PRE- and POLYFLUOROALKYL (PFAS) SUBSTANCE AWARENESS

San Francisco Fire Department

presented by

San Francisco Firefighters Cancer Prevention Foundation
Per- and polyfluoroalkyl substances (PFAS)

What are they?

- A collection of manufactured chemicals that include perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS), Gen X technology, and many other chemicals

- The larger body of chemicals is referred to as fluorinated chemicals - characterized by strong fluorine-carbon bonds

- Fluorinated chemicals’ indestructible quality is what makes them effective firefighting tools
PFAS Have Found Industrial Use Everywhere

- 1956 - 3M Scotch-gard on carpets
- 1962 - Teflon non-stick coating cookware is FDA approved
- Gore-Tex - water-proof, breathable fabric membrane
- Microwave Popcorn - separating steam from the paper in popcorn bags
- AFFF Firefighting Foams
What’s the Problem?

- The *Fluorine-Carbon bond* is very hard to break.

- This *F - C bond* has incredible environmental persistence —> known as a “forever chemical.”

  • **CONCERN: Bioaccumulation** - Long-chained PFAS (C8) accumulate, increase in concentration, and stay in our bodies.

  • *Short-Chained PFAS (C6)* – Research shows they seem to have the same toxicity as long chained PFAS when exposure to short-chained is at higher levels.

  • *Biomagnification* - as you go up the food chain, we get higher levels in our bodies.
Health Effects of PFAS

- Cancer
- Cardiovascular Disease
- Increased Cholesterol Levels
- Liver Malfunction
- Thyroid Disease
- Hormonal Changes
- Obesity
- Contribute to Low Infant Birthweight
- Immune System Reduction
- Decreased Response to Immunizations

In 2018, there were almost 800 studies being conducted on PFAS and human health


Source: www.ncbi.nlm.nih.gov/pubmed/20049206
• **1951** - DuPont makes C8 – used in manufacturing Teflon

• **1954** - DuPont employees express concerns about C8 toxicity

• **1961** – DuPont confirms that C8 is toxic in animals and causes *observable changes* in organ functions

• **1981** - DuPont finds evidence of birth defects in babies born to female employees & decides to pull female employees from Teflon work

• **1999** - DuPont dumps 55,000 pounds of C8 into the Ohio River

• **Feb 13th, 2017** - Global Settlement $670 Million - covers all the C8 cases that were filed in federal court, resulting from C8 being dumped in the Ohio River (https://thedevilweknow.com)
Firefighters & PFAS

- **AFFF Foam** (Class B)
  - Are effective surfactants
  - Lowers the ignition temperature
  - Smothers the fire from oxygen

- **PPE**
  - Dr. Peaslee, Notre Dame tested 40 sets of turnouts for Fluorine
    - Tested All 3 Layers:
      - **Moisture Barrier** —→ Polytetrafluoroethylene (PFTE) (Teflon)
      - **Thermal Liner** —→ Fluorine found in High End PPE
      - **Outer Layer (shell)** —→ Side-chain fluoropolymer
## Total Fluorine Measurements

<table>
<thead>
<tr>
<th>Sample part</th>
<th>State</th>
<th>N samples</th>
<th>Average F (ppm)</th>
<th>Std Dev. F (ppm)</th>
<th>% change</th>
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<tbody>
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<td>Moisture Barrier</td>
<td>New</td>
<td>9</td>
<td>178300</td>
<td>31100</td>
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<tr>
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<td>21500</td>
<td>5300</td>
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<tr>
<td>Outer Layer</td>
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<td>55</td>
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<tr>
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<tr>
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<td>Used 2008</td>
<td>2</td>
<td>15600</td>
<td>3600</td>
<td>-41%</td>
</tr>
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</table>

Source: [https://station-pride.com/2018/02/18/fire-gear-laboratory-test-results/](https://station-pride.com/2018/02/18/fire-gear-laboratory-test-results/)
Preventative Measures - RIGHT NOW

Limit Exposure - PFAS are BIOACCUMULATIVE

• Keep Wearing the Gear, there is no alternative…yet.

• Treat PPE with respect. Use them for fires, but not for non-fire emergencies (community events, shopping, as a “raincoat,” walk-through drills…).

• Keep gear separate from your kids, out of the back of your car. Put PPE in a bag.

• Wash the gear before you wear it.

• Keep it separate from where you live in the house.
Preventative Measures - Long Term

Proactive Actions

• Exploring alternative PPE treatments that will produce similar benefits

• Studies to determine how much dermal absorption is occurring

• Dust Analysis - PFAS degrade & become brittle —–> Inhalation Hazard (Dust Analysis)

Legislative Actions

• Push Congress to establish a First Responder PFAS Task Force

• Mandate PPE companies to include % of PFAS used in PPE

• Create a Maximum number to limit the PFAS allowed in PPE
One Final Note

1992 - DuPont scientists found that PFOA cause **TESTICULAR CANCER**

“In addition to causing testicular tumors, PFOA causes many other effects on the male reproductive system, including increased size of the testes, epididymides and seminal vesicles, and decreased prostate in rats.”

“In the female, PFOA causes **MAMMARY TUMORS** and cellular effects on the ovary.”

“Beginning in 1992, DuPont scientists began to publish papers addressing how PFOA causes testicular tumors and other harmful effects on the male reproductive tract (they have not studied mammary gland and ovarian effects). First, they found that PFOA increases blood levels of estradiol (the major form of estrogen in humans and rodents) in male rats. They also found that PFOA affects testosterone regulation, tending to decrease blood levels of testosterone and alter the production of testosterone in testicular cells, effects that are likely due to a “lesion at the level of the testes.”
