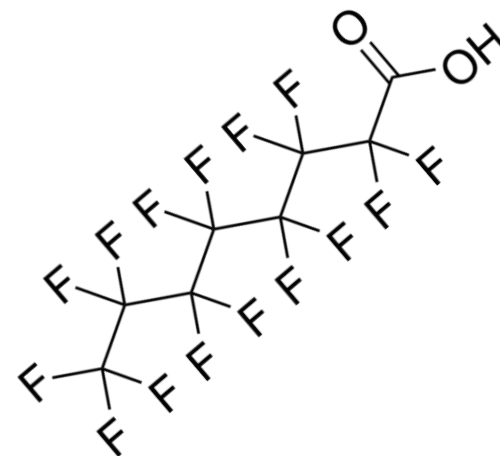
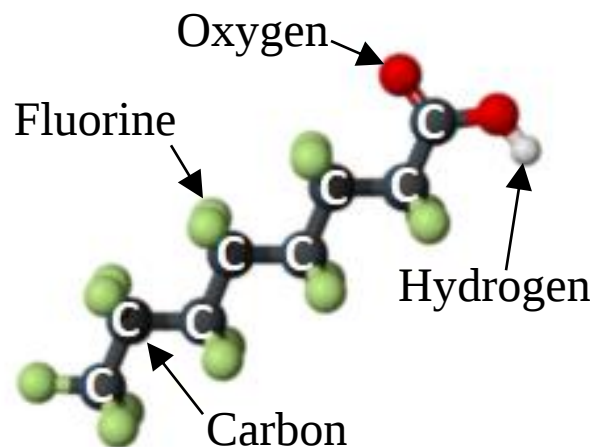




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Per and Polyfluoroalkyl Substances (PFAS)



Michael Hilton

VP, Engineering / International Sales

March 2020



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Company Overview

- Industrial Furnace Company, Inc. (IFCO) is a family owned company founded in 1948.
- Headquarters in Rochester, New York and division in Atlanta, Georgia
- Broad background in refractory construction and steel erection, IFCO began building furnaces over 70 years ago.
- Leading experts in furnace engineering, construction, maintenance, operations, and repairs.
- Industries we service : Mining, Wastewater, Mineral Recovery, and Refinery.
- World leader in Multiple Hearth Furnace engineering, repairs, parts, and construction.
- We have serviced most of the MHF's and FBI's in the U.S.
- International Mining presence starting in 2011 (Canada, Brazil, Greece, Turkey and Europe)
- International Processes using MHFs, Horizontal and Vertical Shaft Kilns.
- Mechanical Engineering services since 1982 / Electrical & Integration department since 2006.
- MACT upgrades and annual MACT operator training requirements.
- In-house pilot facility with cyclones and bag house, and fully automated controls.

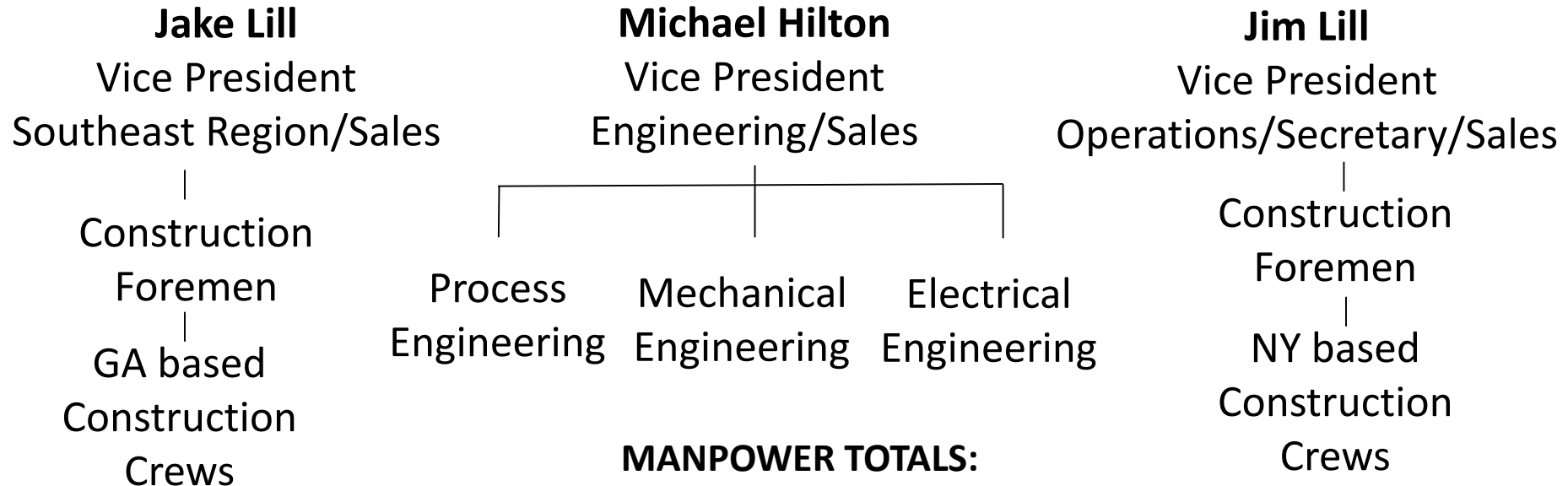


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Organizational Chart

William T. Lill Jr.
President



MANPOWER TOTALS:

OFFICE PERSONNEL: 25 PEOPLE

CONSTRUCTION CREWS: APPROXIMATELY 95-125 PEOPLE



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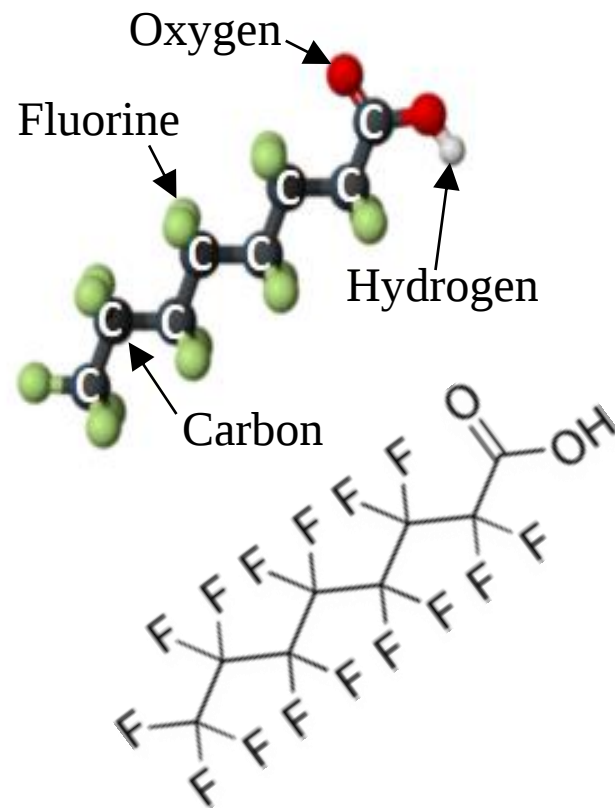
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What is PFAS?

A group of man-made chemicals that includes PFOA, PFOS, and GenX. It is made up of 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.
- Extremely **Persistent** in the environment and resistant to typical environmental degradation processes.
- **Bio-accumulative** in organisms
- **Toxic** at relatively low Parts Per Trillion (ppt) levels.

“Forever Chemical”





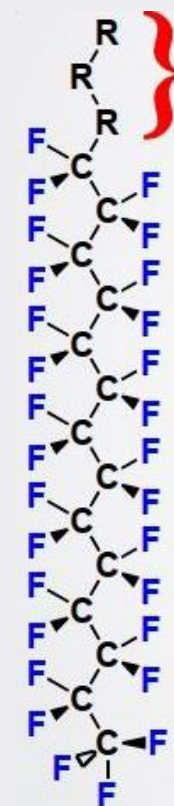
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Fluorocarbon Chemical Structure

- R can be organic or inorganic.
 - CF₃
 - COOH
 - OH
 - Chains
- Can be monomer or polymer.
- Chain can contain only carbon or other atoms.
- Perfluoro chain length 2- > 40 and longer.

“Every {R} group that is potentially reactive and tested to date has yielded Perfluoro acids”





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PFAS Sources and Uses

- Lubricants
- Refrigerants
- Chemical intermediates
- Chemical synthesis processing
- Pyrotechnics
- Cosmetics
- Surfactants

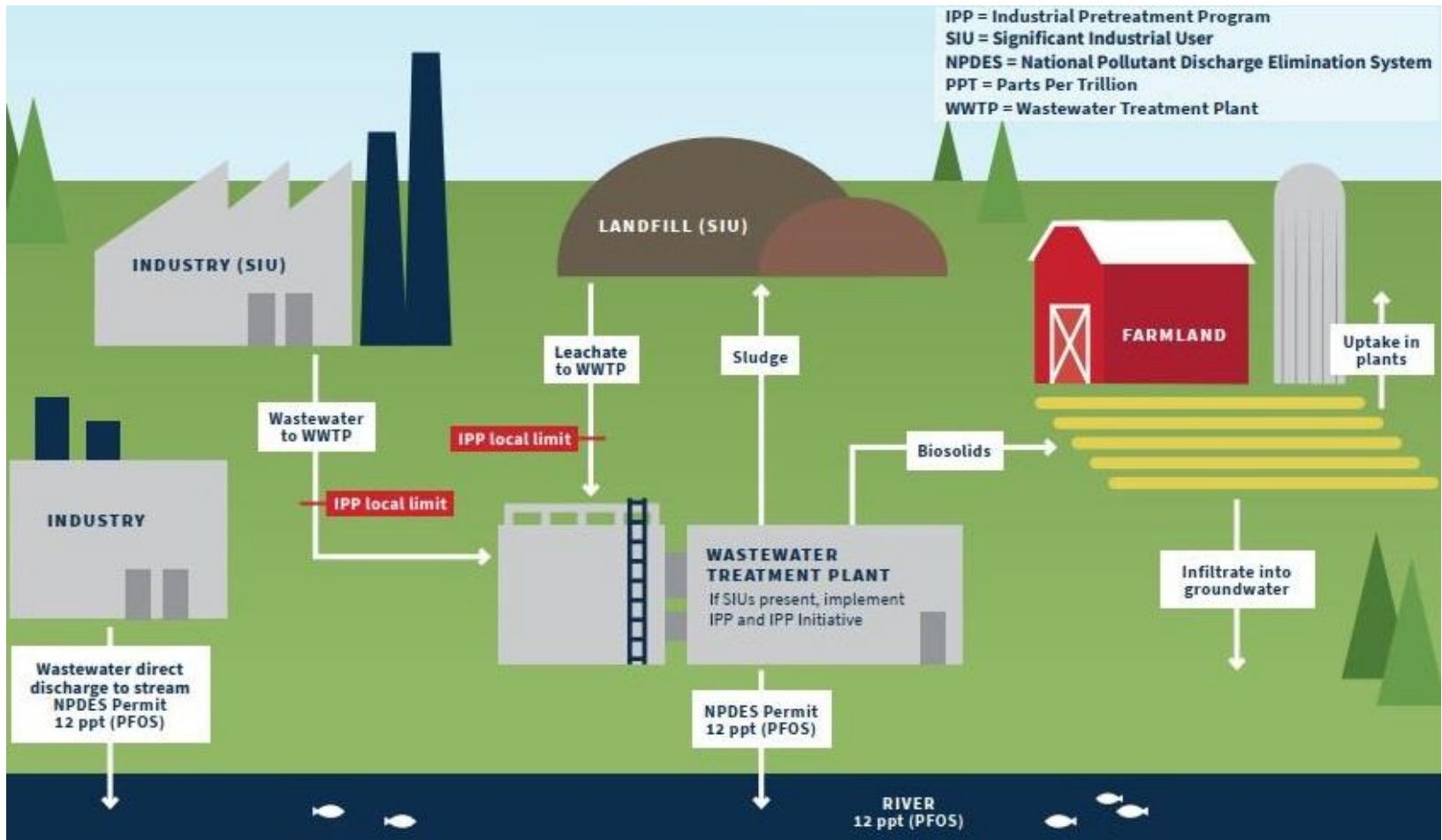




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PFAS Environmental Cycle





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Health Effects from PFAS

Adverse health outcomes in humans that ingest PFAS (by eating or drinking food or water than contain PFAS), the PFAS are absorbed, and can accumulate in the body. PFAS stay in the human body for long periods of time.

Human epidemiology studies show increase cholesterol levels with more limited findings related to:

- infant birth weights
- effects on the immune system
- cancer (for PFOA)
- thyroid hormone disruption (for PFOS)



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Federal (EPA) Response

2016 May > Released health advisories which set 70ng/L - 0.07ppb - 70,000ppt (individual or total) limit for lifetime exposure in drinking water.

2019 Feb > PFAS Action Plan to outline an understanding of PFAS, prevent future contamination, and effectively communicate findings to the public.

2019 Dec> Released interim recommendations for addressing contamination. Screening level of 40ng/L and a preliminary remediation goal of 70ng/L.

- PFAS treatment in model wastewater treatment reactors
Evaluating PFOS fate during activated sludge treatment
- PFAS in wastewater residuals and effluent
Evaluating nine wastewater treatment facilities for treatment of PFAS



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Federal (EPA) Response

- Fate of PFAS during land application of biosolids
Evaluating the fate of common wastewater related contaminants including PFAS
- PFAS occurrence and fate during direct potable reuse (DPR)
Evaluating the fate of PFAS within wastewater treatment plants.
- PFAS from source water to drinking water
Evaluating the impact of wastewater treatment on downstream drinking water treatment including PFAS.

Regulations fall under the Safe Drinking Water Act (SDWA), 40 CFR Part 141.

<https://www.epa.gov/pfas/epas-pfas-action-plan>



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State Responses

- Health Based Levels Combined PFAS **70ng/L or 0.07ppb**. Includes Alaska, California, Connecticut, Maine, Massachusetts, Pennsylvania and Rhode Island.
- Health Based Levels Combined PFAS **20ng/L or 0.02ppb**. Includes Vermont.

Landfill and Land Applications Stopped in Maine!

Download PDF Document to detail state limits:

<https://www.awwa.org/Portals/0/AWWA/Government/SummaryofStateRegulationtoProtectDrinkingWater.pdf>

“Coming Soon” This will effect your Industry



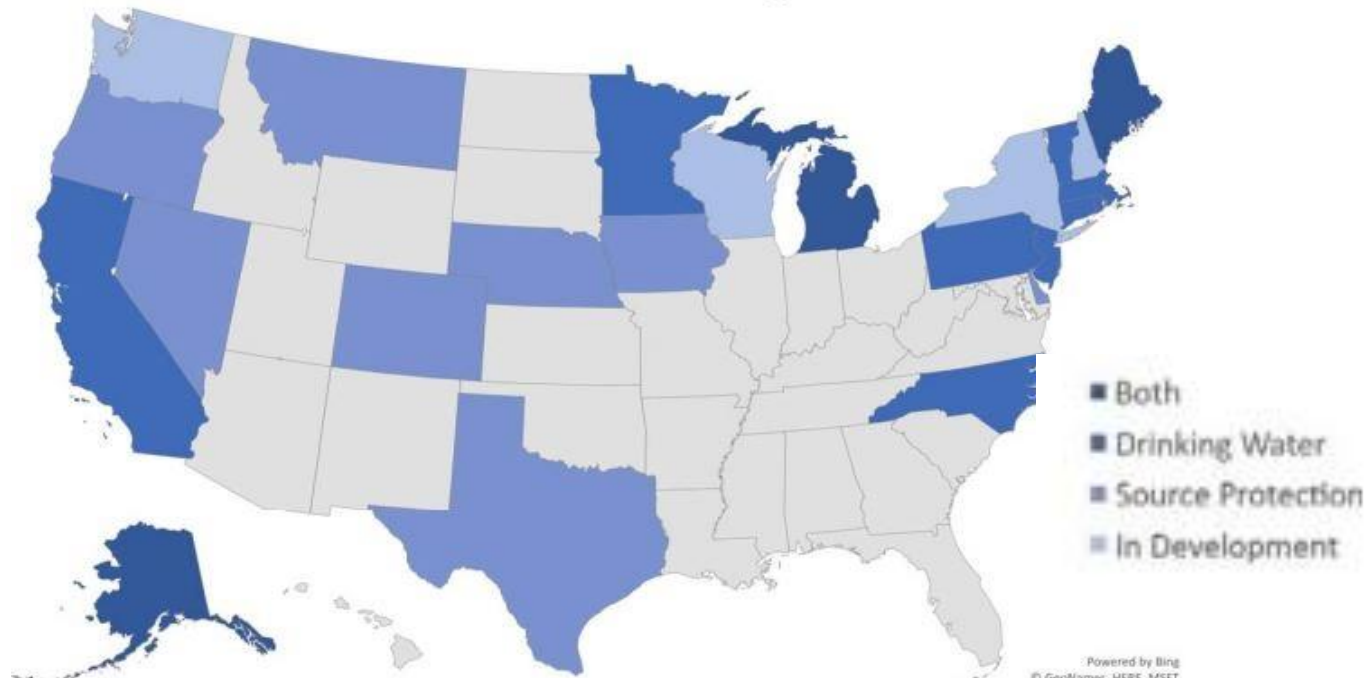
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State Responses

- 14 states have established policies for PFAS in drinking water and
- 17 states have established policies to protect sources of drinking water from PFAS.

State Policies for PFAS to Protect Drinking Water





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NEBRA Study

North East Biosolids & Residuals Association

2018 - Tour of all biosolids facilities in New Hampshire and Massachusetts with local EPA personal. Findings: every facility had PFAS with ranges of 8 to 11 ppb.

2020 - Every facility has PFAS with ranges of 5 to 25 ppb.

*** 70 times the EPA limit of 0.07ppb (70ppt) ***



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PFAS with Municipal Sludge

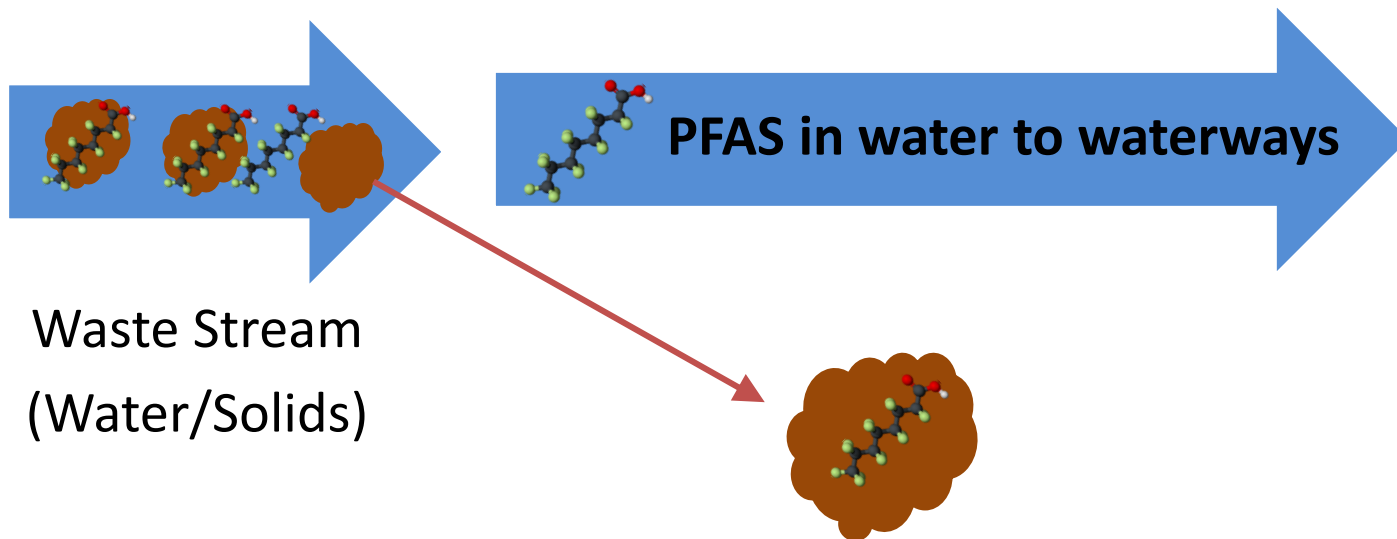
- a. PFAS chemicals enter the wastewater treatment facility via the sludge or other biosolids.
- b. Sludge is separated from the water.
- c. Sludge is further dewatered before thermo-processing.
- d. Resulting product is dried (dryers) and subsequently deposited of as Class "A" Sludge and / or Fertilizer, -OR-
- e. Reduced by Incineration – process can reach the temperatures to breakdown the PFAS Chains (greater than 1400°F).



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PFAS with Municipal Sludge

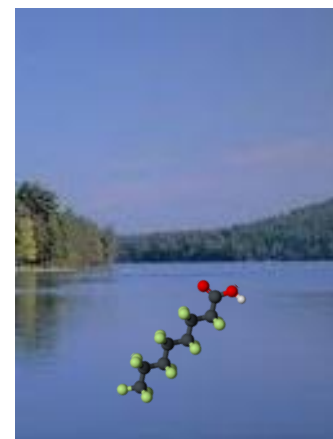


Waste Stream
(Water/Solids)

PFAS in water to waterways

Dewatered Solids w/PFAS
Ready for Further Processing

Dirty Water

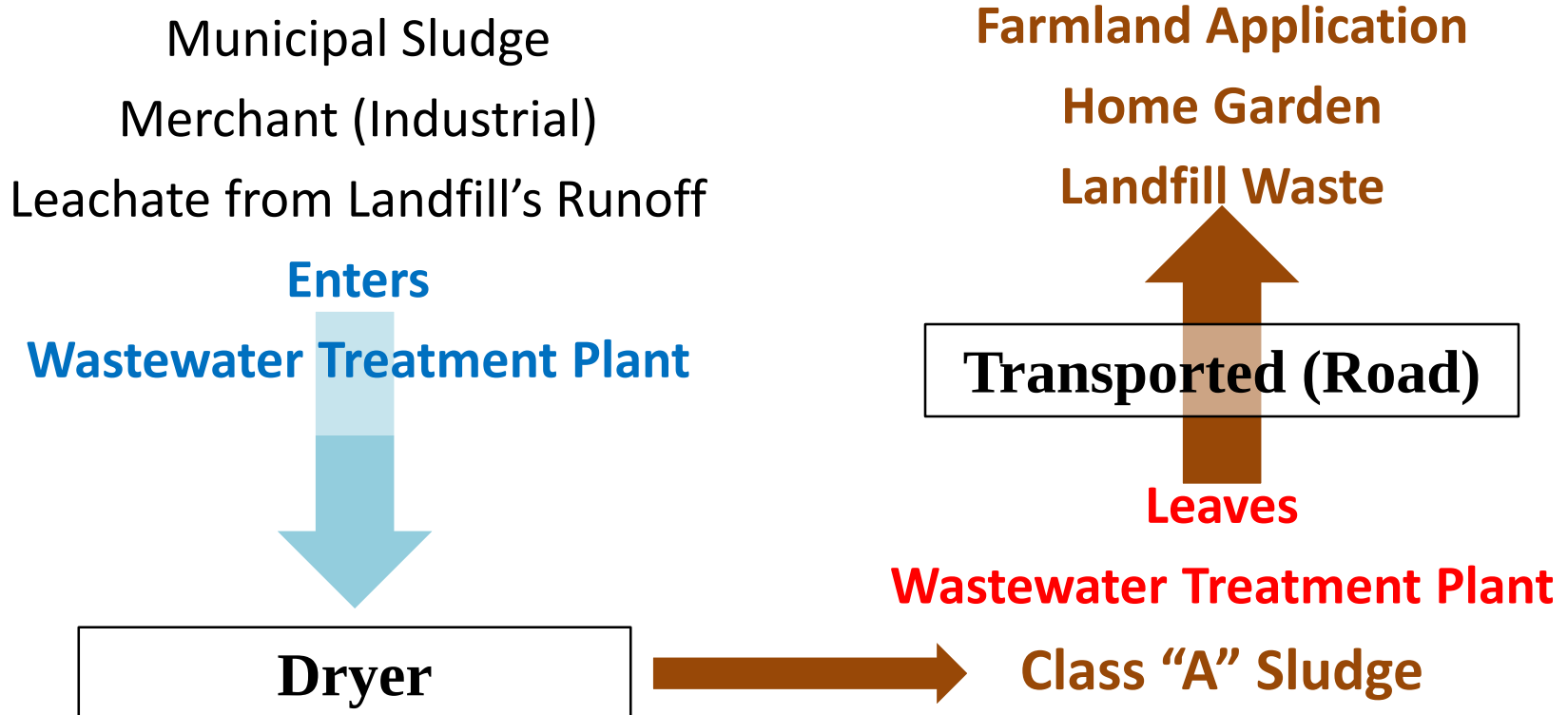




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PFAS Cycle with Drying



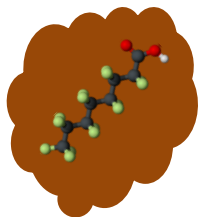


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PFAS with Drying (Class “A” Sludge)

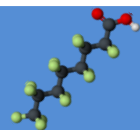
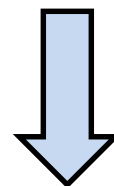
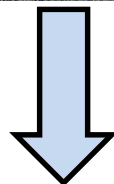
Low Temp



**Dewatered
Solids w/PFAS**

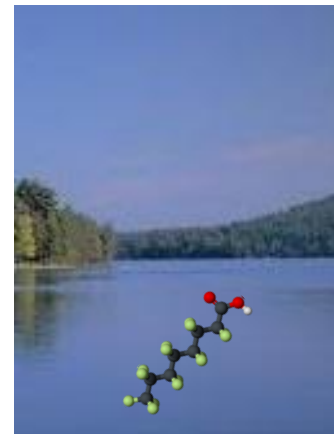


Drying



PFAS in water to waterways

Dirty Water





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PFAS Cycle in Wastewater

Municipal Sludge
Merchant (Industrial)
Leachate from Landfill's Runoff

Enters

Waster Treatment Plant



Thermo-Processor



Farmland Application
Waterways and Bodies
Municipal Solid Waste

Leaves

Waster Treatment Plant

Effluent Water

Class "A" Sludge



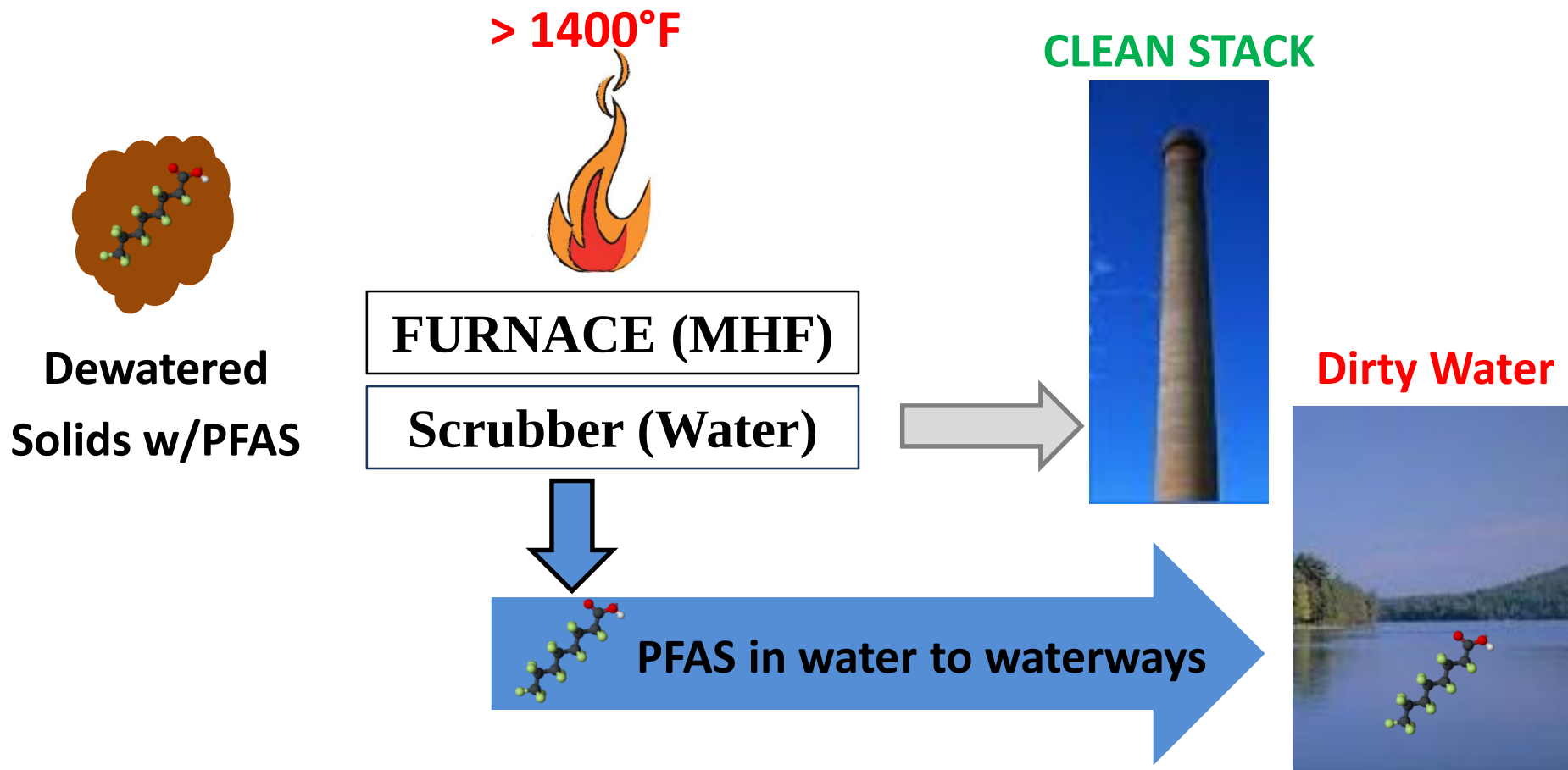
Environmental



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PFAS with Incineration

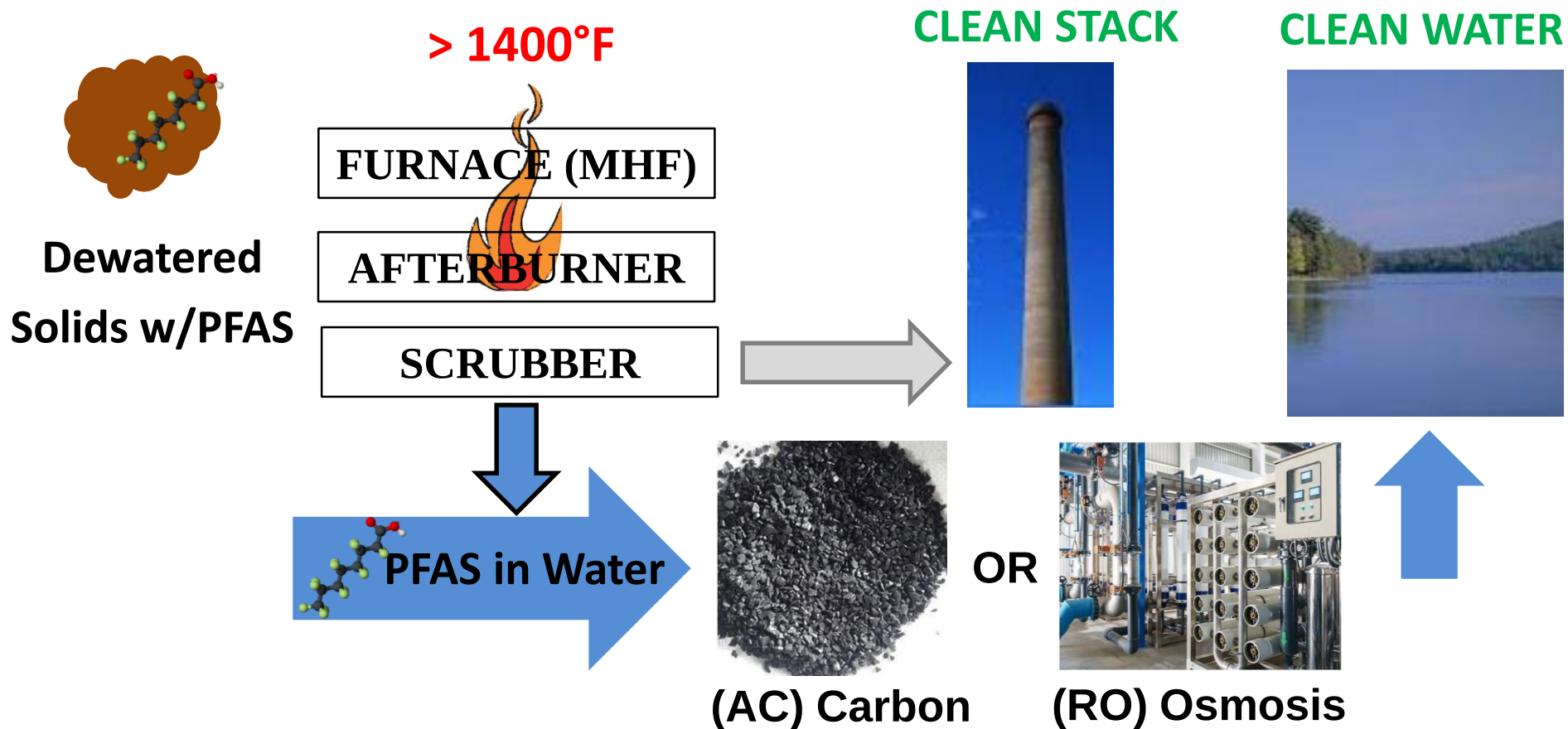




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Ideal Process for PFAS in Sludge



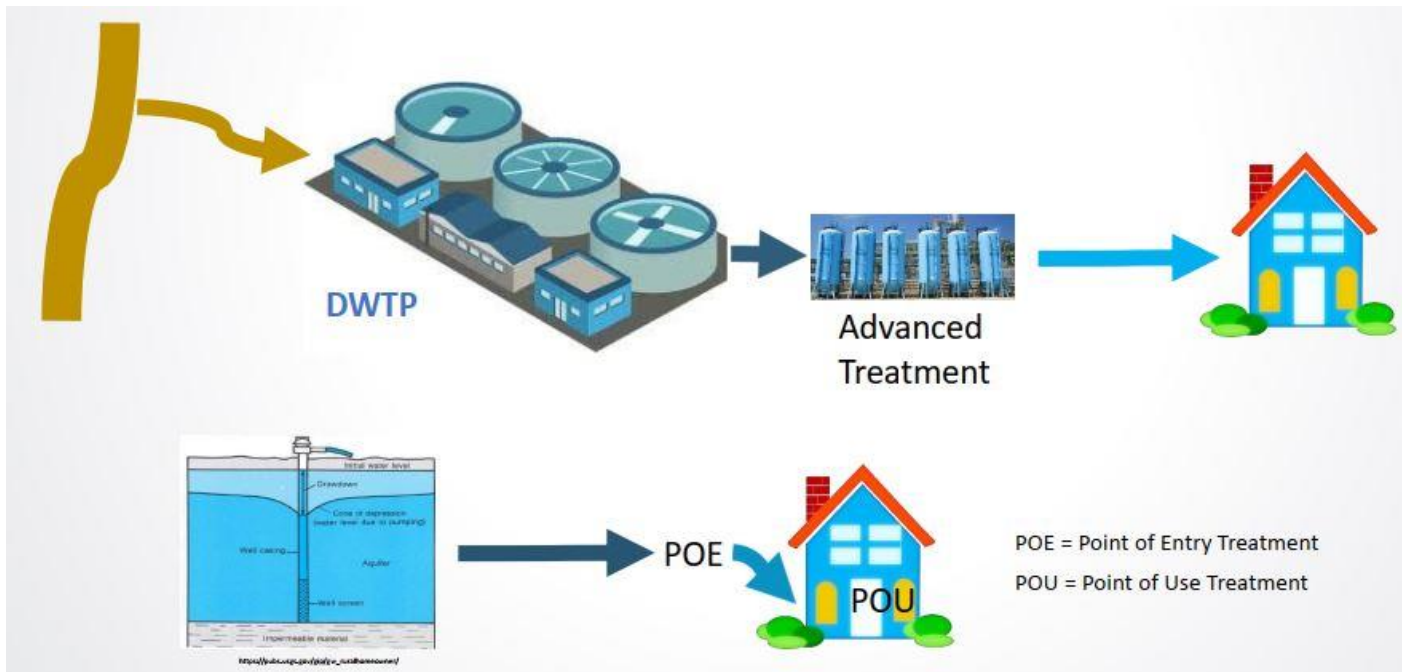


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PFAS Mitigation

Mitigation of PFAS will require a 2 Step Process

Step 1: Treat the drinking water to cut off the exposure route. \$\$\$





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PFAS Mitigation

Step 2: Manage the sources. \$\$



Manufacturing



Landfills



Residential



* Wastewater *

* Almost there with current technology *

“Coming Soon” This will effect your Industry



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PFAS Closing Statement

Is a **Man-Made Forever Chemical**

It is in our **water sources**

Transported to treatment plants via **water** and **sludge**

Can be broken down via **incineration**

Activated Carbon filters out up to 97% of PFAS chemicals

Need to mitigate it from the **source** before entering **water system**



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Closing Comments

THANK YOU

Questions