



PFAS GROUNDWATER SAMPLING – CASE STUDY

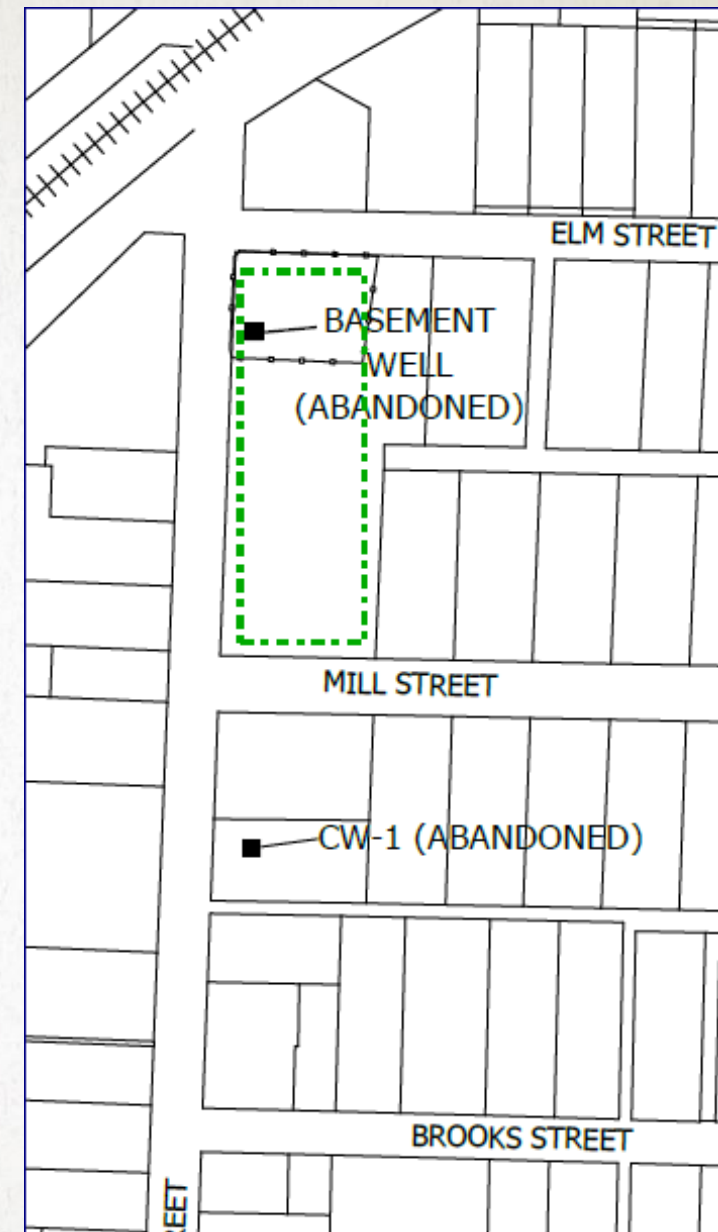
**ANTHONY MOORE
ENVIRONMENTAL WORKS, INC.
EFO CONFERENCE 2022**

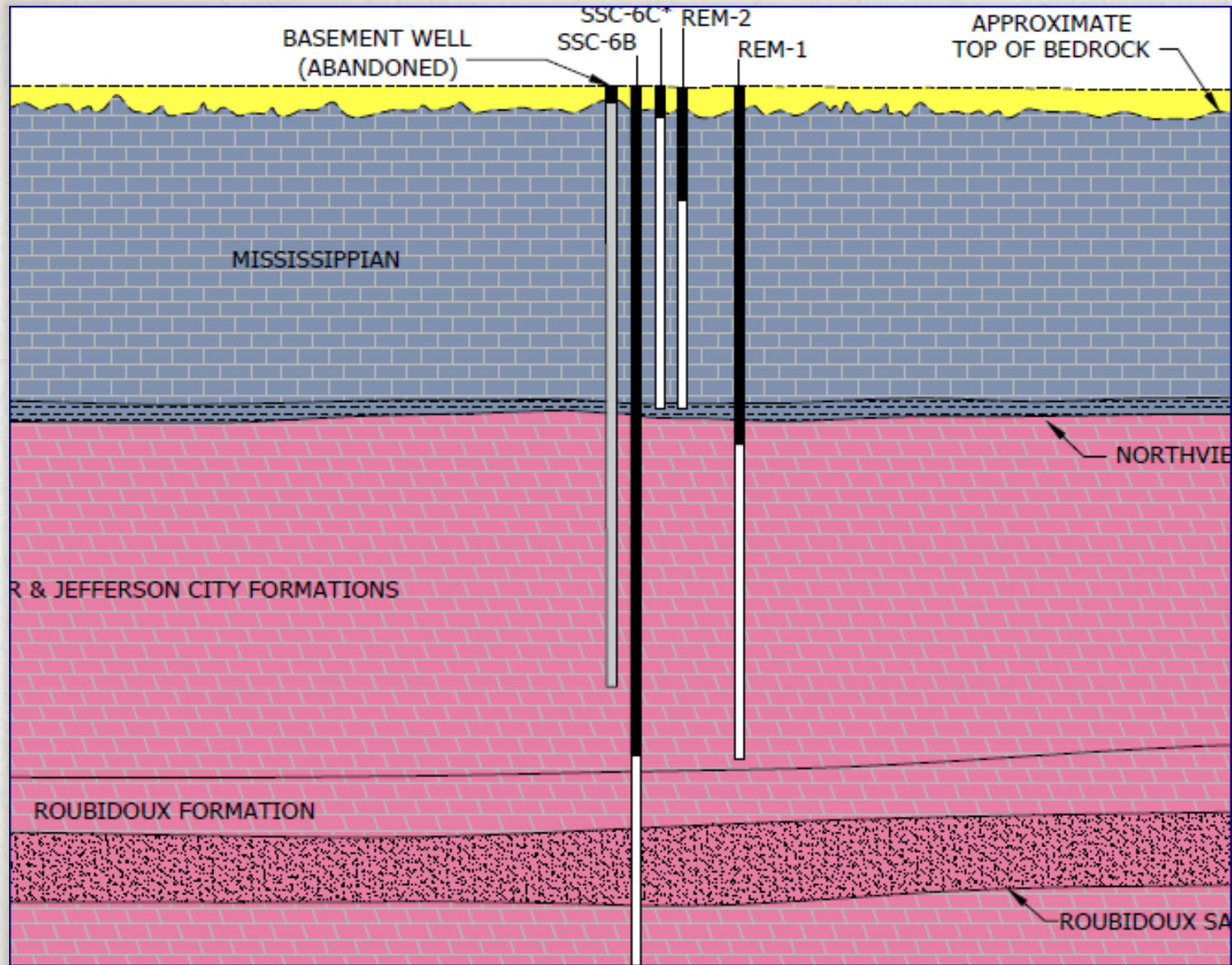
PRESENTATION OUTLINE

- Site History and Background
 - PFAS Sampling Request
 - PFAS Analysis Methods
 - PFAS Sampling Procedures
 - PFAS Sampling Results and Next Steps
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SITE BACKGROUND AND HISTORY

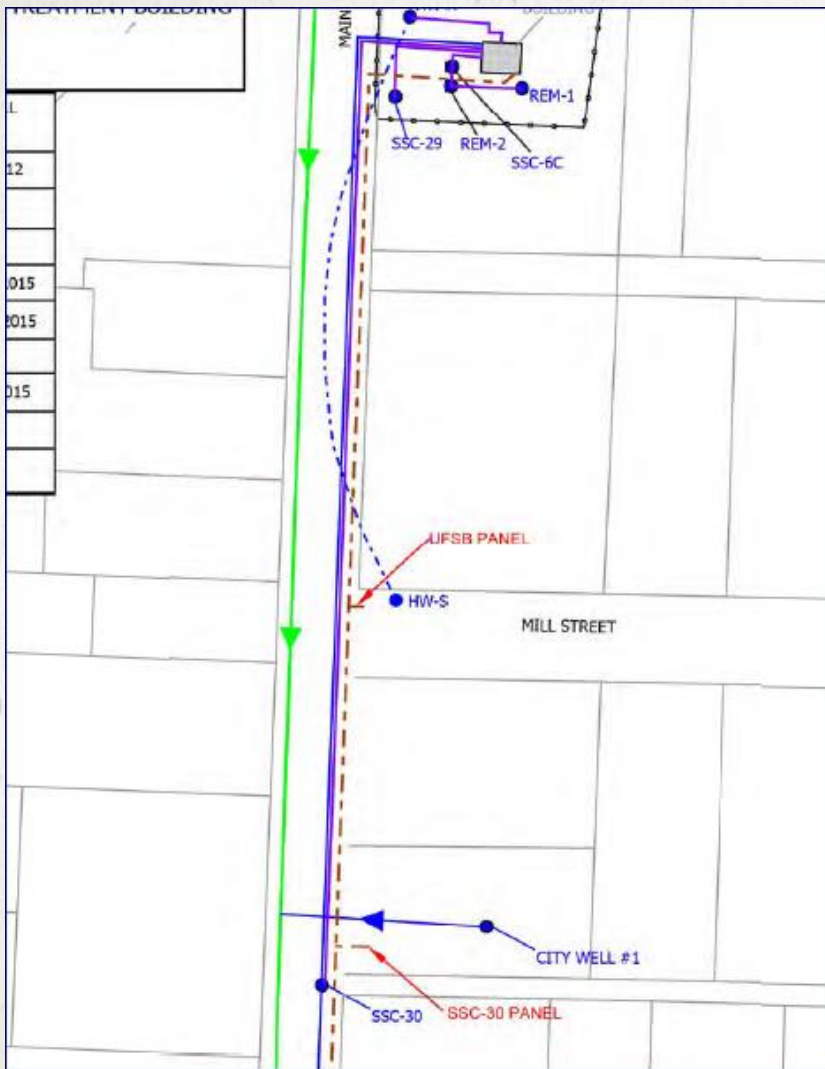
- Manufactured printed circuit boards from 1968 - 1973
- Contamination discovered in 1982 at city drinking water well approximately 750 ft south of the site
- Completed Remedial Investigation from 1988 – 1990
 - Surface soil, subsurface soil, surface water, and groundwater sampling (over 400 samples)
 - Multiple surface geophysical surveys to identify karst features
 - Installed 33 monitoring wells
 - Borehole geophysical surveys and extensive hydraulic testing at 11 bedrock wells
 - Two dye trace tests



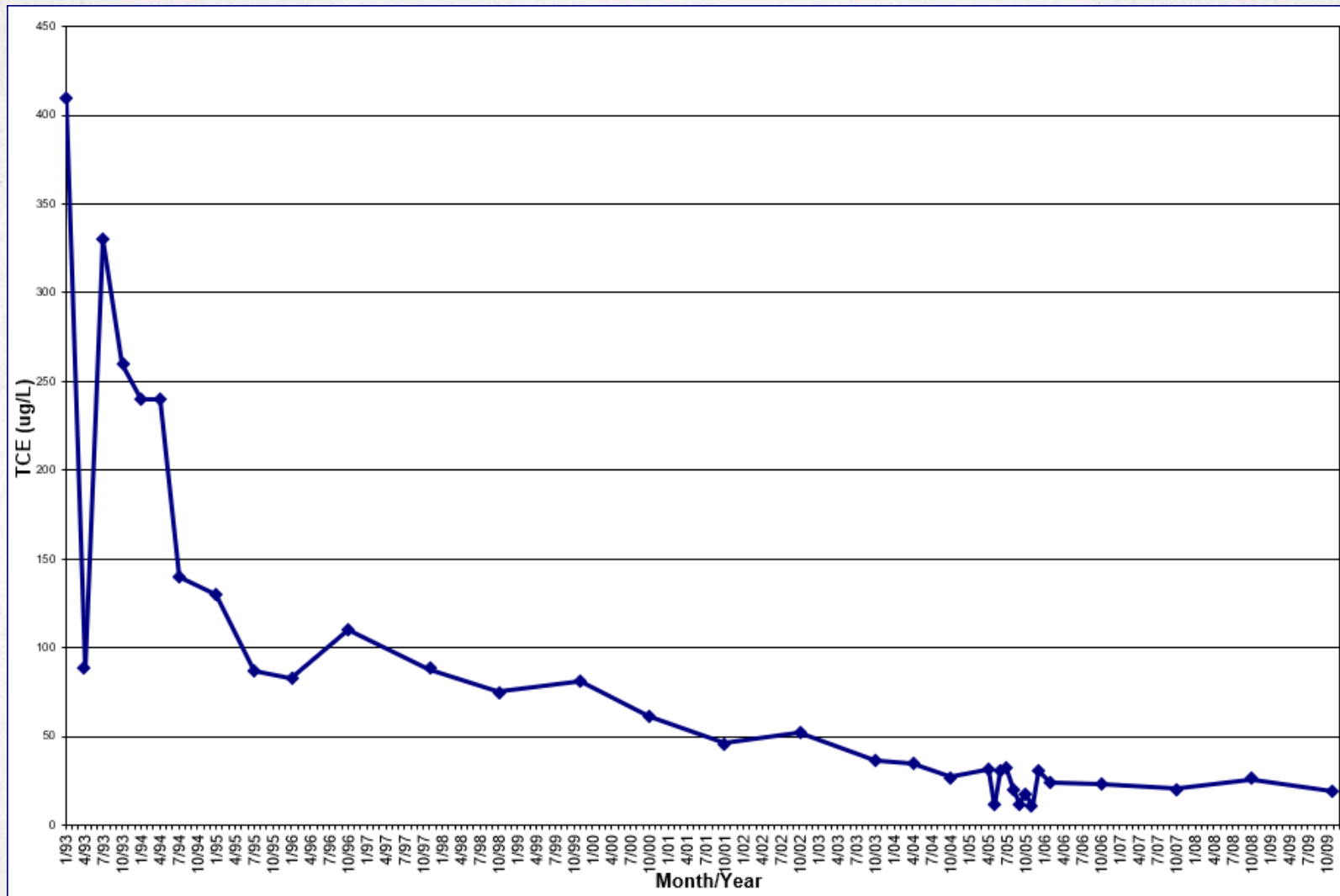


SITE BACKGROUND AND HISTORY

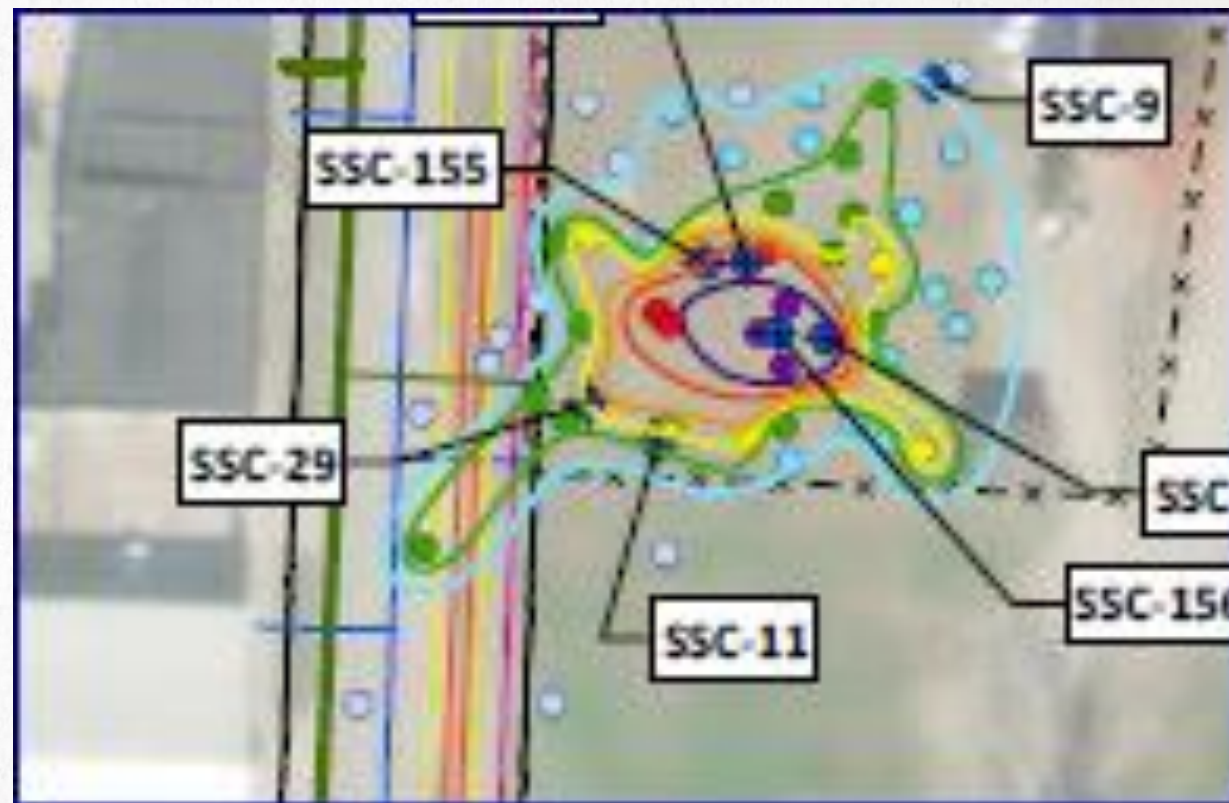
SITE BACKGROUND AND HISTORY



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PFAS SAMPLING REQUEST

- Agencies requested a limited PFAS investigation because PFAS were used in the manufacture of electronic circuits and may warrant consideration in next five-year review.
- Although no evidence that PFAS were used at the site, it was agreed to analyze for specific PFAS that were used at some circuit board manufacturing facilities from 1968 – 1973, specifically, PFOA and PFOS.
- Approximately one year later, the Agencies requested that PFAS samples be analyzed for the full method reporting list, including...
 - PFAS that are not associated with circuit board manufacturing,
 - Were not developed or commercially available until after 1973, and
 - Do not have risk-based screening levels against which the results can be compared.



PFAS ANALYSIS METHODS

Method 533

Method 537.1

Method 8327

Method 1633

ASTM, ISO, DoD

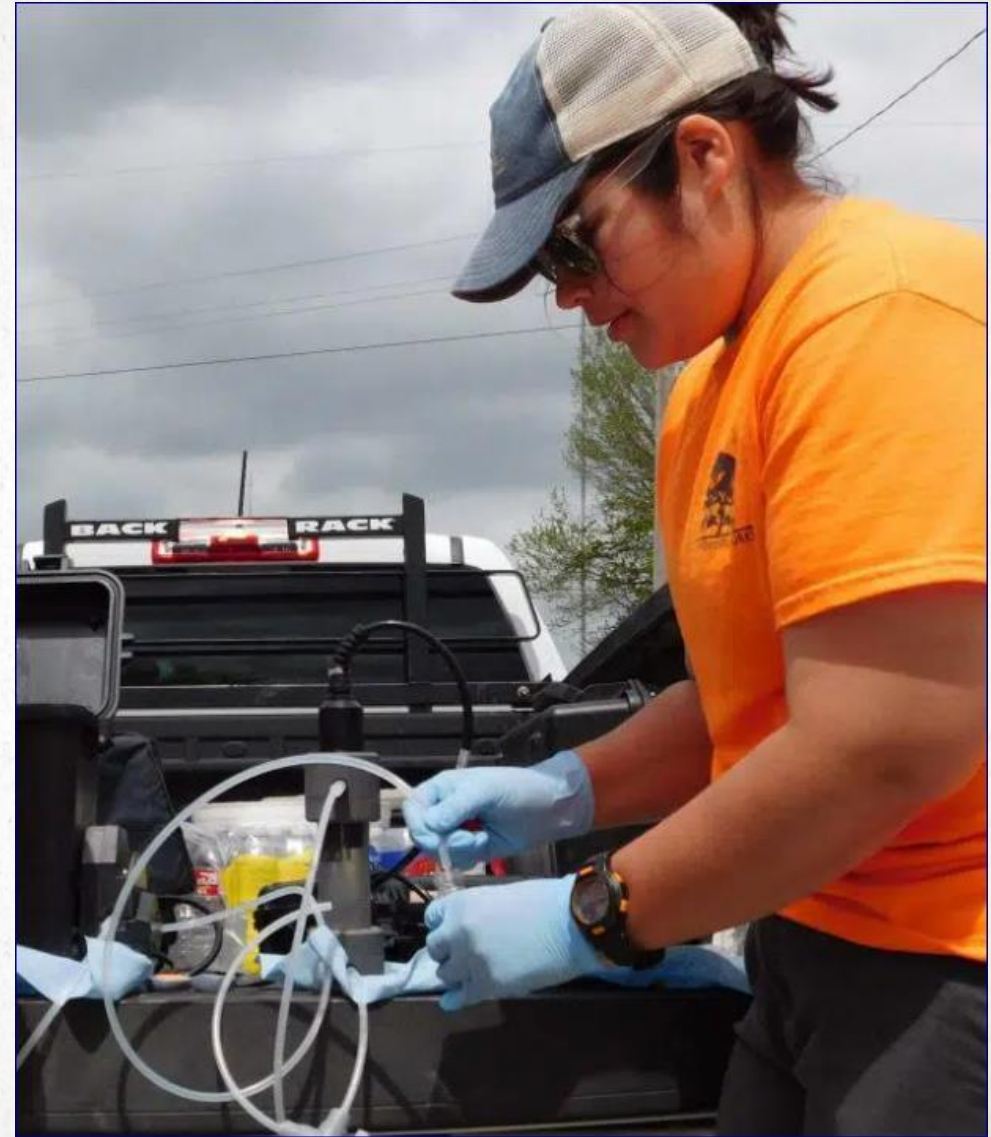


PFAS ANALYSIS METHODS

- Drinking Water
 - Method 537/537.1
 - 537 developed in 2009 for 14 compounds
 - Revised to 537.1 in 2018 to include 4 addtl GenX compounds
 - Method 533
 - Developed in 2019 to include multiple short-chain compounds that cannot be measured by 537.1
 - Isotope dilution for drinking water
 - 25 compounds, including 11 not in 537.1
- Non-Potable Water
 - ASTM D7979-19
 - First validated method using LC/MS/MS
 - Developed through EPA Region 5
 - Method 8327
 - Finalized in November 2021
 - Similar to ASTM D7979, but no isotopic dilution
 - Method 1633
 - Draft method for 40 compounds in multiple media
 - EPA and DoD collaboration
 - TOF and Fluorine Screening Methods

PFAS SAMPLING PROCEDURES

- SOP Development
 - Sampling processes – generally the same
 - No – Teflon, Gore-Tex, fabric softeners, sunscreen, powdered nitrile gloves, Tyvek, etc.
 - Yes – HDPE, PVC, Rite in the Rain books, pens,alconox, etc.
 - 3 x 15 mL tubes, 4°C ± 2°C, 14 day prep time, 28 analysis time, no trip blank but duplicate and MS/MSD



PFAS SAMPLING RESULTS AND NEXT STEPS

- Sampling locations – source area and up-gradient, all hydrogeologic zones
- Results compared to RSLs. Did not compare to HAs b/c not applicable and in ppq range, below reporting limits
- Multiple compounds reported, but most are GenX compounds, not related to historical operations, or developed after site operations
- PFOA and PFOS were reported, but below RSL
- Perform second sampling event to confirm results
- Purge water disposal

| Well ID Sample Type Sample Date | | | MW-7 N 5/31/2022 | SSC-11 N 6/3/2022 |
|---|--------------|-------|------------------------|-------------------------|
| Analyte | Abbreviation | RSL | | |
| Hexafluoropropylene Oxide Dimer Acid | HFPO-DA | 60 | < 50 | 610 |
| Perfluorooctanesulfonic Acid | PFOS | 40 | < 9.9 | < 10 |
| Perfluoroundecanoic Acid | PFUnA | NE | < 50 | < 50 |
| N-Methylperfluorooctanesulfonamidoacetic Acid | N-MeFOSAA | NE | < 50 | < 50 |
| Perfluoropentanoic Acid | PFPeA | NE | < 50 | 59.0 |
| Perfluoropentanesulfonic Acid | PFPeS | NE | < 9.9 | < 10 |
| Fluorotelomer Sulphonic Acid 6:2 | FtS 6:2 | NE | < 50 | 110 J+ |
| N-Ethylperfluorooctanesulfonamidoacetic Acid | N-EtFOSAA | NE | < 50 | < 50 |
| Perfluorohexanoic Acid | PFHxA | NE | < 50 | < 50 |
| Perfluorododecanoic Acid | PFDoA | NE | < 50 | < 50 |
| Perfluorooctanoic Acid | PFOA | 60 | < 9.9 | 12.0 J+ |
| Perfluorodecanoic Acid | PFDA | NE | < 50 | < 50 |
| Perfluorodecanesulfonic Acid | PFDS | NE | < 9.9 | < 10 |
| Perfluorohexanesulfonic Acid | PFHxS | 390 | < 50 | < 50 |
| Perfluorobutanoic Acid | PFBA | NE | < 50 | < 50 |
| Perfluorobutanesulfonic Acid | PFBS | 6,000 | 12.0 | < 10 |
| Perfluoroheptanoic Acid | PFHpA | NE | < 50 | < 50 |
| Perfluoroheptanesulfonic Acid | PFHpS | NE | < 50 | < 50 |
| Perfluorononanoic Acid | PFNA | 59 | < 9.9 | < 10 |
| Perfluorotetradecanoic Acid | PFTeA | NE | < 50 | < 50 |
| Fluorotelomer Sulphonic Acid 8:2 | FtS 8:2 | NE | < 50 | < 50 |
| Perfluorononanesulfonic Acid | PFNS | NE | < 50 | < 50 |
| Perfluorotridecanoic Acid | PFTriA | NE | < 50 | < 50 |
| Perfluorooctanesulfonamide | PFOSA | NE | < 9.9 | < 10 |
| 9CI-PF3ONS | 9CI-PF3ONS | NE | < 9.9 | < 10 |
| Fluorotelomer Sulphonic Acid 4:2 | FtS 4:2 | NE | < 50 | < 50 |
| 11CI-Pf3OUdS | 11CI-Pf3OUdS | NE | < 9.9 | < 10 |
| 4,8-Dioxa-3H-perfluorononanoic Acid | DONA | NE | < 9.9 | < 10 |



QUESTIONS???

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