

# **Reproductive outcomes at changing PFAS exposures in Minnesota**

CHE Webinar, September 9, 2020

Introduction by Philippe Grandjean, MD  
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## Public Health Assessment for

### PERFLUORO-CHEMICAL CONTAMINATION IN LAKE ELMO AND OAKDALE, WASHINGTON COUNTY, MINNESOTA

EPA FACILITY ID: MND980704738 AND MND980609515

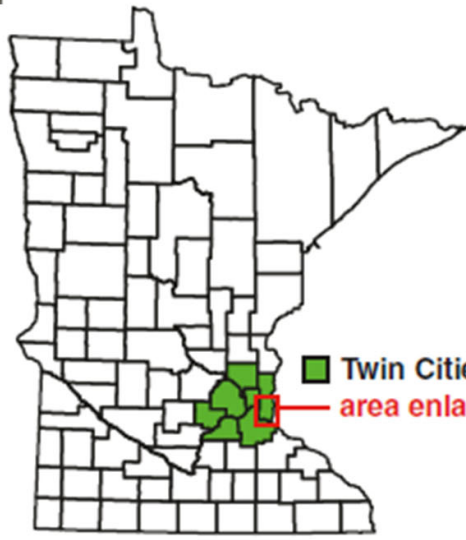
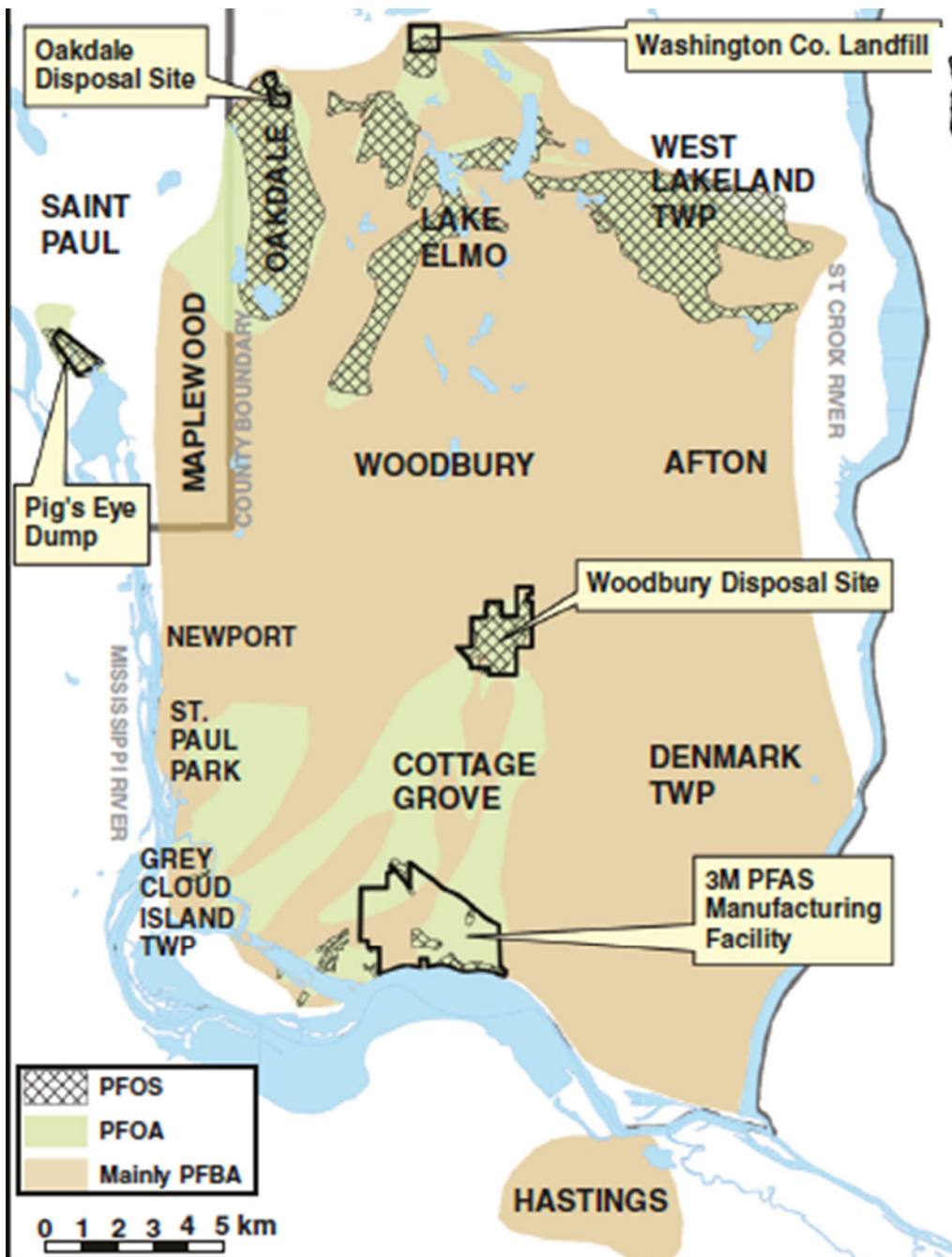
AUGUST 29, 2008

Prepared by:

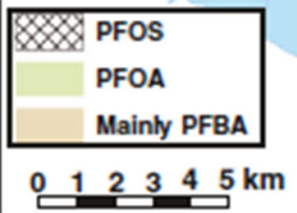
Minnesota Department of Health  
Under Cooperative Agreement with the  
U.S. Department of Health and Human Services  
Agency for Toxic Substances and Disease Registry

## Summary

Perfluorochemical (PFC)-containing wastes were disposed of by the 3M Company (3M) in two land disposal sites, the 3M-Oakdale Disposal Site in Oakdale and the former Washington County Landfill in Lake Elmo, Minnesota. PFCs were released from the two facilities resulting in contamination of groundwater and nearby drinking water wells. Past exposure through: drinking water, possible air emissions during the handling, disposal, or burning of wastes, or direct contact with the wastes could have been significant for some people.



Washington county,  
 East Metro area,  
 Minnesota, and  
 Surroundings  
 (Goeden et al., 2019)



# Groundwater contamination

In Oakdale, the average PFOA concentration in the municipal water was 0.57  $\mu\text{g/L}$  (or 570 ppt), (before water filtration, from 2006).

Much higher levels were found close to Cottage Grove:

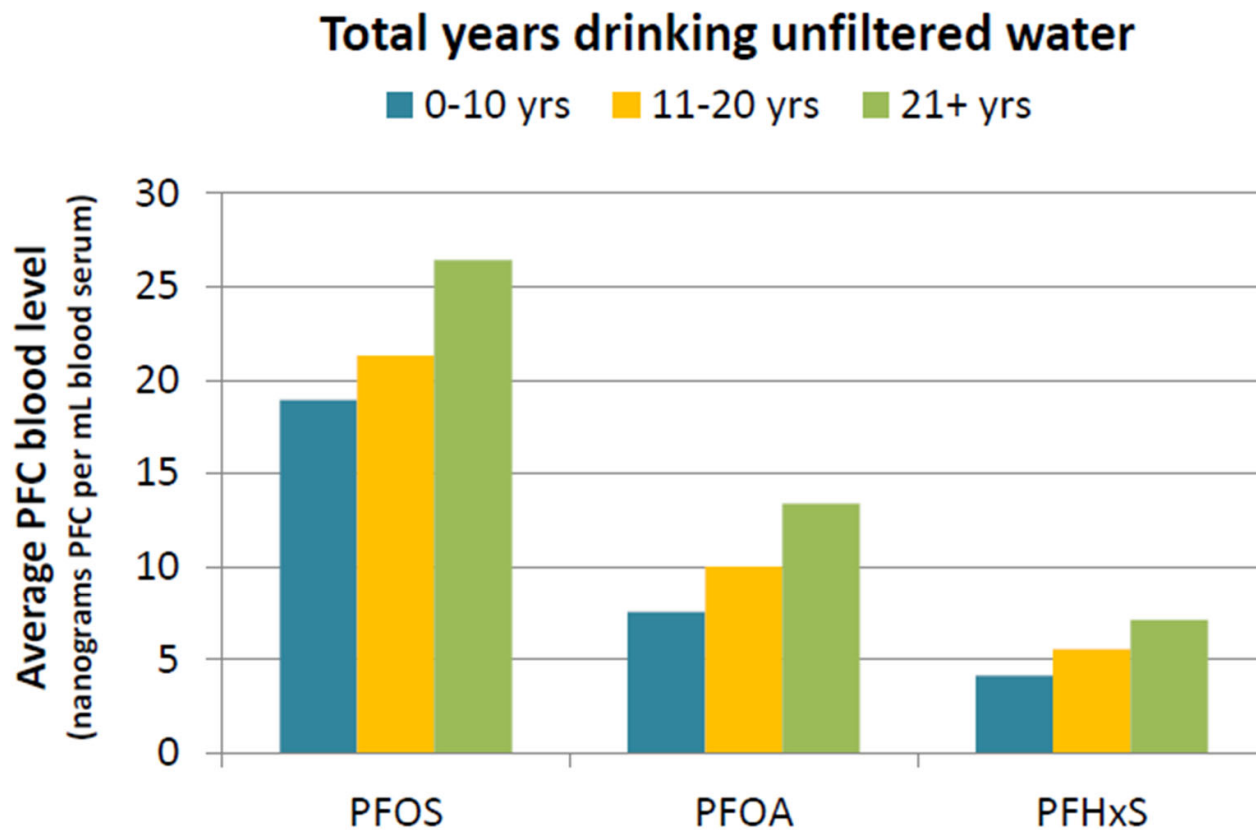
PFOA: 619  $\mu\text{g/L}$

PFBA: 318  $\mu\text{g/L}$

PFOS: 26  $\mu\text{g/L}$

PFHxS: 40  $\mu\text{g/L}$

# Elevated serum-PFAS concentrations in East Metro



\* Results account for differences in age, gender, blood donation



<b>Year</b>	<b>Exposure evidence</b>	<b>Unpublished</b>
1968	Organofluoride compounds in human blood	
1976	Organofluorines in workers' blood	
1981	PFOA found in cord blood (female worker)	
1993	Transfer into milk observed in goats	
1998	PFOS found in general population blood	
2004	PFAS detected in human milk	
2014	Breastfeeding shown to be major source of PFAS exposure in infants	



# Epidemiologic Assessment of Worker Serum Perfluorooctanesulfonate (PFOS) and Perfluorooctanoate (PFOA) Concentrations and Medical Surveillance Examinations

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*Perfluorooctanesulfonyl fluoride (POSF, C<sub>8</sub>F<sub>17</sub>SO<sub>2</sub>F) is used to create applications for surfactants and paper, packaging, and surface (eg, carpets, textiles) protectants. Such POSF-based products or their residuals may degrade or metabolize to PFOS (C<sub>8</sub>F<sub>17</sub>SO<sub>3</sub><sup>-</sup>). PFOS concentrates in liver and serum and results in hypolipidemia as an early effect of cumulative dosages. Male and female employees of two perfluorooctanyl-manufacturing locations (Antwerp, Belgium and Decatur, Alabama) participated in a periodic medical surveillance program that included hematology, clinical chemistry, thyroid hormone, and urinalysis testing. Serum concentrations of PFOS and perfluorooctanoate*

**P**erfluorooctanesulfonyl fluoride (POSF, C<sub>8</sub>F<sub>17</sub>SO<sub>2</sub>F), which is produced by an electrochemical fluorination process, is used as the basic building block to create unique chemistries through the sulfonyl fluoride moiety using conventional hydrocarbon reactions. Applications include surfactants and paper, packaging, and surface (eg, carpet, upholstery, textile) protectants. Depending upon the specific functional derivatization or the degree of polymerization, such POSF-based products or their residuals may degrade or metabolize to an undetermined

**FINAL REPORT**  
**Epidemiology, 220-3W-05**  
**Medical Department**  
**3M Company**  
**St. Paul, MN 55144**

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**Date: October 11, 2001\***

**Title: A Longitudinal Analysis of Serum Perfluorooctanesulfonate (PFOS) and Perfluorooctanoate (PFOA) Levels in Relation to Lipid and Hepatic Clinical Chemistry Test Results from Male Employee Participants of the 1994/95, 1997 and 2000 Fluorochemical Medical Surveillance Program**

**Study**  
**Start Date: July 1, 2001**

**Protocol Number (not applicable)**  
**IRB Approval**  
**Exempt Expedited**  
**X**



## SCIENCE PUBLICATION STRATEGY

DEC 10 1998

Publication of scientific and technical information on the FC issue should follow a strategic plan so that key findings can be understood in the context of the published scientific literature. Under this strategy, the science needed to evaluate the safety of PFOS (i.e. the available occupational and toxicology studies) will be published -- or in press -- and thus available to be cited when the publication on serum levels in the general population is published. This will allow the serum level findings to be placed in an understandable, credible context which demonstrates that there is no medical or scientific basis to attribute any adverse health effects to 3M products. In this strategy, the analytical methodology will be published concurrently with the serum level findings.

The strategy is described as a series of steps with a timeline for each activity. The strategy begins with a brief summary of the scientific and technical studies published or publically available:

Document released by Minnesota AG PTX1535

3M comment on \$850 million settlement

“This agreement reflects 3M’s long-standing commitment to always acting with integrity and conducting business in an ethical and sustainable way. While *we have never believed there is a PFC-related health issue*, this agreement allows us to move past this litigation and work together with the state on activities and projects to benefit the environment and our communities.”

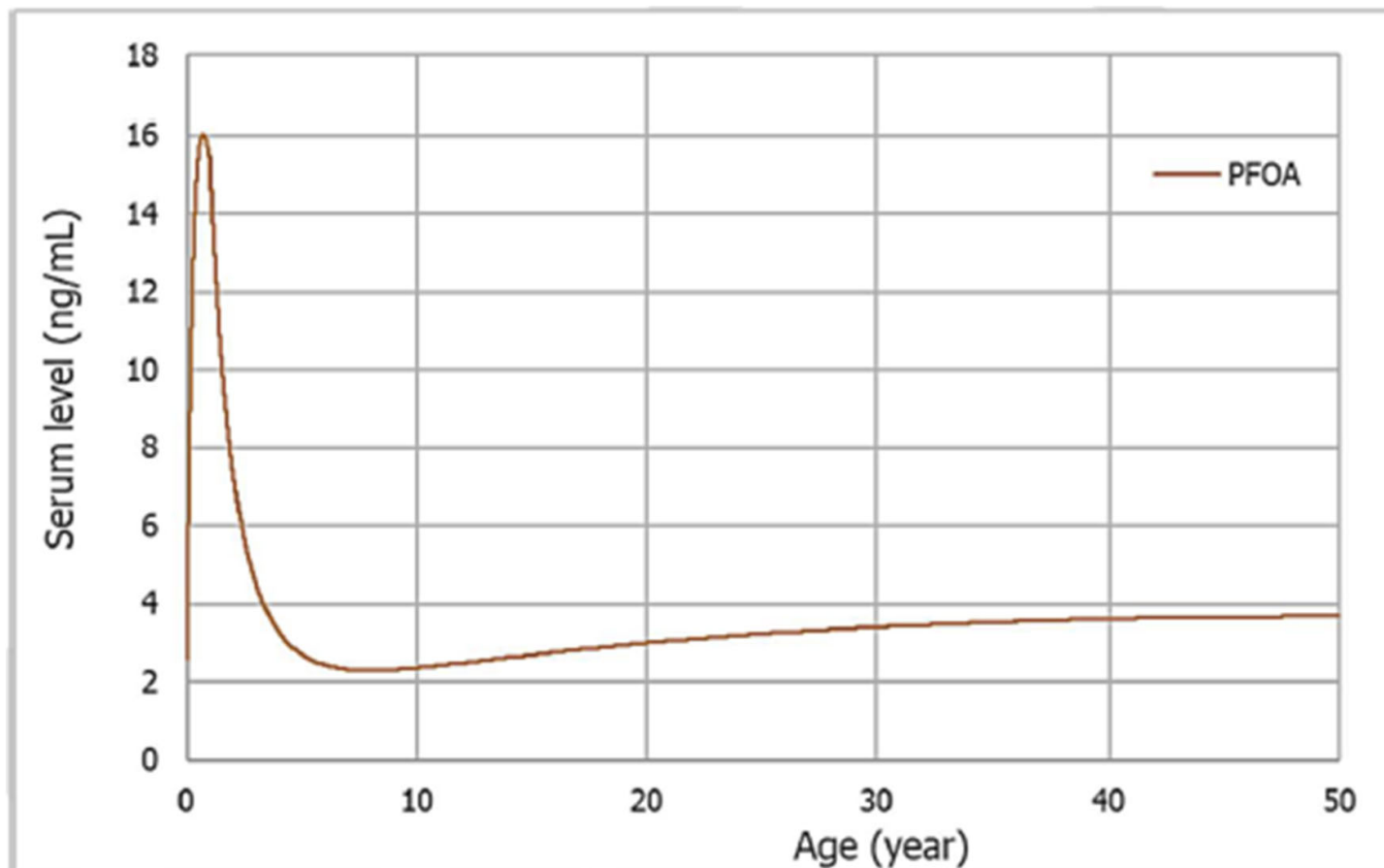
21 February, 2018

## Challenges in exploring reproductive outcomes in PFAS-exposed populations

- PFASs used for more than 70 years
  - Almost no independent PFAS science before 2000
  - PFASs claimed to be inert and innocuous
  - Company-sponsored findings were not released
  - Possible instances of misinformation
  - Chemical waste sites not monitored
- 
- Retrospective exposure assessment difficult
  - Blood concentrations may not reflect retention
  - Most adverse health outcomes are non-specific

## Early-life exposures to PFASs may be of particular relevance

- DOHAD-PPTOX perspective on early-life exposures
  - Prospective studies show prenatal impact
  - Cross-sectional studies tend to underestimate
  - Better exposure assessment in early life shows stronger links to adverse outcomes
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- Decreased birth weight is a marker of toxicity that may be affecting several organ systems
  - Immune functions may be the most vulnerable
  - Delays in scientific insight affect public health
  - How to avoid the “late lessons” paradigm



Serum-PFOS in a woman exposed in utero, via breastfeeding for 12 months and then via diet at 0.33 ng/kg bw per day (EFSA 2020).

# Minnesota current drinking water guideline values (ppt)

PFOS	15
PFOA	35
PFHxS	47
PFBA	7,000
PFBS	2,000

}  $\Sigma = 97$  ppt

EU: EFSA proposal for 4 PFASs, 2020  
TWI for (PFOA+PFNA+PFHxS+PFOS)  
8 ng/kg bw per week  
Corresponding to **5 ppt** in water



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Professor of Environmental Medicine, University of Southern Denmark  
and Adjunct Professor of Environmental Health, Harvard University

Fellow, American Association for the Advancement of Science (1994)

Science Communication Award, University of Southern Denmark (2012)

Bernardino Ramazzini Award, Collegium Ramazzini (2015)

Basic & Clinical Pharmacology & Toxicology Nordic Award (2015)

John R. Goldsmith Award, International Society for Environmental Epidemiology (2016)

European Environment Agency: Member, Scientific Committee (2012-)

Founding Editor, Environmental Health (2002-)

Service as health expert on PFASs for State of Minnesota and exposed communities

I declare that my research is funded by public sources only and  
that I have no conflicts of Interests to declare