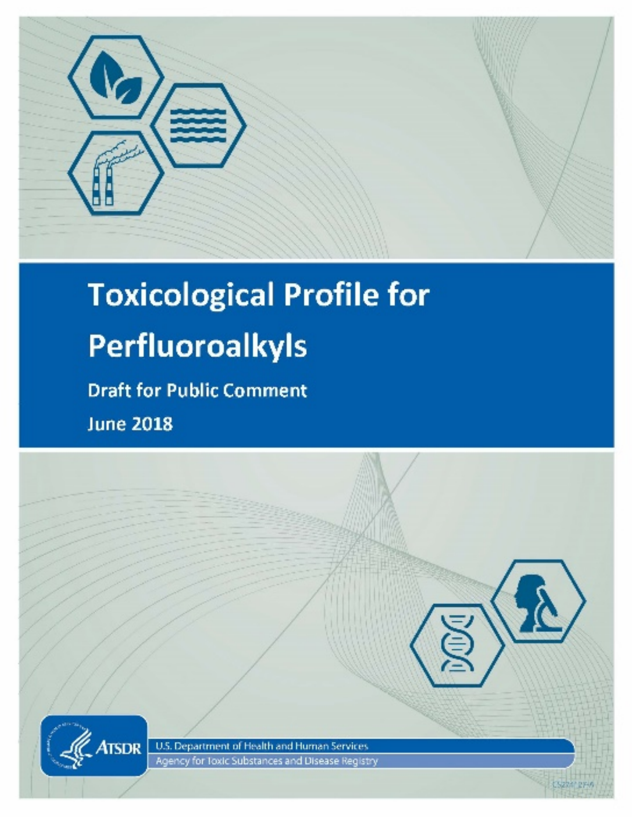
ATSDR National PFAS Activities

September 5, 2018

Bill Cibulas, PHD, MS
Acting Director
Division of Toxicology and Human Health Sciences

Perfluoroalkyls Toxicological Profile (ToxProfile)

- **Released for public comment on June 20, 2018**
  - Considered draft until finalized following public comment period
- **What's new in this ToxProfile**
  - Updates minimal risk level values for PFOA and PFOS
  - Sets new minimal risk level values for PFHxS and PFNA
- **Minimal risk level values**
  - Estimate of the amount of a chemical a person can eat, drink, breathe each day without detectable risk to health
  - Developed for health effects other than cancer
  - Derived for different exposure periods: acute, intermediate, and chronic
  - Used as screening tool to help identify exposures that could be potentially hazardous to human health



New Opportunities

- **2018 National Defense Authorization Act & 2018 Omnibus Appropriations**
  - Statistically-based PFAS biomonitoring exposure assessments (EAs) at no less than 8 current or former DOD sites (short term – completed within two years)
    - 10 million dollars for FY2018
    - EAs will include measurement of PFAS in serum and urine, as well as limited environmental (dust and tap water) sampling
  - Multi-site PFAS health study (long term – completed over next 5-7 years)
    - 10 million dollars anticipated for FY2019 for this effort, with possibility of additional funds in subsequent years
    - Study design will be informed by data from PFAS EAs

Multi-Site PFAS Health Study

- **ATSDR published feasibility assessment of possible future drinking water epidemiological studies at Pease, NH in November 2017**
  - Pease International Tradeport is former Air Force base
    - In 2014, one of three wells that serve Pease showed elevated levels of PFOS
    - Level above provisional health advisory set by EPA
    - NH DHHS conducted human biomonitoring program (over 1,500 participants)
  - ATSDR reviewed epidemiological studies that evaluated health effects of PFAS exposures
  - Based on literature review and sample size calculations, report concluded that cross-sectional epidemiological studies of children and adults at only one site (e.g., Pease)
    - Feasible for some health endpoints (e.g., lipids, kidney function)
    - Insufficient sample size for other health endpoints (e.g., thyroid, liver and immune function, autoimmune diseases)
  - Highlighted need for multi-site study

Multi-Site PFAS Health Study

- **Study communities impacted by PFAS-contaminated public drinking water supply wells and/or private wells**
- **Expected sample size: 8,000 total participants**
  - 2,000 children
  - 6,000 adults
  - Based on review of scientific literature to study health outcomes of interest
- **Cross-sectional study at multiple locations with separate evaluations of children (ages 4–17) and adults (ages ≥18)**
- **Site considerations**
  - Documented past or present PFAS drinking water concentrations at the tap,
  - The magnitude of past or present PFAS concentrations at the tap,
  - Size of population exposed,
  - Amount of information available on the contaminated drinking water system or private wells, and
  - If biomonitoring for PFAS has previously occurred at the site.

Multi-Site PFAS Health Study (cont.)

Health Outcomes to be Studied					
Outcome	**Children**	**Adults**	**Outcome**	**Children**	**Adults**
Lipids	X	X	Neurobehavioral	X	
Cardiovascular	X	X	Osteoarthritis/ Osteoporosis		X
Kidney function/ Disease	X	X	Endometriosis		X
Liver function/Disease	X	X	Immune function	X	X
Thyroid	X	X	Vaccine response	X	
Sex hormones/ maturation	X		Autoimmune disease		X

Multi-Site PFAS Health Study (cont.)

- **Biomarkers to be studied**
  - Total cholesterol, low density lipoprotein, high density lipoprotein, total triglycerides
  - Uric acid, creatinine
  - Thyroxine (T4), T3, thyroid stimulating hormone (TSH)
  - Glucose, insulin, glycosylated hemoglobin (HbA1c), auto-antibodies (GAD-65 and IA-2), C-peptide, pro-insulin
  - Alanine transaminase (ALT), γ-glutamyltransferase (GGT), direct bilirubin, and cytokeratin-18 (CK-18)
  - Immunoglobulin G (IgG), IgA, IgE and IgM; (C reactive protein, and antinuclear antibodies (ANA) – adults; antibodies to measles, mumps, rubella, tetanus, and diphtheria – children)
  - Testosterone, estradiol, sex hormone-binding globulin (SHBG), follicle stimulating hormone, insulin-like growth factor
  - Cytokines and adipokines (e.g., IL-1β, IL-6, IL-8, MCP-1, TNFα, leptin, adiponectin, resistin, PAI-1)

Thank you

https://www.atsdr.cdc.gov/pfas

For more information, contact NCEH/ATSDR
1-800-CDC-INFO (232-4636)
TTY: 1-888-232-6348 www.atsdr.cdc.gov www.cdc.gov
Follow us on Twitter @CDCEnvironment

Listening Session

- **EPA announced four actions the Agency will take following the Summit:**
  - EPA will initiate steps to evaluate the need for a maximum contaminant level (MCL) for PFOA and PFOS.
  - EPA is beginning the necessary steps to propose designating PFOA and PFOS as “hazardous substances” through one of the available statutory mechanisms, including potentially CERCLA Section 102.
  - EPA is currently developing groundwater cleanup recommendations for PFOA and PFOS at contaminated sites and will complete this task by fall of this year.
  - EPA is taking action in close collaboration with our federal and state partners to develop toxicity values for GenX and PFBS by this summer.