In Situ PFAS Smoldering Demonstration

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Agenda

- Introduction to PFAS
- DoD Funding Program
- Technology Overview
- Demonstration Status
- Summary

Introduction to Per- and Polyfluoroalkyl Substances (PFAS)

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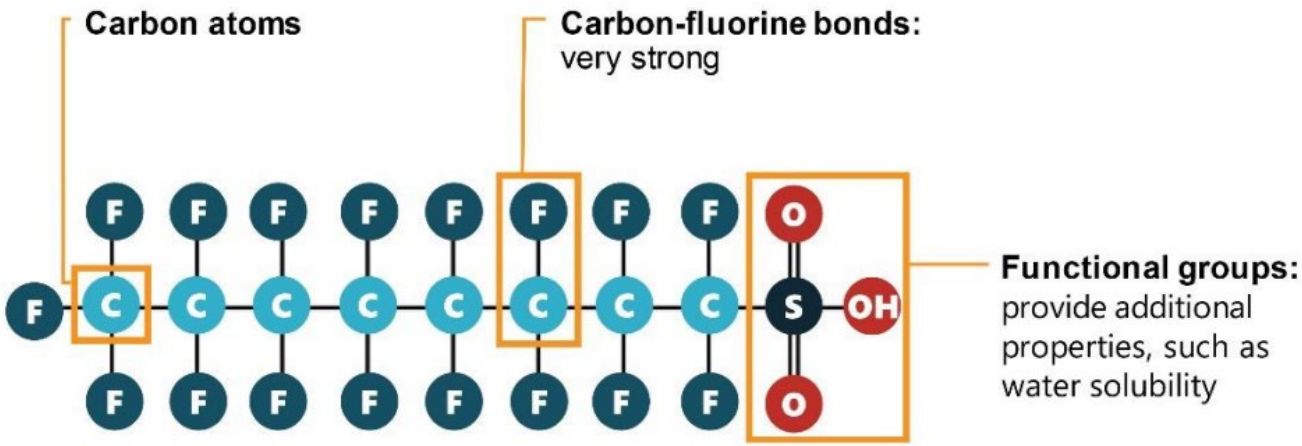
Per- and Polyfluoroalkyl Substances (PFAS)

- Large group of synthetic chemicals used in a wide range of applications, including firefighting foams
- Persistent in the environment and challenging to remediate due to strong carbon-fluorine bond



(AAAS, 2021)

Department of Defense (DoD) Environmental Technology Programs

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DoD Environmental Technology Programs

SERDP
DOD ▪ EPA ▪ DOE

Science and Technology

- Strategic Environmental Research and Development Program (SERDP)
- Fundamental research to impact real world environmental management

ESTCP

Demonstration and Validation

- Environmental Security Technology Certification Program (ESTCP)
- Transition innovative technologies from the lab to the field

>$300M invested on PFAS since 2011

Technology Overview

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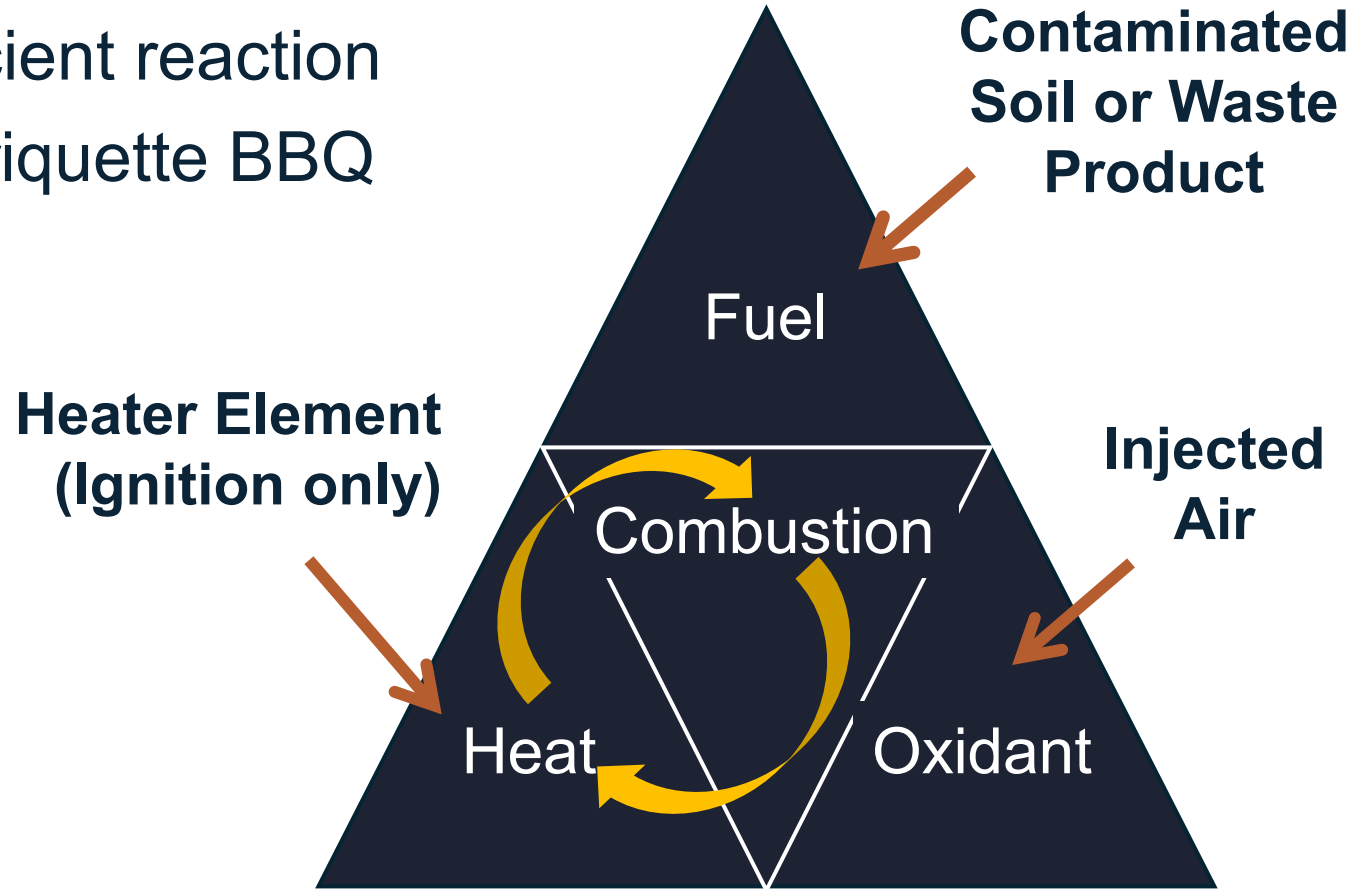
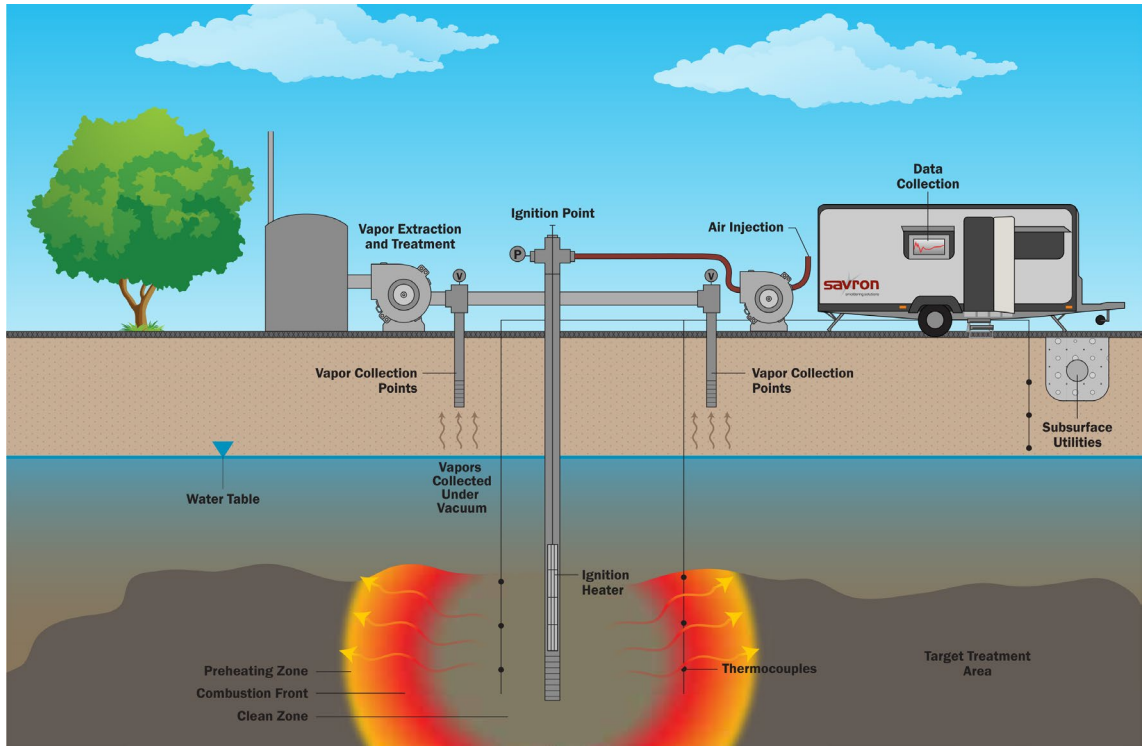
Smoldering Combustion

- Flameless, energy efficient reaction
- Similar to a charcoal briquette BBQ



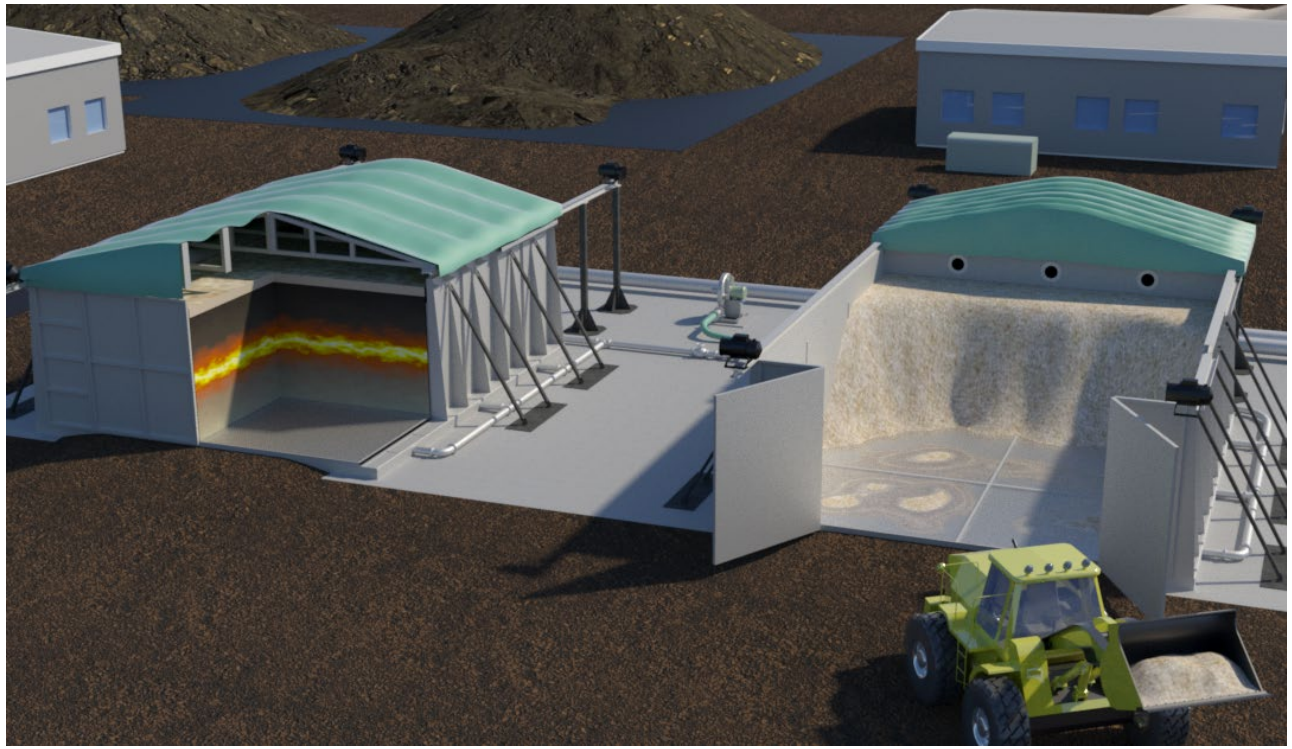
STAR

- **In situ (below ground)**
  - Applied via ignition points and portable heaters



STARx

- **Ex situ (above ground)**
  - Applied via engineered soil pile systems



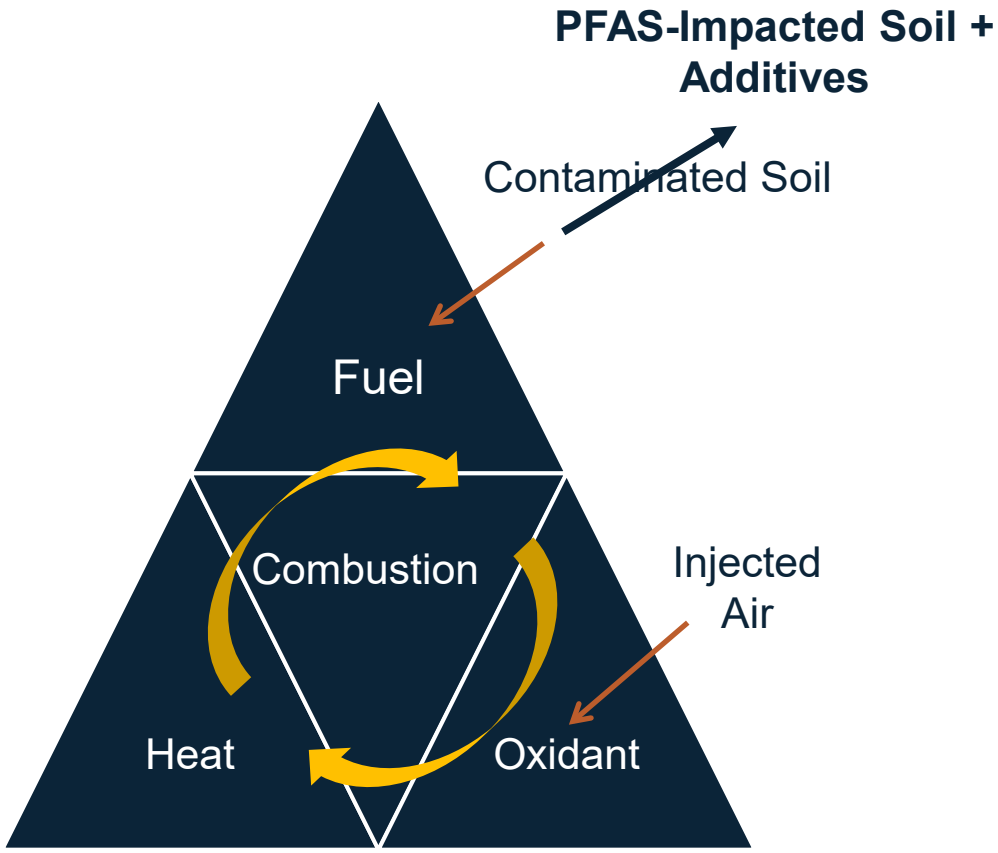
STAR

STARx

Full scale systems implemented at sites around the world for treating hydrocarbon-impacted soils and sludges

PFAS Smoldering

Same energy-efficient, flameless form of combustion as used for hydrocarbon applications



- **Carbon-based additive** (e.g., granular carbon): used as fuel to sustain reaction and reach the high temperatures required for PFAS destruction
- **Calcium-based additive** (e.g., Quicklime): used to improve PFAS destruction and minimize byproducts in emissions

Ex Situ PFAS Smoldering

- Full-scale demonstration completed at Joint Base Elmendorf Richardson (JBER) in Alaska
- Treated 440 yd^3 of PFAS-impacted soil to below Alaska soil cleanup criteria
- Successful PFAS **destruction** using mobile smoldering system
- Commercially available technology

Revegetation Study

	Treated	Treated + Compost	Treated + Fertilizer
July 1 2024			
Aug 21 2024			

Joint Base Cape Cod Demonstration

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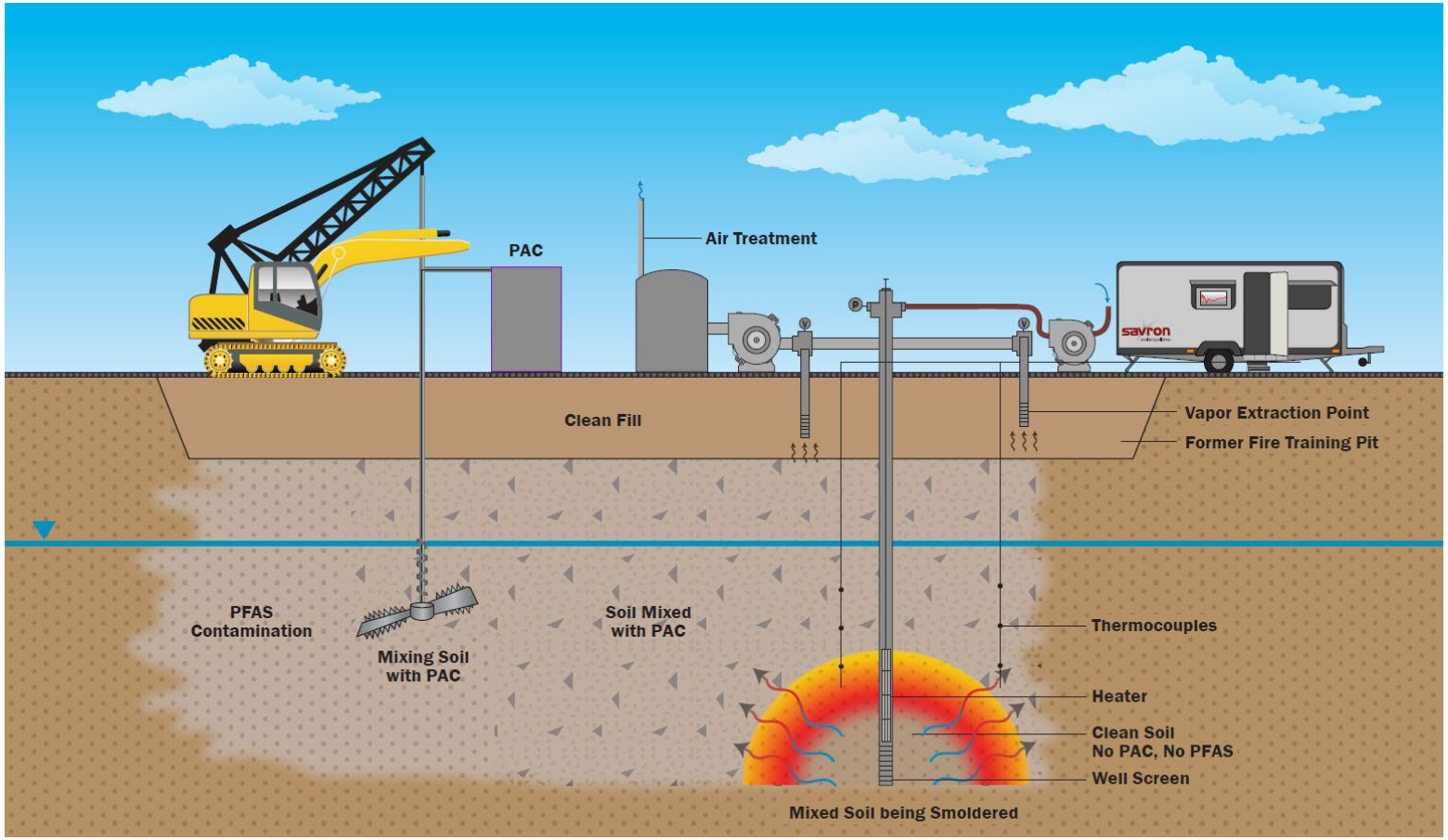
In Situ PFAS Smoldering



- Demonstration of PFAS destruction in source zone at Joint Base Cape Cod FTA-1
- In situ soil mixing for powdered activated carbon (PAC) and calcium additives
- **4** ignition points, **650 yd^3** soil volume

Cap Installation (Fall 2024)

In situ soil mixing of carbon and calcium additives

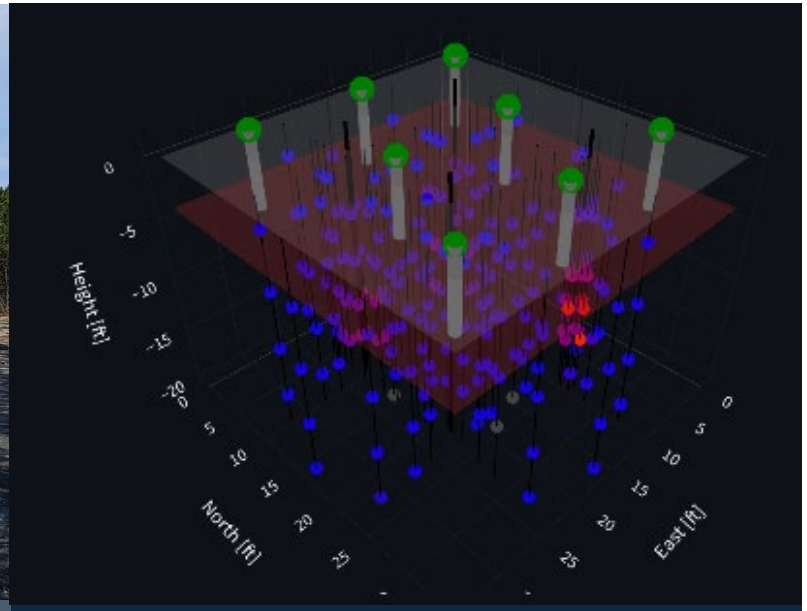
Gravel and soil layer added and compacted

Placed **asphalt vapor cap**

Cell Installation (June 2025)

Drilling install: 4 ignition points,
8 vapor extraction points,
60 multilevel thermocouples

Connection of **above-ground equipment**



Deployment of **data management systems**

Current Status

- First round of operations complete (July 2025)
- Successful smoldering ignition achieved
- Emissions samples collected by third party contractor
- Some challenges with horizontal propagation observed
- Currently reviewing data and potential operational modifications

Summary

Summary

- PFAS can be successfully destroyed using smoldering
- Mobile ex situ treatment system recently demonstrated in Alaska to treat PFAS-impacted soil stockpile
- In situ field demonstration in progress at Joint Base Cape Cod

Questions?

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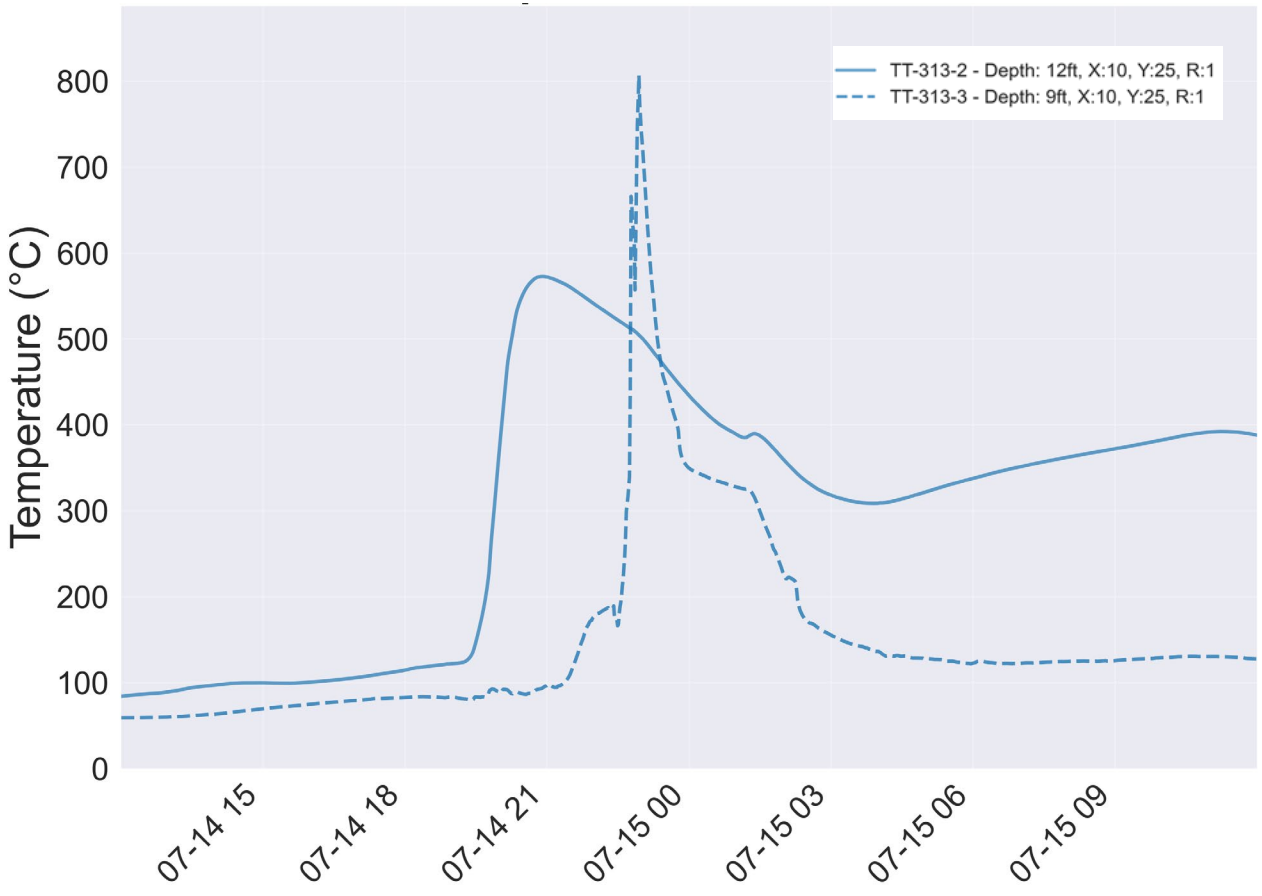
Extra Slides

Operations – July 8 to 19



Emission sampling pre and post emissions treatment