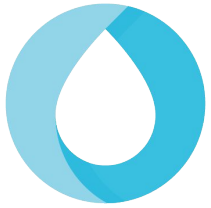

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WATER TECHNOLOGIES

THE VALUE OF SINGLE-SOURCE PROVIDERS OF EMERGING CONTAMINANT REMOVAL, INCLUDING PER- AND POLY-FLUOROALKYL SUBSTANCES

PRESENTERS

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Presentation Outline

- **Overview**
  - About Us
  - Environmental Compliance
  - Routes of Exposure
- **Solutions**
  - Why Carbon and Resin Work
  - PFAS Removal
  - Testing
  - Mobile Units
- **Case Studies**
- **Wrap-Up**
  - Comprehensive Portfolio
  - Next Steps

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About Evoqua

OUR KEY SECTORS

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Current Status of Environmental Compliance Regulation

Water

- EPA: Lifetime health advisory; final regulatory determination; Toxic Release Inventory (TRI) reporting obligation @ 100 lbs.
- State-by-state action levels, often more stringent.
- Congress: Monitoring legislation that would force the EPA to regulate PFAS at a faster pace (e.g. PFAS Action Act, BIF).

CERCLA

- Hazardous Substance: Monitoring potential indications for regulation as a “hazardous substance”, which could create a pathway for potential liability & cleanup provision (e.g., investigation/cleanup trigger at existing/future sites). Reactivation remains a viable option.
- Reportable Quantity: if releases occur, this could establish reporting obligation and state-specific cleanup levels.

Air & Waste

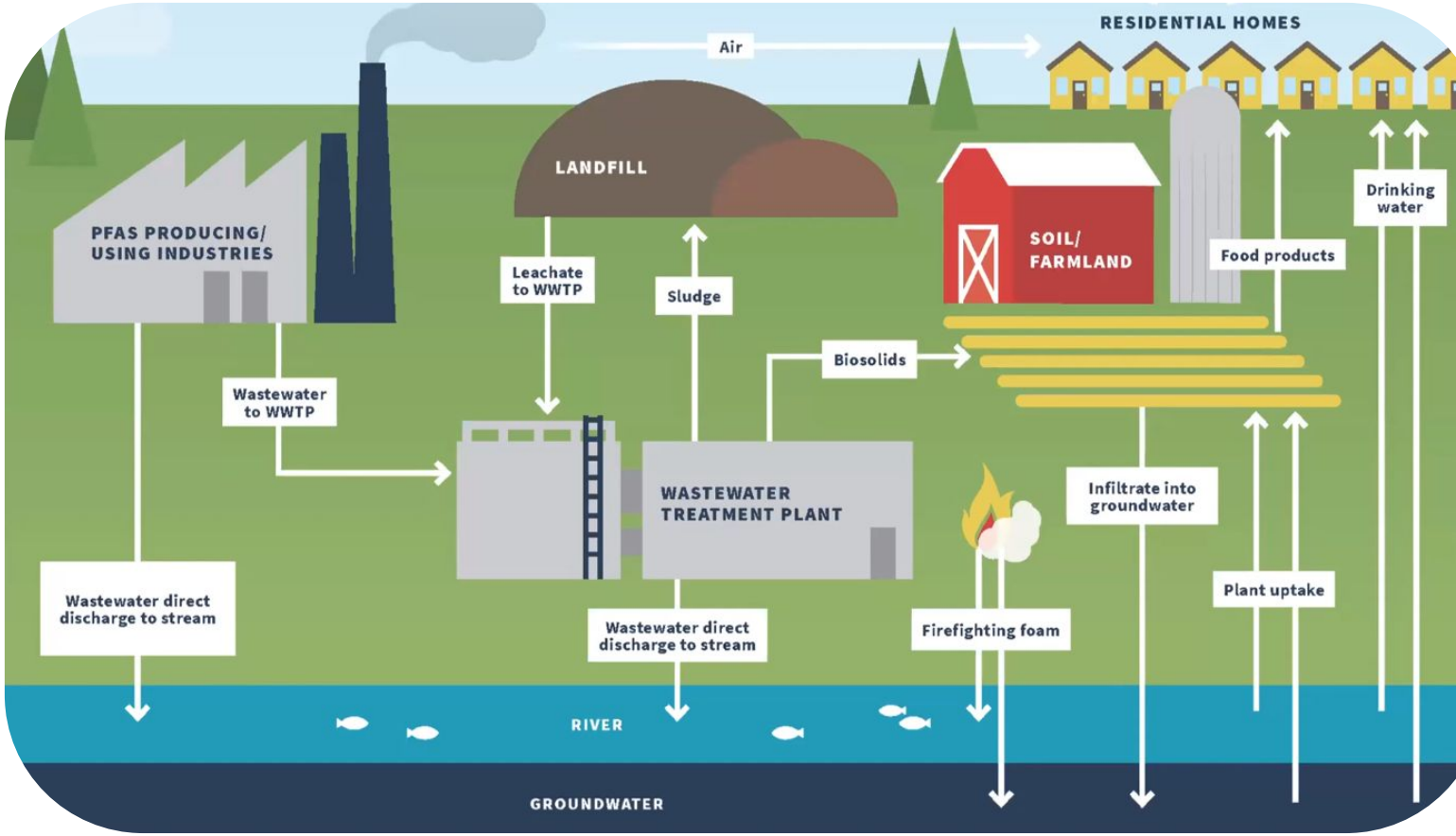
- Not a “Hazardous Waste” nor a “Hazardous Air Pollutant” nor a “Hazardous Substance”

EPA’s Interim Guidance (December 2020):

- Outcome of NDAA - not a rule or statement of policy.
- Limited data, test methods, and future projects/guidance are forthcoming.

Routes of Exposure/ Health Effects

- **Sources**
  - Manufacturer (primary producers)
  - Commercial applications
  - Landfill
  - Wastewater effluent
  - Firefighting foam applications
- **Exposure Routes**
  - Occupational exposure
  - Drinking water
  - Atmospheric transport; contaminated food, consumer products
- **Adverse health effects**
  - C8 Health Study
  - Thyroid disease, increased cholesterol, prenatal cancer, ulcerative colitis
  - Toxicology - Low birth weight, vaccine efficacy, altered puberty, skeletal variations, liver effects



SOLUTIONS

PFAS Removal Solutions

Adsorption - - - Separation

Granular Activated Carbon

- Named Best Available Technology by EPA for organic contaminant removal
- Removes other organic contaminants
- Minimal maintenance

Single Pass Ion Exchange

- Lower EBCT / Higher flowrate
- Small footprint
- No chemicals or liquid waste
- Spent resin can be incinerated
- Minimal maintenance

Membranes

- Highly effective
- Removes dissolved solids

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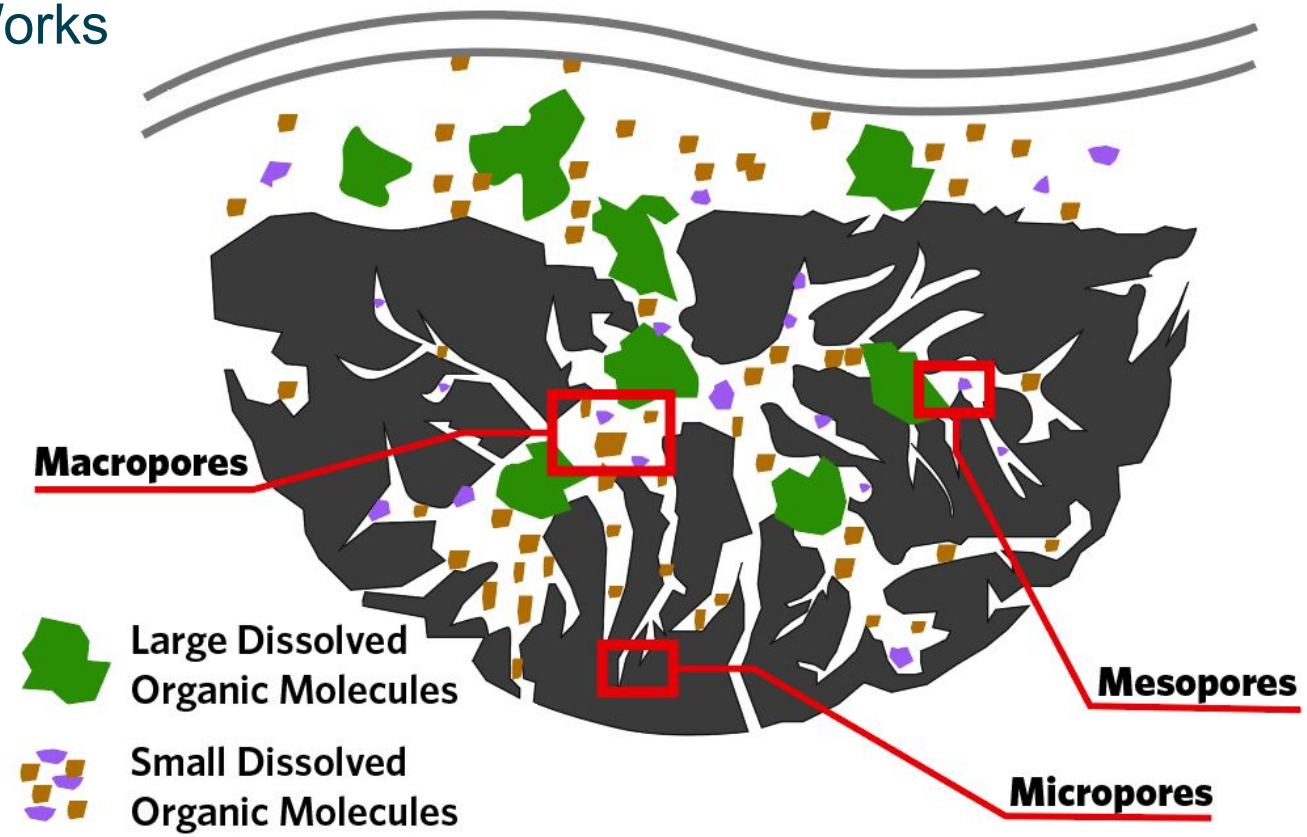
Why Granular Activated Carbon (GAC) Works

- GAC is a highly porous media with large surface area for contaminant adsorption.
- All carbon is not created equal.
- Performance determined by porosity and surface chemistry.
- Evoqua helps to match the user with the best performing GAC for their application.



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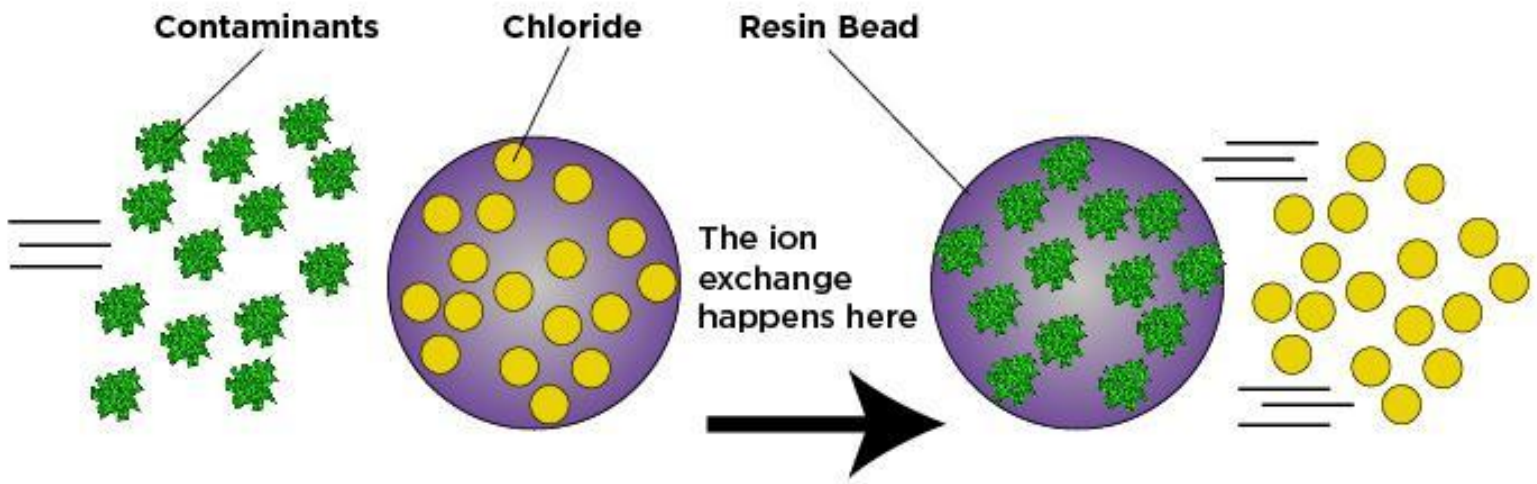
Why Ion Exchange (IX) Resin Works

- Ion Exchange is based on the principle of exchanging a harmless ion for the contaminant.
- Smaller system footprint if space is an issue.
- Lifecycle costs are easier to predict.
- Spent resin can be incinerated.



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Performance Testing

- Pilot (shown right) or bench scale testing can be used to test the effectiveness of the technology for contaminant removal before a full-scale system is installed for community's drinking water.

- Accelerated bench scale testing can simulate months of runtime within days.

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Mobile Units

When your operation cannot be interrupted

- Rapid or emergency response
- Temporary or semi-permanent installation

- More than drinking water applications …
    - Construction site water treatment (50-2000+ gpm)
    - Industrial process water
    - Industrial wastewater

- Footprint: variable / skid-mounted and tailored to site constraints

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CASE STUDIES

Water Treatment at Construction Sites – Contaminant Removal

- Lakefront development in West Michigan with a tight timeline
- A very high water table required quick response with a tight footprint
- Water tests uncovered PFAS at higher-than-accepted levels
- The City set the treatment goal to “non-detect”
- The treatment goal was met throughout the project

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Water Treatment at Construction Sites – Contaminant Removal

- Water tested positive for PFAS, metals and other inorganics
- Solutions tapped directly at the well head
- Mitigating PFAS, arsenic, mercury, others
- Cleaned effluent discharged into municipal sewer

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Temporary System in Colorado

Emergency Solution Installed To Mitigate Seasonal Taste & Odor Issues

- Seasonal taste and odor issues due to methyl-isoborneol (MIB) and geosmin
- Municipality was planning on designing a new facility, but wouldn't be available for several years. They needed a solution before the warmer seasons
- RSSCT testing validated a system consisting of GAC systems in parallel

Kennebunk, Kennebunkport & Wells Water District (KKWWD), Maine

Proactive, Tested Many Carbon Systems

- Evoqua advised KKWWD to pilot test several types of carbon to determine which performed best given their local water chemistry.
- The results showed that the Evoqua's carbon made from coconut provided an additional 3 months of full scale run time, versus other carbons.
- KKWWD installed a full-scale high pressure vessel system to remove PFAS from the water.

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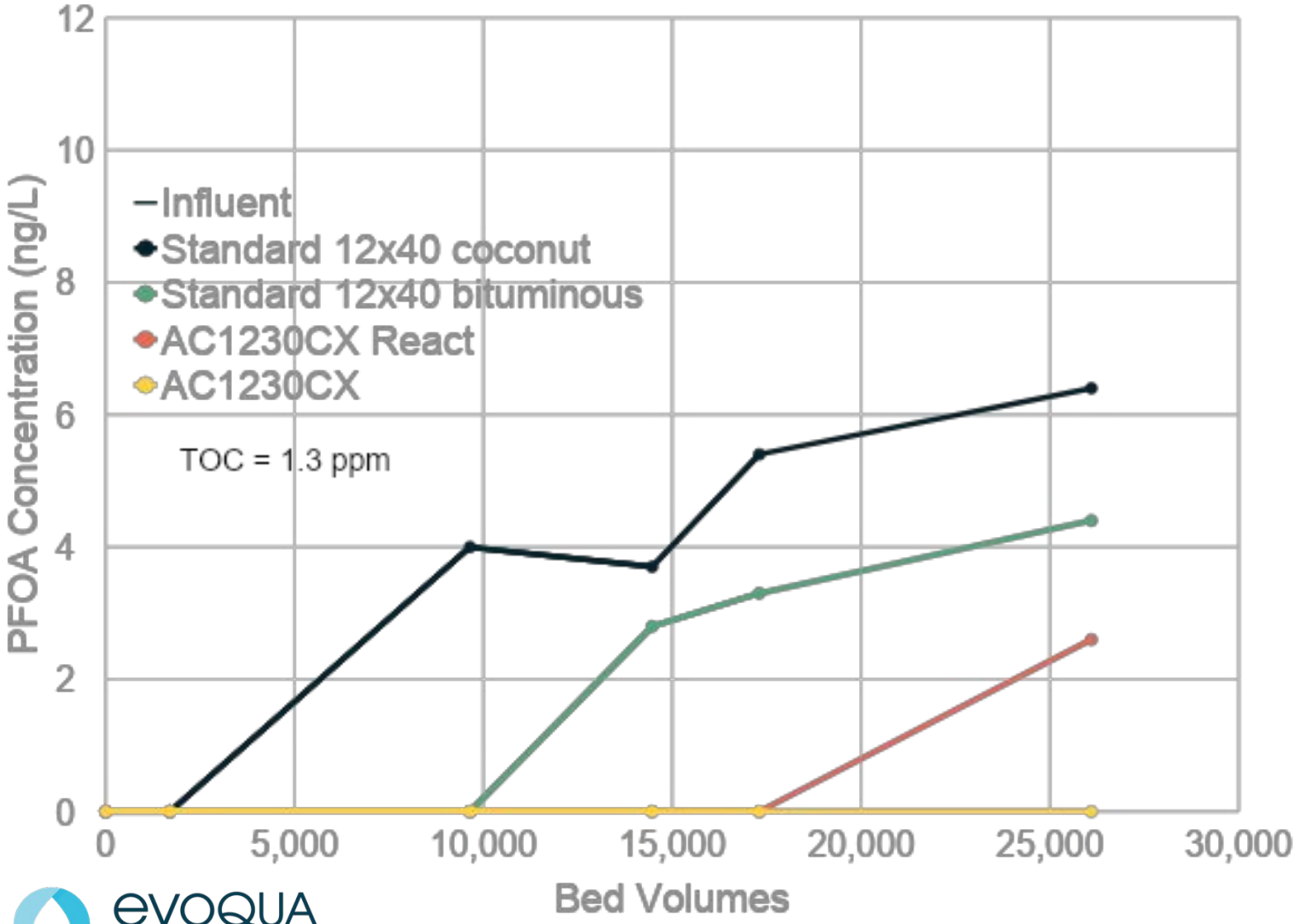
KKWWD: GAC Pilot Investigation



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KKWWD: GAC Installed Solution

- Single 12’ sand filter vessel
- One lead/lag GAC system
- 12’ diameter vessels
- 34,700 lbs AquaCarb®1230 CX media
- 10 minute EBCT design/8 min EBCT actual
- Outdoor installation
- Custom-Segregated React and Return can save 30% on carbon rebeds
- Septa design allows for built in flexibility

Right: Interior lining of GAC vessel with Septa underdrain design

KKWWD – Online In Time For Tourists With Minimal Impact to Ratepayers

- "Our goal now is to continuously produce drinking water with non-detect levels," says KKWWD, Superintendent. **"With Evoqua's lead-lag system we should have no problem."**

- **The impact to ratepayers is roughly three to four cents per day**, according to Labbe, and they won't see the increase for several years.

- "It's still cheaper than buying water from an outside water utility, and **it keeps us independent**,".

https://www.seacoastonline.com/news/20180118/kkwwd-shuts-down-well-due-to-pfc-levels

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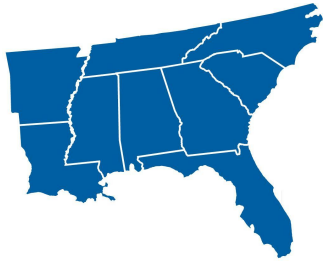
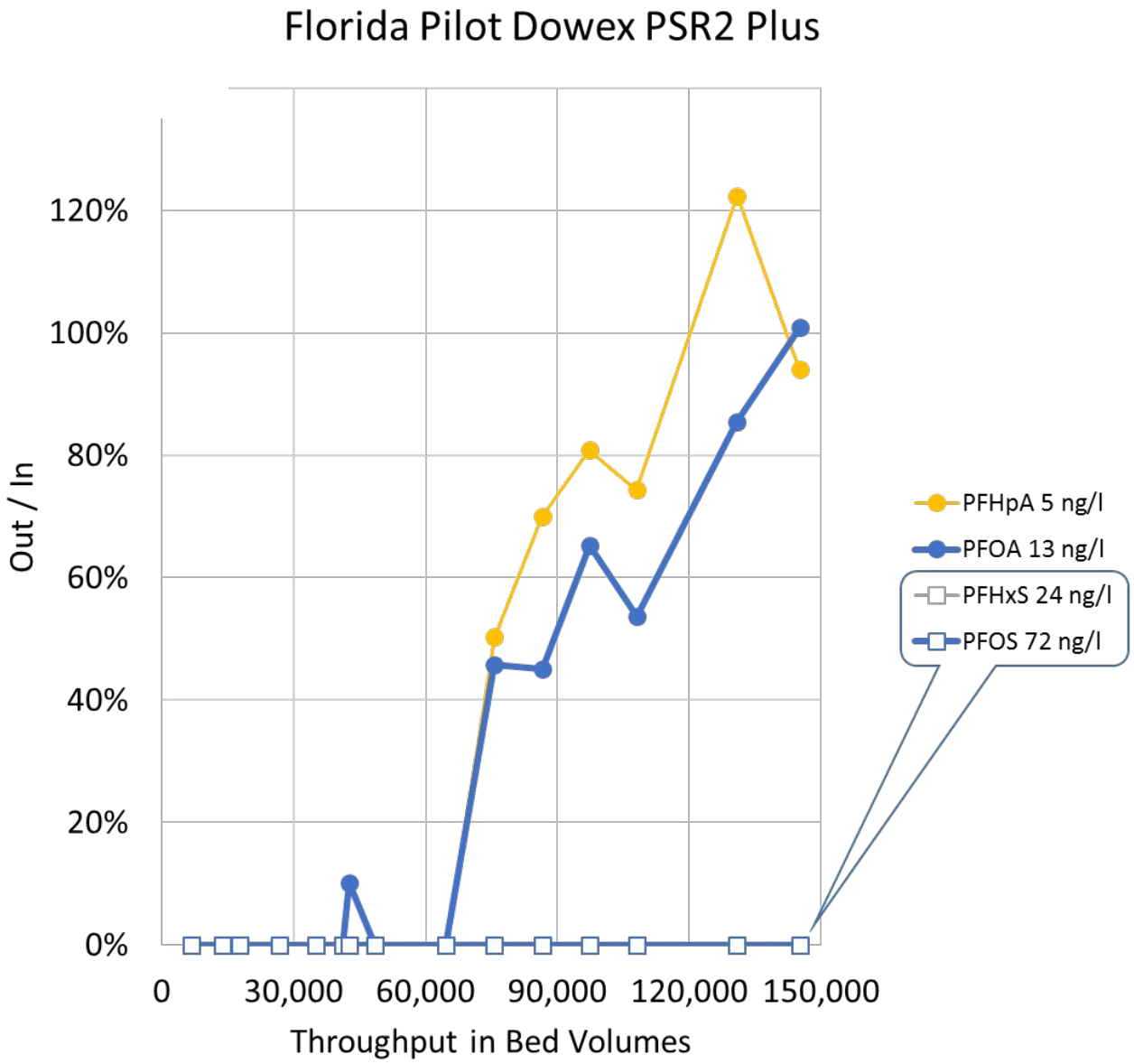
Southeast US High TOC GW

- GW affected by PFOA/PFOS
- Drinking water source; unknown confirmed source of contamination
- Influent concentrations >EPA LHA
- Opportunity brought by relationship with engineering firm
- Challenging Water: TOC: 14 ppm
- Treatment objective: <10 ppt
- Pilot (shown right); GAC and IX



GAC & IEX Pilot Results

- Initial piloting effort supported IEX; not suited to GAC
- Resin turned black within 24 hours yet still provided removal
- Moved to full scale comparison with IEX with several providers/configurations



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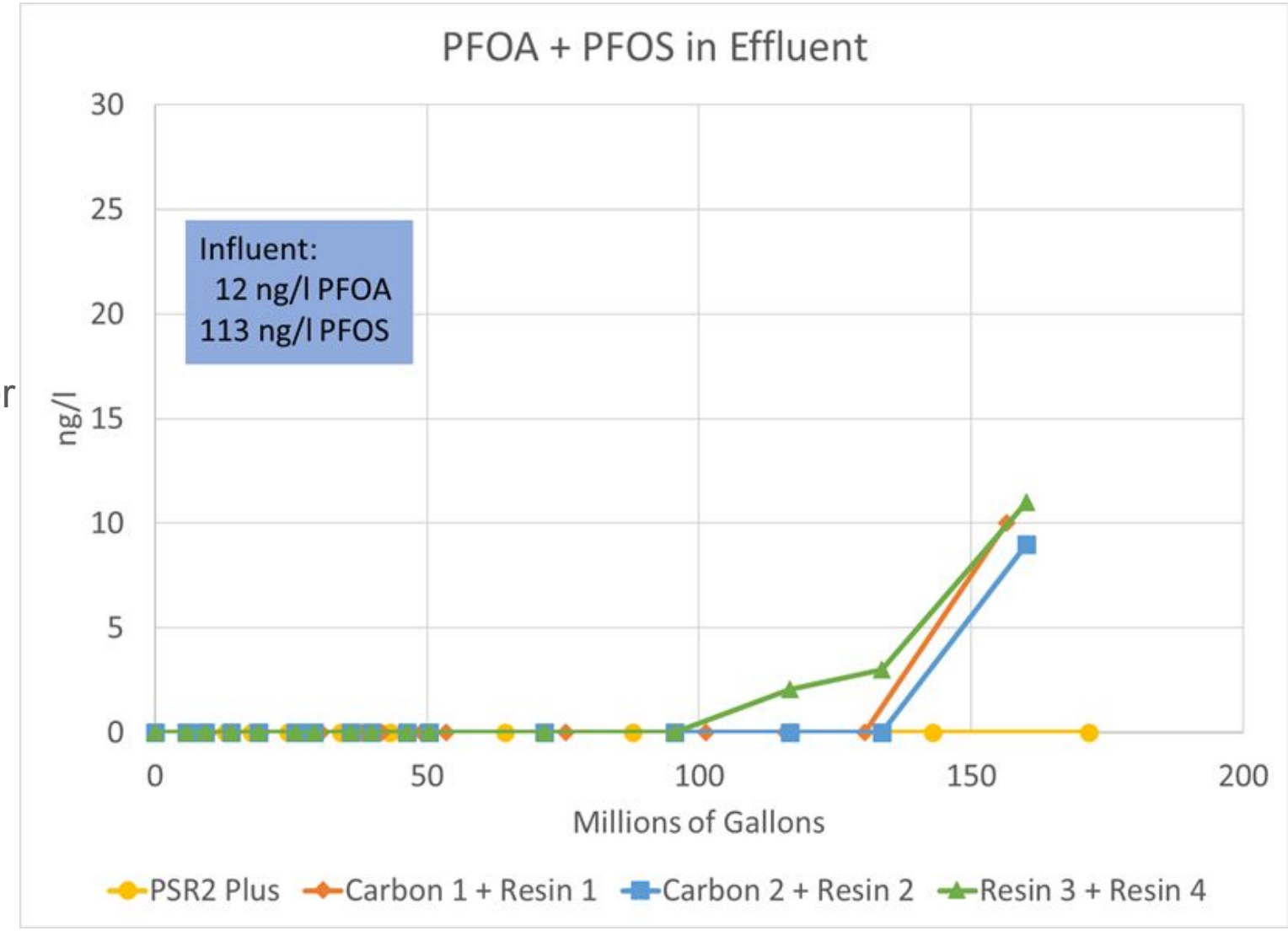
Full-Scale Study

- Full scale comparison of 4 different resins
- Septa Design spec'd to provider greater flexibility
- The superior treatment configuration: Evoqua's using the PSR2 PLUS resin
- Greater volume of water treated before media exhaustion



Wrap-Up

Portfolio – Comprehensive Solutions

Unbiased Technology, Start to Finish

- Temporary mobile assets for rapid deployment providing treatment today
- Treatability studies – identifying the optimal technology train for each customer
- Permanent solution
- Servicing network – 85% of the US pop. within 2 hours
- Reactivation services / disposal know-how

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Next Steps

1. Assess risk
   - Regulatory requirements (geographical, temporal, activity type)
   - Brand protection concerns

2. PFAS sampling and analysis
   - SOPs, NELAP/DOD QSM, MDLs vs MRLs

3. Remedial alternatives
   - Lifecycle costs, destructive technology vs concentration methods, disposal methods

4. Testing methodologies
   - Pilot, RSSCT, Lifecycle costs, destructive technology vs concentration methods, disposal methods

Summary: Your Water Is Unique

A Customized Solution Just For Your Community Based On Local Water Conditions

And Now….Time For Your Questions

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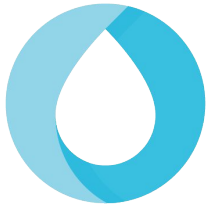

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THANK YOU