

PFAS Emerging Contaminants

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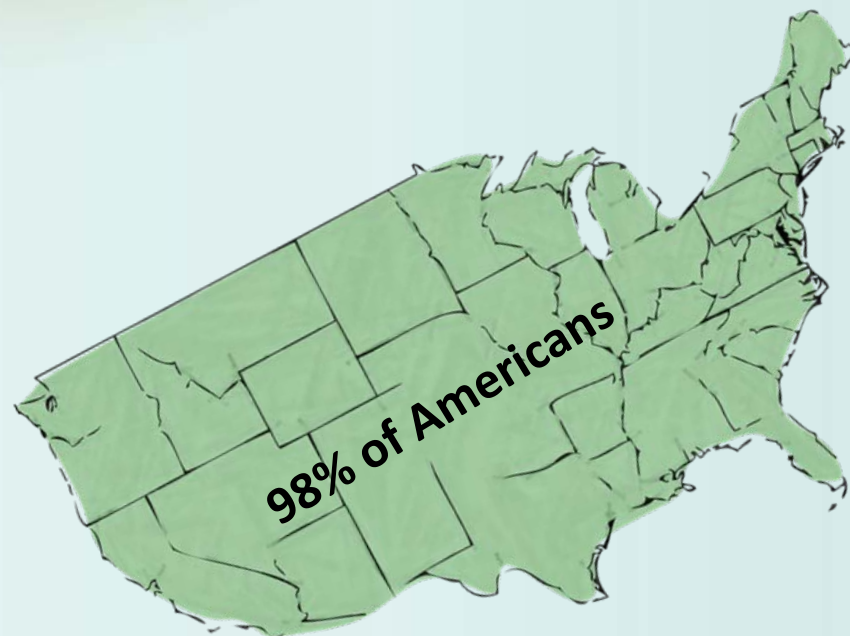
Environmental
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CONFERENCE
2018

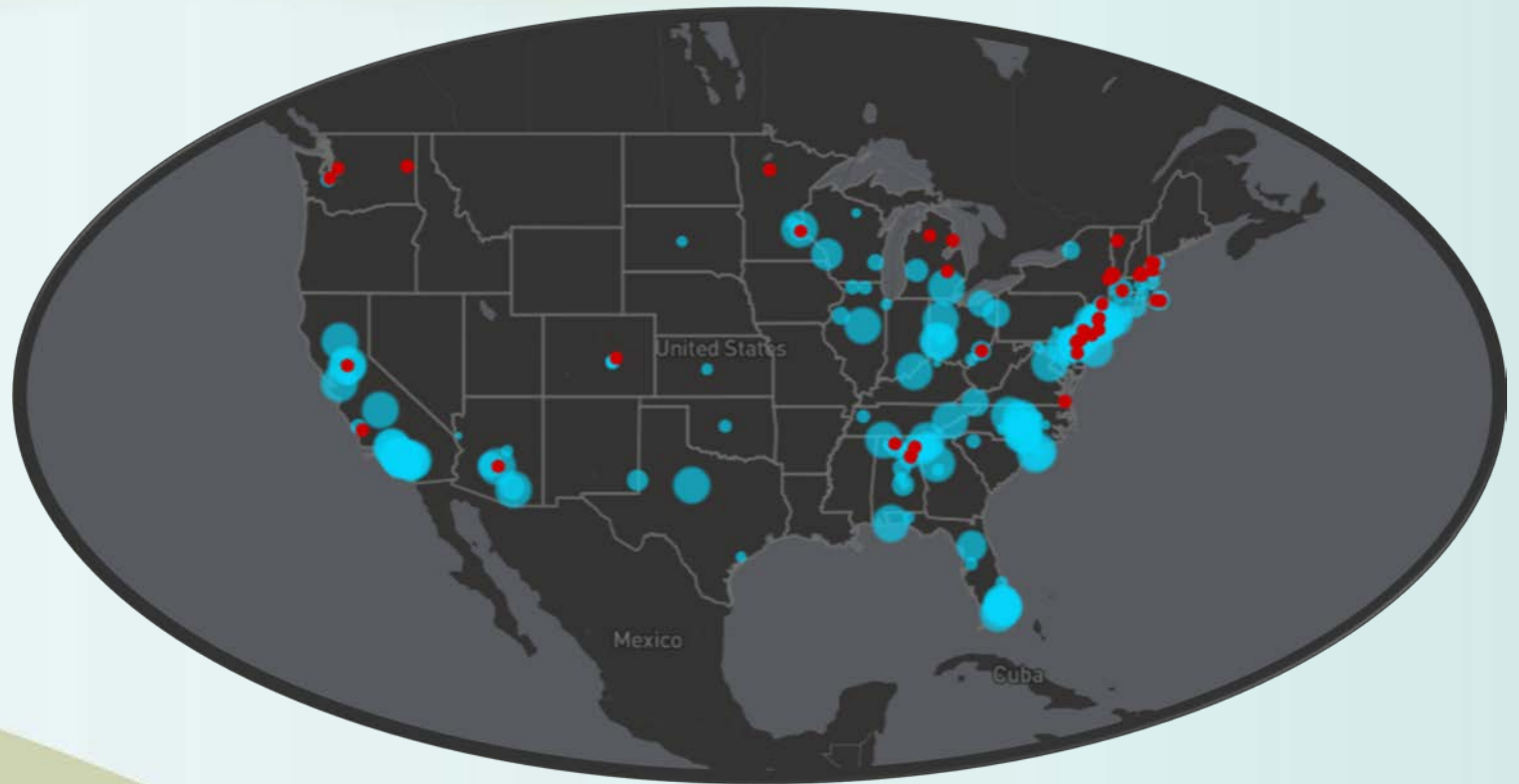
IS THE THREAT OF PFAS CONTAMINATION A REC?

Pervasive Throughout the USA

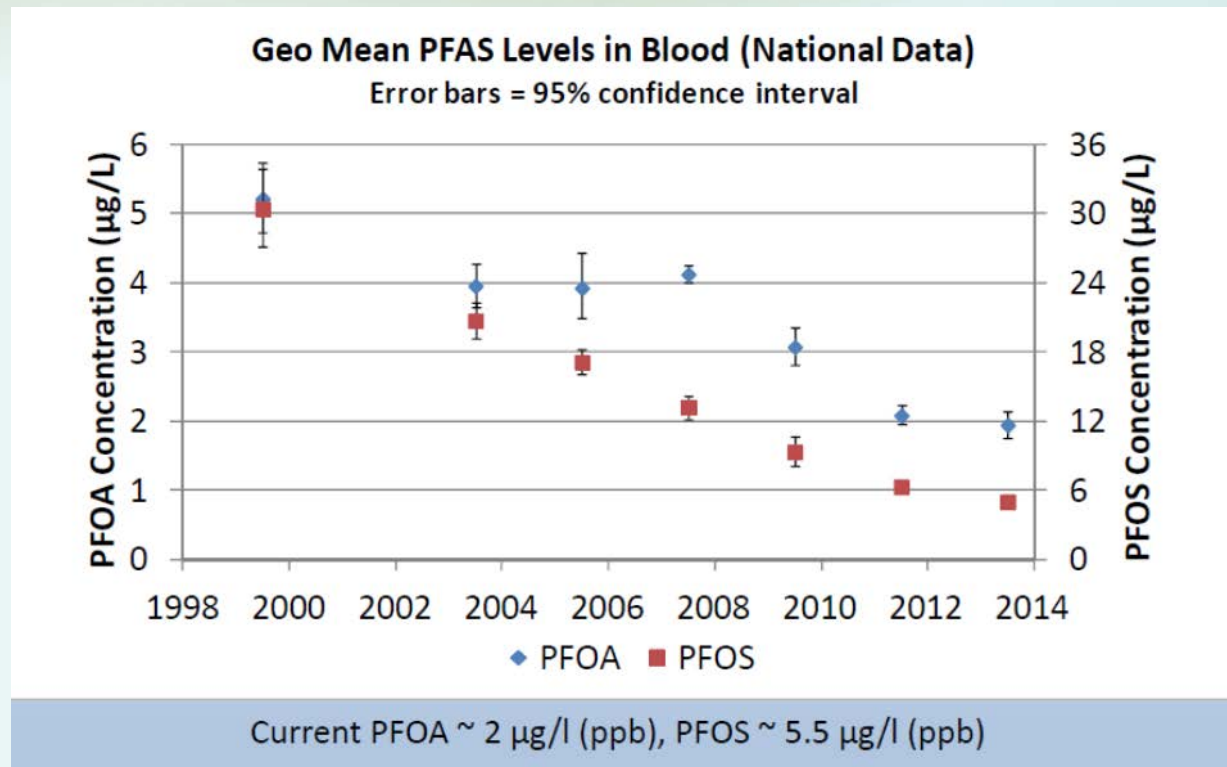
- Fire-fighting Foaming Agent
- Teflon®
- Non-stick Pans
- Gortex®
- Pizza boxes
- Scotchgard® Stainmaster®
- Water-proofing
- Fast Food and Butcher Paper
- Metal Plating Bathes
- Carpet Manufacturing



Known PFAS Contamination



PFAS Concentration in Blood



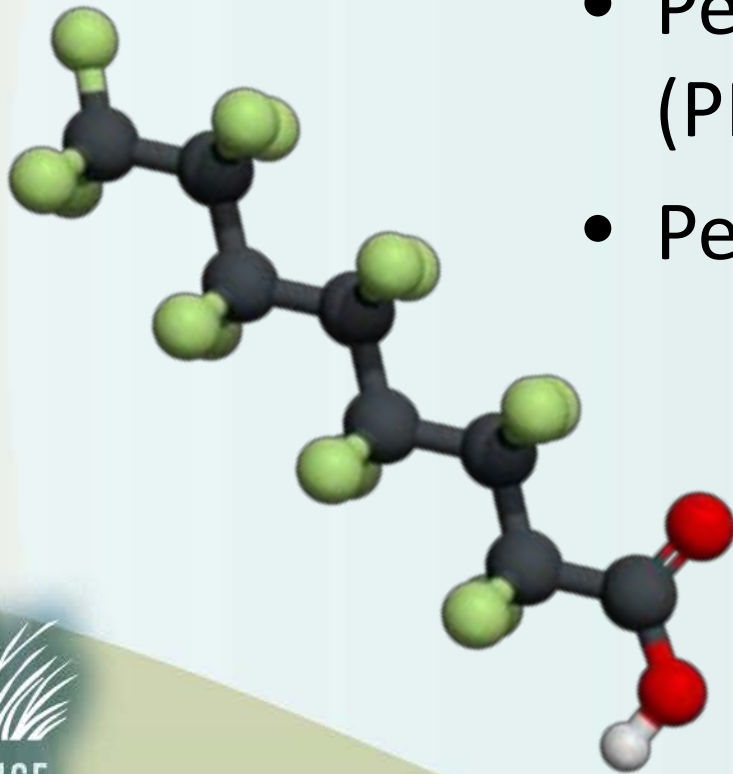
WHAT ARE PFAS?

Don't worry ! Just a little science.



Polyfluoroalkyl Substances

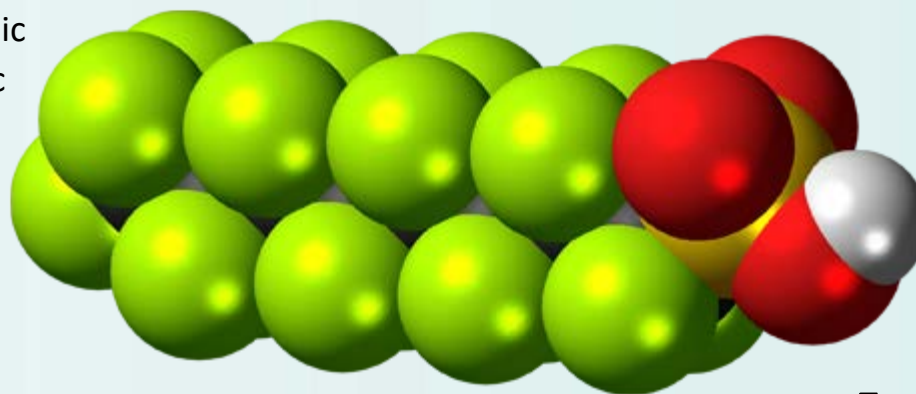
- Over 2,000 PFAS Compounds
- Perfluorooctanesulfonic acid (PFOS)
- Perfluorooctanoic acid (PFOA)



PFAS – General Chemistry

Fluorocarbon Tail

Strong Bonds
Hydrophobic
Oleophobic



Functional Group

Strong to weak acids
Hydrophilic

Difficulty in Sample Collection and Laboratory Analysis

Sample Collection

PFAS-free water

PFAS-free sample equipment

100% cotton clothing
(wash 6X no fabric softener)

Boots without water proofing

Nitrile gloves

Trip – Equipment Blanks

No Personal Care Products

Tyvek®

Laboratory Analysis

Drinking Water Method 537
Reports 14 compounds

Method 537 – modified

Acid Wash

Report Additional Compounds

ASTM Method 7979

Minnesota uses a version

SW-846 method to be released this year
and likely based on ASTM method

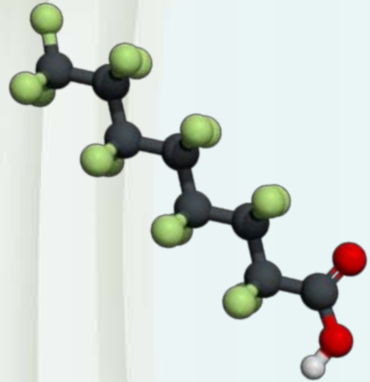
TOXICOLOGY



Animal Exposure – Lau Et al. (2006)

- Basis for the 70 ppt EPA Advisory Level
- PFOA exposure to mice
- Toxicity Endpoints
 - Neonatal eye opening
 - Neonatal body weight
 - Reduced phalangeal ossification (bone development)
 - Maternal Liver Weight

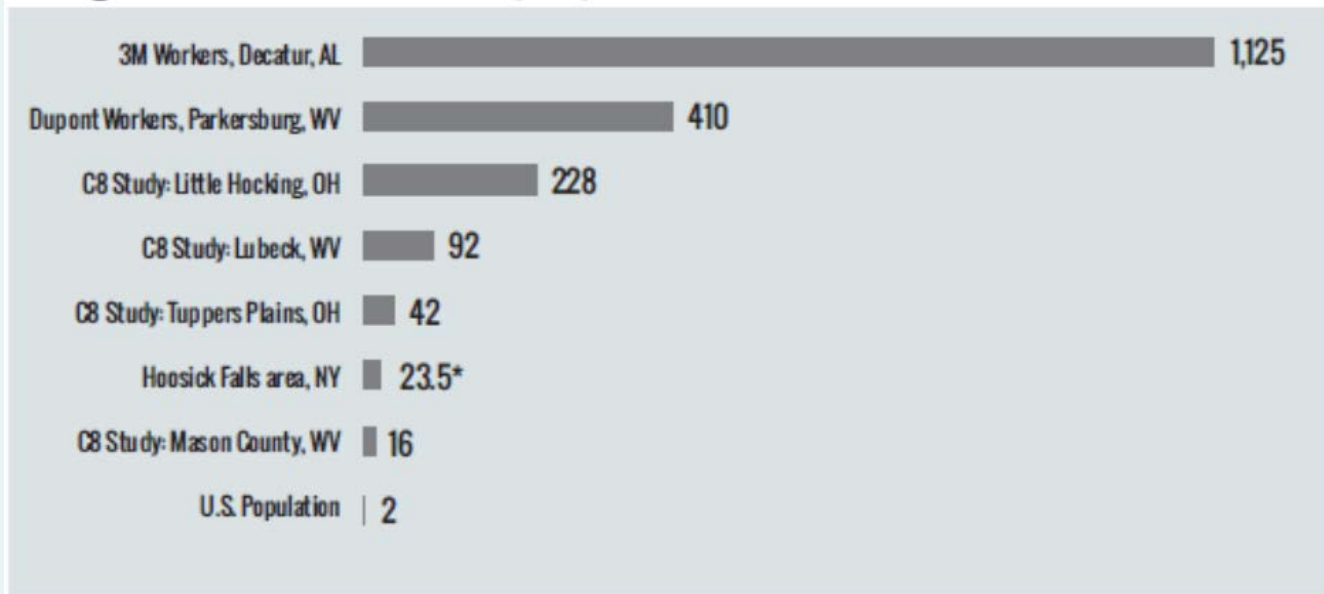
Human Exposure - C8 Science Panel



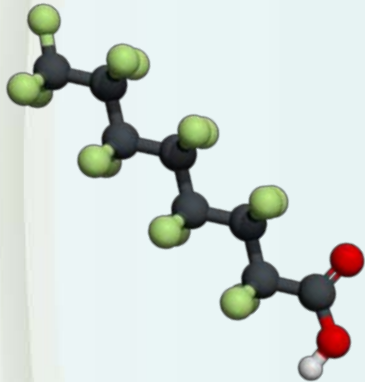
- Studied Exposure in Mid-Ohio Valley
- Releases from DuPont's Washington Works Plan
- Chosen by both DuPont and Plaintiffs for legal settlement
- Conclusions in form of "Probable Links"

PFAS Blood Levels in C8 Areas

Average PFOA Levels in Blood (Micrograms per Liter)



Human Exposure - C8 Science Panel



- High Cholesterol
- Ulcerative Colitis
- Thyroid Disease
- Testicular Cancer
- Kidney Cancer
- Pregnancy–Induced Hypertension

UNCERTAINTY



Toxicology – Key Points

- Most epidemiological (human) and animal (laboratory) studies on PFOA and PFOS
- Both PFOA and PFOS bioaccumulate in human blood.
- PFOA and PFOS persists in humans for years, but in rats and mice for only days.

ATSDR

When referring to PFOA and PFOS, “lack of consistency between effects observed in humans and those observed in laboratory animals.”



VS



Lau Study compared to C8 Panel

- Lau Toxicity Endpoints
 - Neonatal eye opening
 - Neonatal body weight
 - Reduced bone development (young)
 - Maternal Liver Weight
- C8 Panel No Probable Links
 - No Link birth defects
 - No Link low birth weight
 - No Link miscarriage - stillbirths
 - No Link osteoarthritis (aged)
 - Probable Link pregnancy-induced hypertension

CONSERVATIVE ENOUGH?

Oh no, here comes more science!



Calculation of Reference Dose

1. Lowest Effect Level (mice) is 1 mg/kg-d
2. Adjust to humans to account for longer half-life;
now 0.0053 mg/kg-d
3. Conversion from LOAEL to NOAEL – 10
Inter-species – 3
Sensitive Individuals – 10
 $10 \times 3 \times 10 = 300 = \text{Uncertainty Factor}$
4. Adjust for uncertainty factor; 0.000018 mg/kg-d

Minnesota Department of Health, Toxicology Summary for: PFOA, May 2017

USEPA Drinking Water Health Advisory for PFOA, May 2016

Calculation of Drinking Water

USEPA Equation:

$$DWEL = \left(\frac{RfD * bw}{DWI} \right) RSC$$

DWEL - Drinking Water Equivalent Level

RfD – Refence Dose

bw – Body Weight

DWI – Drinking Water Intake

RSC - Relative Source Contribution

RfD – 1.8×10^{-5} mg/kg-d (*from 1.0 mg/kg-d*)

bw – 70 kg

DWI – 2.0 l/day or 3.6 l/day

RSC – 20% (*80% from background*)

USEPA Drinking Water Health Advisory for PFOA, May 2016

Calculation of Drinking Water

What is an appropriate water ingestion rate?

$$DWEL = \left(\frac{0.000018 \frac{mg}{kg} - d * 70 kg}{2.0 \text{ l/d ay}} \right) 20\%$$

$$DWEL = 126 \text{ ppt (RSC=80\%)}$$

$$DWEL = \left(\frac{0.000018 \frac{mg}{kg} - d * 70 kg}{3.6 \text{ l/d ay}} \right) 20\%$$

$$DWEL = 70 \text{ ppt (RSC=80\%)}$$

*USEPA 95th percentile of
consumer-only lactating women.*

*USEPA Exposure Factors Handbook:
2011 Edition, September 2011*

Calculation of Drinking Water

What is an appropriate Relative Source Contribution?

$$DWEL = \left(\frac{0.000018 \frac{mg}{kg} - d * 70 kg}{2.0 l/d ay} \right) 20\%$$

$DWEL = 126$ ppt (Background=80%)
 $DWEL = 315$ ppt (Background =50%)
 $DWEL = 504$ ppt (Background =20%)

$$DWEL = \left(\frac{0.000018 \frac{mg}{kg} - d * 70 kg}{3.6 l/d ay} \right) 20\%$$

$DWEL = 70$ ppt (Background =80%)
 $DWEL = 175$ ppt (Background =50%)
 $DWEL = 280$ ppt (Background =20%)

USEPA Drinking Water Health Advisory for PFOA, May 2016

Calculation of Drinking Water

What if we used a different RfD, DWI, and RSC?

$$DWEL = \left(\frac{0.0018 \frac{mg}{kg} - d * 70 kg}{2.0 \text{ l/d ay}} \right) 50\%$$

$$DWEL = 31 \text{ ppb}$$

HOW DO WE COMPARE?



Location	PFOA	PFOS
Michigan	0.07	0.07
Alaska	0.40	0.40
Connecticut	0.07	0.07
Colorado	0.07	0.07
New Jersey	0.014	NA
Texas	0.29	0.56
Canada	0.20	0.60
Denmark	0.10	0.10
Sweden	0.09	0.09
UK	0.30	0.30

THE LAWSUITS

and future movies.....



Class–Action Suits

- Mid-Ohio Valley (DuPont)
- Alabama municipalities (3M et al)
- Michigan PFAS sites with Willow Grove Naval Air Station in Pennsylvania
- Minnesota (3M)

Mid-Ohio Valley - DuPont

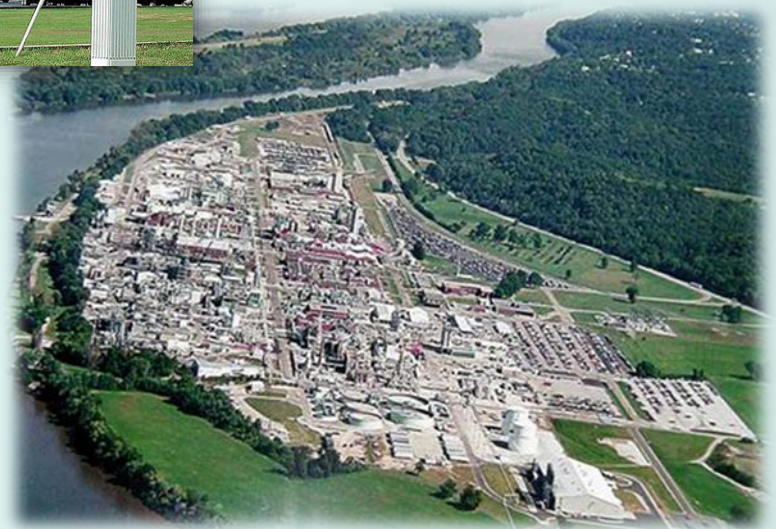
C8 Science Advisory Panel

2018 – \$671 million settlement
Ohio AG files suit

2017- Consent order for cleanup to
70 ppt.

2005 – DuPont pays \$16.5 million to
EPA to settle TSCA violations

1999 – Taft Stettinius & Hollister file
suit for health damage to
farmer Tenant's cattle.



Alabama Litigation

- **Background Leading Up to Litigation**
 - **2007 CDC Studies**
 - **State Sampling Water Systems**
 - **2008-2009 EPA Water System Sampling**
 - **2009 EPA Provisional Health Advisory**
 - **2013 Spring EPA issued fact sheet for PFC detected Decatur, AL – detected but below PHA levels**
 - **2016 EPA Issued Health Advisory for PFOA/PFOS**
 - **May 20, 2016 AL DPH New Release ID municipal systems with PFOA/PFOS > EPA Advisory levels**



Alabama Litigation

- **10-5-2015 *WEST MORGAN-EAST LAWRENCE WATER AND SEWER AUTHORITY v. 3M CO, DYNEON, L.L.C., and DAIKIN AMERICA, INC.*** –seeks money for treatment system
- **6-24-2016 *TENN. RIVERKEEPER, INC. V. 3M CO.*** [plus municipalities] seeks cleanup of landfills leaching to river
- **9-22-16 *THE WATER WORKS AND SEWER BOARD OF GADSDEN v. 3M*** [plus 30+ carpet manufacturers and suppliers] – seeks money for treatment systems upgrades
- **5-15-2017 *THE WATER WORKS AND SEWER BOARD OF THE TOWN OF CENTRE v. 3M*** [plus 35 carpet manufacturers] seeks money for treatment systems upgrades

Alabama Litigation

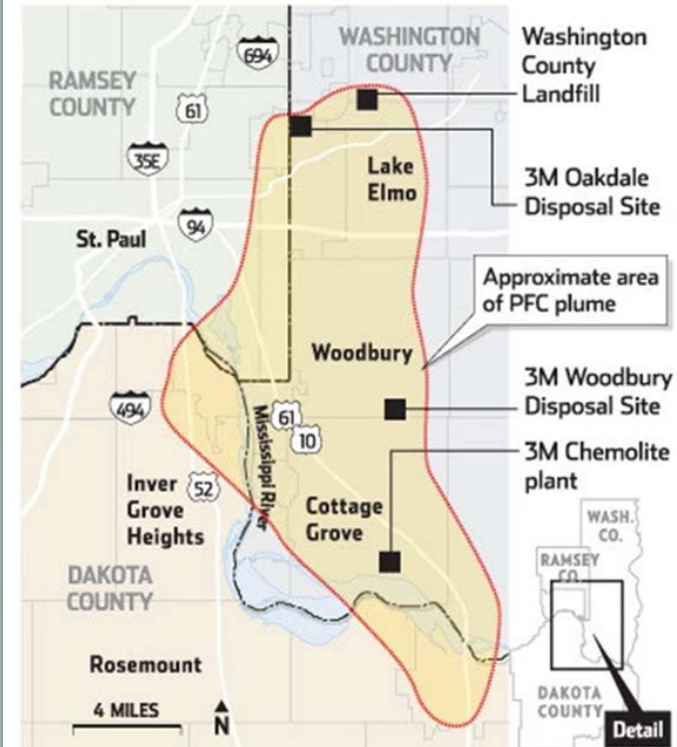


Minnesota – 3M Company

- PFAS contaminated groundwater discovered in 2002.
- UC Berkley Study
 - Increase in premature births and low birth weight
- Minnesota AG files suit against 3M Company.
- Bottled water and filtration systems for some municipal homes.
- 2018 3M settles for \$850 million.

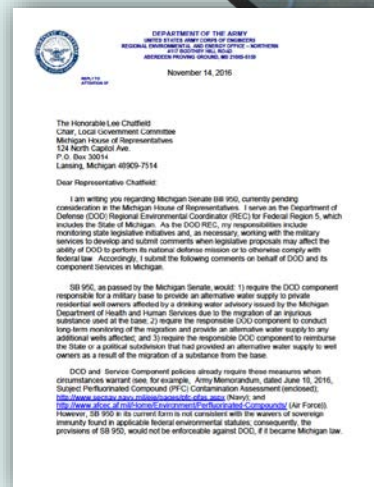
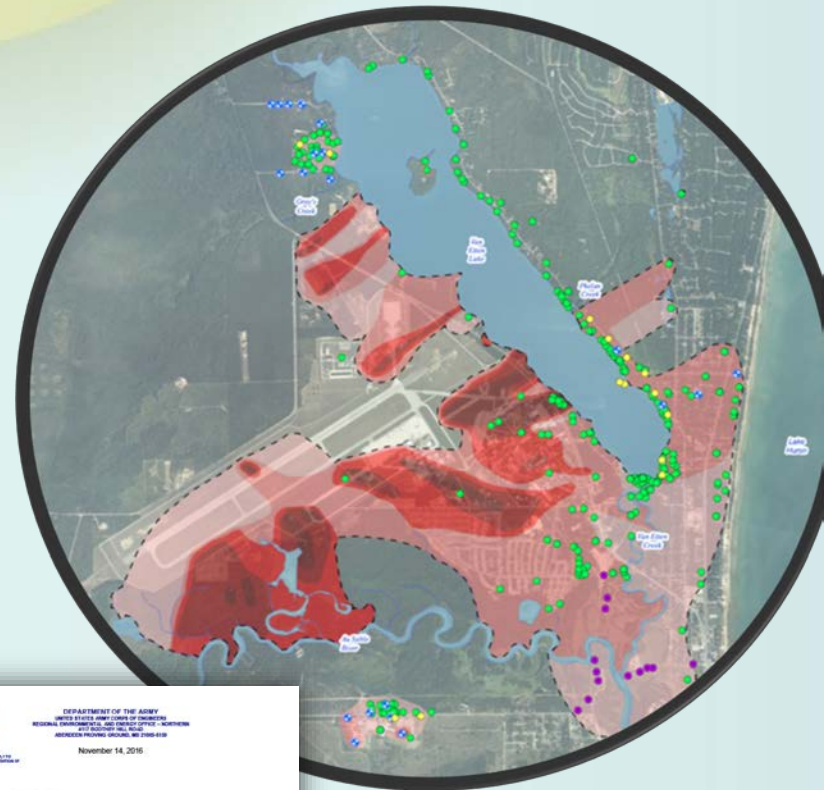
A new fight over PFCs

The Minnesota attorney general's office is suing 3M Co. for allegedly damaging the environment. 3M chemicals leaked out of landfills and have been found in groundwater in a large area of Washington County. 3M claims the levels are harmless.



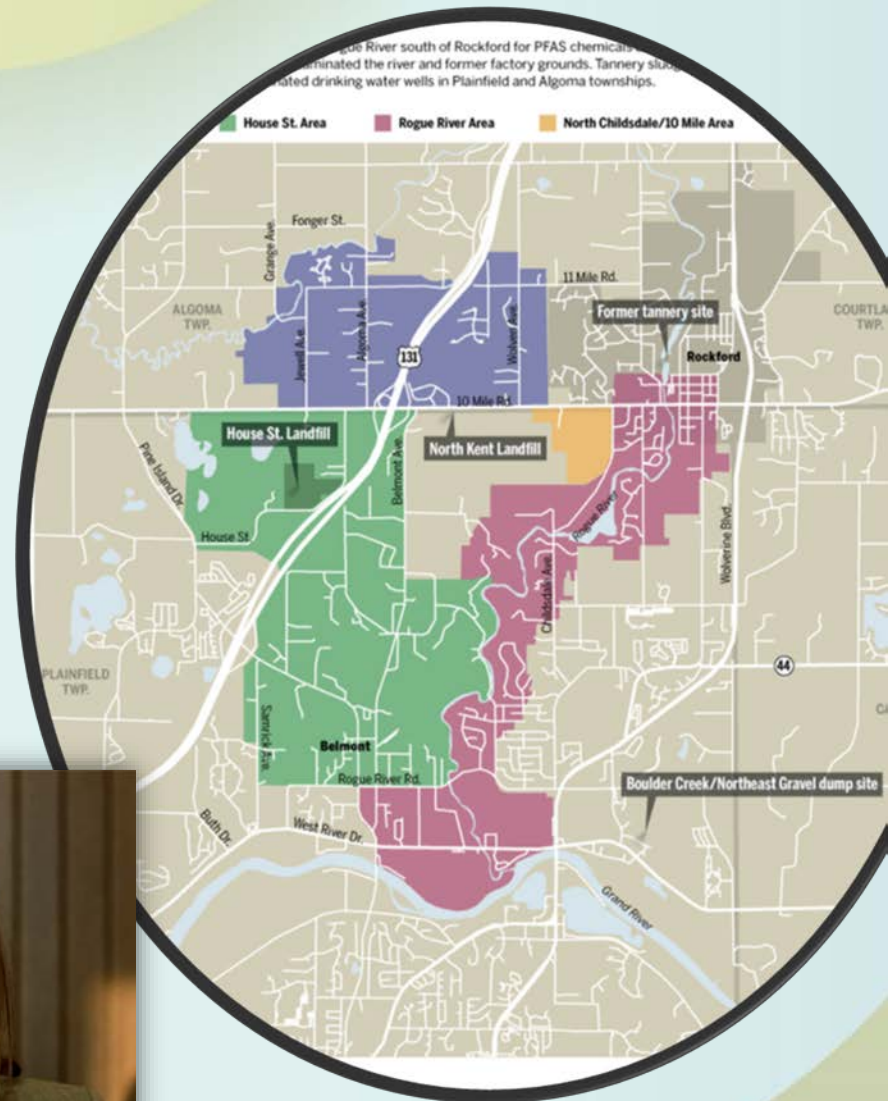
Michigan – Wurtsmith Air Force Base

- US Air Force claims “sovereign immunity” to avoid compliance with state law.
- Municipal drinking water system expanded.
- Homes provided drinking water treatment systems
- GAC Groundwater Treatment
- Fish Advisory



Michigan – Wolverine

- Former Tannery and Landfill
- USEPA Order.
- State of Michigan Law Suit
- Possible Class-action



IS THE THREAT OF PFAS CONTAMINATION A REC?

Regulation

- No federal regulation
- Some state regulation
- Are PFAS Hazardous Substances or only Hazardous Materials?

High Risk Properties

- Airports
- Landfills
- Metal plating operations
- Leather Tannery
- Cardboard or coated paper manufacturing
- Chemical plant
- Carpet manufacturing

EPA PFAS Links

- “PFAS, including PFOA and PFOS, are not listed as CERCLA hazardous substances, but in some circumstances could be responded to as CERCLA pollutants.”
Laws and Regulations Link: <https://www.epa.gov/pfas/pfas-laws-and-regulations>
- PFOS and PFOA EPA Drinking Water Health Advisory
EPA Actions: <https://www.epa.gov/pfas/epa-actions-address-pfas>
- Health Effects
<https://www.epa.gov/pfas/basic-information-pfas#health>
- Community Engagement
<https://www.epa.gov/pfas/pfas-community-engagement>
- SW-846 Compendium
<https://www.epa.gov/hw-sw846/sw-846-compendium>

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