Perfluorochemicals (PFCs) in the East Metro

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• What are PFCs (also known as PFAS)?
  • Where do they come from?
  • Why are they important?
• What are MDH’s Health-Based Values?
• What about PFCs in Minnesota?
• How have PFCs affected drinking water supplies and what actions have been taken?
• What are future options for community water supplies?
PFCs (also known as PFAS)

• Human-made chemicals found in everyday items

• Used since 1940s to make products that resist heat, stains, water, oil and grease; production increased rapidly in 1970s

• Many other specialized industrial and commercial uses (operative word: non-stick)
PFCs in the Environment

• PFCs are persistent in the environment

• PFCs can be found in
  • **Food** packaged or processed with PFAS-containing materials or grown in contaminated soil/water
  • **Commercial household products**, including stain-resistant fabrics, nonstick products, polishes, paints, waxes, and cleaning products
  • **Workplaces** that use PFAS
  • **Drinking water**, typically associated with a specific facility or site
  • **Living organisms**, including fish, animals, and humans
• PFCs do not break down
  • C-F bond strongest covalent bond
  • No hydrolysis, photolysis, or biodegradation

• Do not adsorb readily to aquifer materials
  • Infiltrate rapidly to the groundwater
  • Little or no retardation in aquifers
  • Rates affected by PFC chain length and functional group

• Chemical structure similar to fatty acids
  • “Proteinphiles” - adsorbed into blood serum of living organisms
  • Also controlled by chain length and functional group
Why are PFCs important?

• Most people have been exposed to PFCs because they are in so many products

• PFCs can accumulate and stay in the human body for long periods of time

• There is some evidence that exposure to PFCs at high levels is associated with negative health outcomes
MDH Health-Based Values

Most Sensitive Health Effects
Exposure ≠ Health Effects
Margin of Safety
Fraction from Drinking Water
High-End Water Intake Rate

Health-Based Value
MDH Health-Based Values

- MDH evaluates the combined effects of PFCs: Health Risk Index (HRI)
  - Allows us to account for differing levels of toxicity in similar chemicals
- Protective for people who are exposed over their lifetimes
- Protective for fetuses
- Based on animal studies showing slight liver and thyroid effects (adults) and immune system and developmental effects (infants/children)

<table>
<thead>
<tr>
<th>Compound</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PFOS</td>
<td>0.027 ppb</td>
</tr>
<tr>
<td>PFOA</td>
<td>0.035 ppb</td>
</tr>
<tr>
<td>PFBA</td>
<td>7.0 ppb</td>
</tr>
<tr>
<td>PFBS</td>
<td>2.0-3.0 ppb</td>
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</tbody>
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Location of 3M PFC Sites in Washington Co., Minnesota
• In the eastern half of the county, groundwater flows to the St. Croix River
• In the western half of the county, groundwater flows to the Mississippi River
• Locally, groundwater flow may be influenced by pumping wells
PFAS in Surface Water – Important Transport Pathway

**Notes:** Map combines data from all aquifers, actual concentrations in any area may vary; blank spaces indicate no sample data.
Result: Extremely Large “Co-Mingled” Plumes

- Over 130 sq. mi.
  - 4 major aquifers
  - 8 municipal systems & >1,800 private wells
  - Much larger than predicted by models
- PFBA most widespread
  - More PFBA in source areas
  - More mobile
- Movement of PFAS affected by several factors
PFOS and PFOA Less Widespread

- PFOS and PFOA present at high concentrations in source areas
- Groundwater concentrations decrease rapidly with distance from source
- Surface water concentrations
- Different PFAS “signatures” in each site based on chemistry at time of disposal
  - Washington Co. landfill & Woodbury Disposal Sites dominated by PFCAs
  - Helped to identify transport pathways
Well Sampling Effort & Private Well Drinking Water Advisories

- ~2,500 wells sampled since 2003
  - Frequent, intensive monitoring of private wells:
    - Near source areas
    - Areas with high or changing PFAS concentrations
    - Areas with complex geology
  - Less frequent monitoring of “sentry” private wells:
    - Distal portions of plumes
    - Areas with low and stable PFAS concentrations
    - Areas with relatively simple geology
- >800 drinking water advisories issued
Community Water Supply Impacts

• Everything in a drinking water system is interdependent and very complex
  • Trade-offs: choice of technology, design, and operations can have unintended consequences

• Communication must include the public, regulators/regulatees, and elected officials

• Water systems do not have the luxury of waiting; people drink water every day
Health risks are incremental
Standards are discreet segments
Public perception varies

Health Risk and Regulation
Regulatory Consistency vs. Scientific Discovery

- Implementation of regulations requires consistency
- Science is always learning new facts
- Need space between the two
- Four-quarter average concentration used
Response Actions – East Metro

- Removal & proper disposal of contaminated soil
- Treatment of groundwater
- Treatment of drinking water where Health-Based Values exceeded

City of Oakdale water treatment plant

Residential carbon filters
Oakdale (27,973)

- Has 9 wells; PFAS exceeds MDH health-based guidance value in 7
- PFAS concentrations highest in the state for community systems; peak of 440 ppt PFOA and 610 ppt PFOS
- Treatment (GAC) installed in 2006 for 2 wells; change carbon annually
- Primarily rely on 2 treated wells and 2 “clean” wells for water supply
- Video: http://bit.ly/2rWs9z5
Cottage Grove (36,492)

- Has 12 wells; 8 with PFAS exceeding MDH health-based guidance values
- PFAS concentrations: no PFOS, 66 ppt PFOA
- Impacted when health-based guidance values lowered
- Installed GAC treatment on 2 wells in 2017
- Have a direct blending point for 7 wells that can manage concentrations
- Temporary watering ban in 2017 after receiving health advisory letter from MDH and prior to treatment
• 19 wells; PFAS exceeds MDH health-based guidance values in 5 wells

• PFAS concentrations
  • PFBA: 0.1-0.41 ppb (all wells)
  • PFHxS: 0.07 ppb (Well 13 only)
  • PFOA: 0.014-0.049 ppb (8 wells)
  • PFOS: 0.023-0.026 ppb (3 wells)

• Primarily rely on wells that meet MDH health-based values for water supply. Others are used only seasonally to meet peak demand.
Saint Paul Park (5,519)

- Has 3 wells, with 2 exceeding MDH health-based guidance values
- PFAS concentrations: no PFOS, 43 ppt PFOA
- Impacted when health-based guidance values lowered
- Want to install treatment on wells
- Managing pumping so clean well is used the most, and enforcing watering restrictions
Lake Elmo (4,878 / 8,069)

- Has 3 wells with 1 exceeding MDH health-based guidance values
- PFAS concentrations: no PFOS, 46 ppt PFOA
- Impacted when health-based guidance values lowered
- Many private wells in the city
- Options for new well limited by water quantity issues
Biomonitoring Shows Effectiveness of Response

Levels down over time

PFCs decreased in blood of people drinking treated water (average concentrations still above national averages)
Future Response Options

- Regional interconnect
- New treatment facilities
- New wells
- Water conservation; limit use of contaminated wells
- Adapted blending scheme
- Others?
• MDH General PFAS Information:  
  http://www.health.state.mn.us/divs/eh/hazardous/topics/pfcs/index.html

• ITRC Factsheets:  https://pfas-1.itrcweb.org

• US EPA information:  https://www.epa.gov/pfas

• MDH Health Risk Limits:  
  http://www.health.state.mn.us/divs/eh/risk/guidance/gw/table.html

• MPCA PFC Investigations:  
  https://www.pca.state.mn.us/waste/perfluorochemicals-pfcs
Questions?

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