PFAS RISK MANAGEMENT AT AIRPORTS

ESAA PFAS SYMPOSIUM, CALGARY AB

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PRESENTATION FOCUS

- Source control
- Contaminated Site Management

Risk Management

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WHAT ARE THE SOURCES?

Spills

Crash sites

Fire suppression in hangars

Tenant materials

Cumulative effects

Fire training

Fire truck certification

24 APECs

2 AECs

Vehicle maintenance / cleaning

1 Determined v. low risk

Note: locations identified are conceptual only and not actual sources at YYC. Shown as a conceptual

WHAT ARE THE SOURCES?

AFFF SDS Composition Information

Chemical name	CAS No.	weight-%
2-(2-Butoxyethoxy)ethanol	112-34-5	5 - 10
Lauryl Imino Propionate, Sodium Salt	14960-06-6	1 - 5
Polyfluorinated alkyl betaine	Proprietary	1 - 5

SOURCE CONTROL

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Emergency use

- **All discharge of firefighting foam is considered an "environmental release"**
- **Foam, fuel and glycol mixtures can be complex to clean-up, particularly in winter**
- **Requires the use of "de-foaming agent"**
- **No available products to enhance breakdown – must be physically or chemically removed**
- **AFFF emergency use no longer covered by environmental liability insurance**
- **Does residual absorb into pavement?**

Switch foams

Change firefighting practices

SOURCE CONTROL

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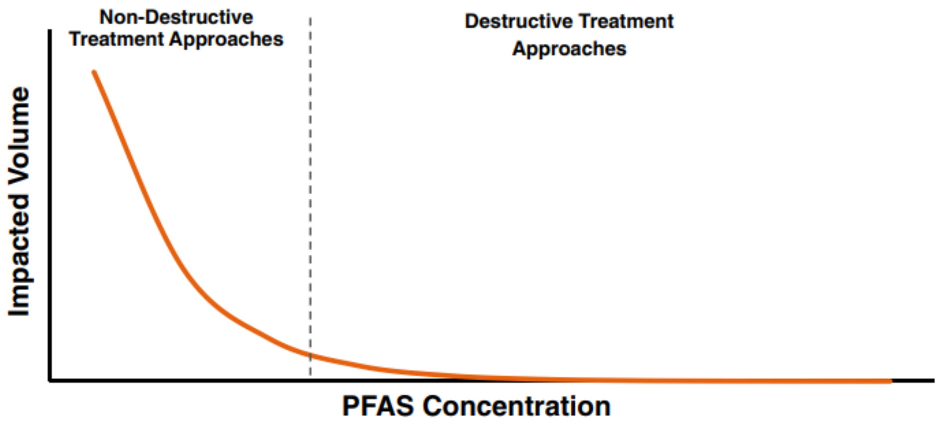
Discretionary & accidental use

- **Historical conflict between fire safety regulations/standards and PFAS goals**
- **Until a 2019 exemption Canadian Airports were required to use fluorinated Aqueous Film-forming Foam (AFFF).**
- **Airports were also required to discharge foam annually as part of fire truck certification.**
- **Hangars and fuel farms across Canada are also required to have AFFF.**
- **Regulatory changes have enabled less discharge of foam and adoption of fluorine-free foam (F3).**

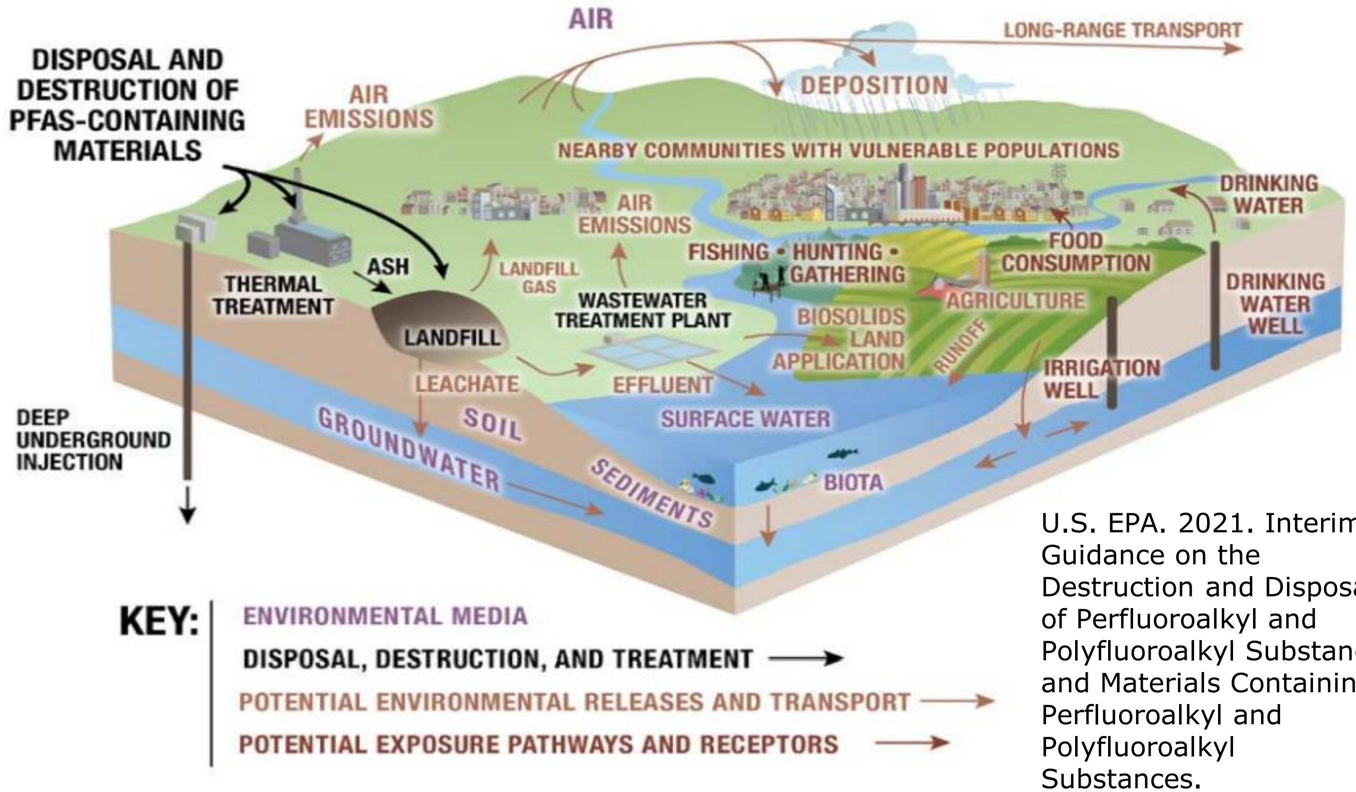
SOURCE CONTROL

Destruction and disposal

- **Incineration is one of the most common forms of disposal/destruction, however there are many sources of uncertainty about its effectiveness and risks (e.g., air emissions, failure to achieve needed temperatures / pressures at conventional incinerators, ash management)**



Horst, J., McDonough, J., Ross, I., & Houtz, E. (2020). Understanding and managing the potential by-products of PFAS destruction. *Groundwater Monitoring & Remediation*, *40*(2), 17-27.



U.S. EPA. 2021. Interim Guidance on the Destruction and Disposal of Perfluoroalkyl and Polyfluoroalkyl Substances and Materials Containing Perfluoroalkyl and Polyfluoroalkyl Substances.

SOURCE CONTROL

Foam Transition and Fire Truck Cleaning Project – Rinse Water

Table 3: Post-TOP Assay PFAS Cleaning Results for Engine Red 4

Sample ID	Sum of PFAS Post-TOP (ug/L)	PFOS (ug/L)	PFOA (ug/L)	PFPeA (ug/L)
RED4-01-C	No sample was collected, as this represents presence of PFAS on the surface of the apparatus			
RED4-02-C	**51,660**	*< 5,000*	**3,500**	**24,200**
RED4-03-C	**2,088**	*< 200*	**120**	**1,120**
RED4-04-C	**760**	*< 200*	**80**	**36**
RED4-05-C	**896**	*< 200*	**84**	**372**
RED4-06-C	**73**	*< 10*	**3.8**	**34**

Courtesy of Arcadis

SOURCE CONTROL

Foam Transition and Fire Truck Cleaning Project - Swabbing

Table 4: Pre-Post TOP Post-TOP Assay PFAS Swab Results for Engine Red 4

Sample ID	Sum of PFAS Pre-TOP (ng/cm^2)	Sum of PFAS Post-TOP (ng/cm^2)
RED4-01-I/A/B	1,040	5,500
RED4-02-I/A/B	24	130
RED4-03-I/A/B	20	1,200
RED4-04-I/A/B	0.5	13
RED4-05-I/A/B	1.2	18
RED4-06-I/A/B	13	600

REBOUND?

Courtesy of Arcadis

Table 16: Summary of PFAS Cleaning Results for all trucks

TID	Description	Sum of PFAS pre-TOP (ug/L)	Removal %	Sum of PFAS post-TOP (ug/L)	Removal %
RED4-02-C	Red 4 - Post Water Rinse 1	5,510		51,660	
RED4-03-C	Red 4 - Post FF1	1,060		2088	
RED4-04-C	Red 4 - Post FF2	185	99.70%	760	99.86%
RED4-05-C	Red 4 - Post FF3	183		896	
RED4-06-C	Red 4 - Post Water Rinse 2	17		73	
RED2-02-C	Red 2 - Post Water Rinse 1	31,817		137,400	
RED2-03-C	Red 2 - Post FF1	1,469		4,000	
RED2-04-C	Red 2 - Post FF2	144	99.93%	558	99.92%
RED2-05-C	Red 2 - Post FF3	53		168	
RED2-06-C	Red 2 - Post Water Rinse 2	24		105	
RED1-02-C	Red 1 - Post Water Rinse 1	5,323		44,460	
RED1-03-C	Red 1 - Post FF1	338		1,094	
RED1-04-C	Red 1 - Post FF2	181	99.49%	1,556	99.17%
RED1-05-C	Red 1 - Post FF3	57		780	
RED1-06-C	Red 1 - Post Water Rinse 2	27		367	
RED5-02-C	Red 5 - Post Water Rinse 1	4,757		95,000	
RED5-03-C	Red 5 - Post FF1	103		930	
RED5-04-C	Red 5 - Post FF2	6.8	99.96%	42	99.97%
RED5-05-C	Red 5 - Post FF3	2.5		20	
RED5-06-C	Red 5 - Post Water Rinse 2	1.9		27	

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Courtesy of Arcadis

DECONTAMINATION PROJECT OVERVIEW

$250k for truck decontamination
+ $170k for rinsate disposal
+ 1 year of detailed planning
+ 50,000 L of rinse water and pure product
+ 6 weeks in the field
+ Min of 88 samples (includes water and swab) sent to Minnesota, Ontario and the UK
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4 x Decontaminated ARFF Trucks and LOTS of data!

CONTAMINATED SITE MANAGEMENT

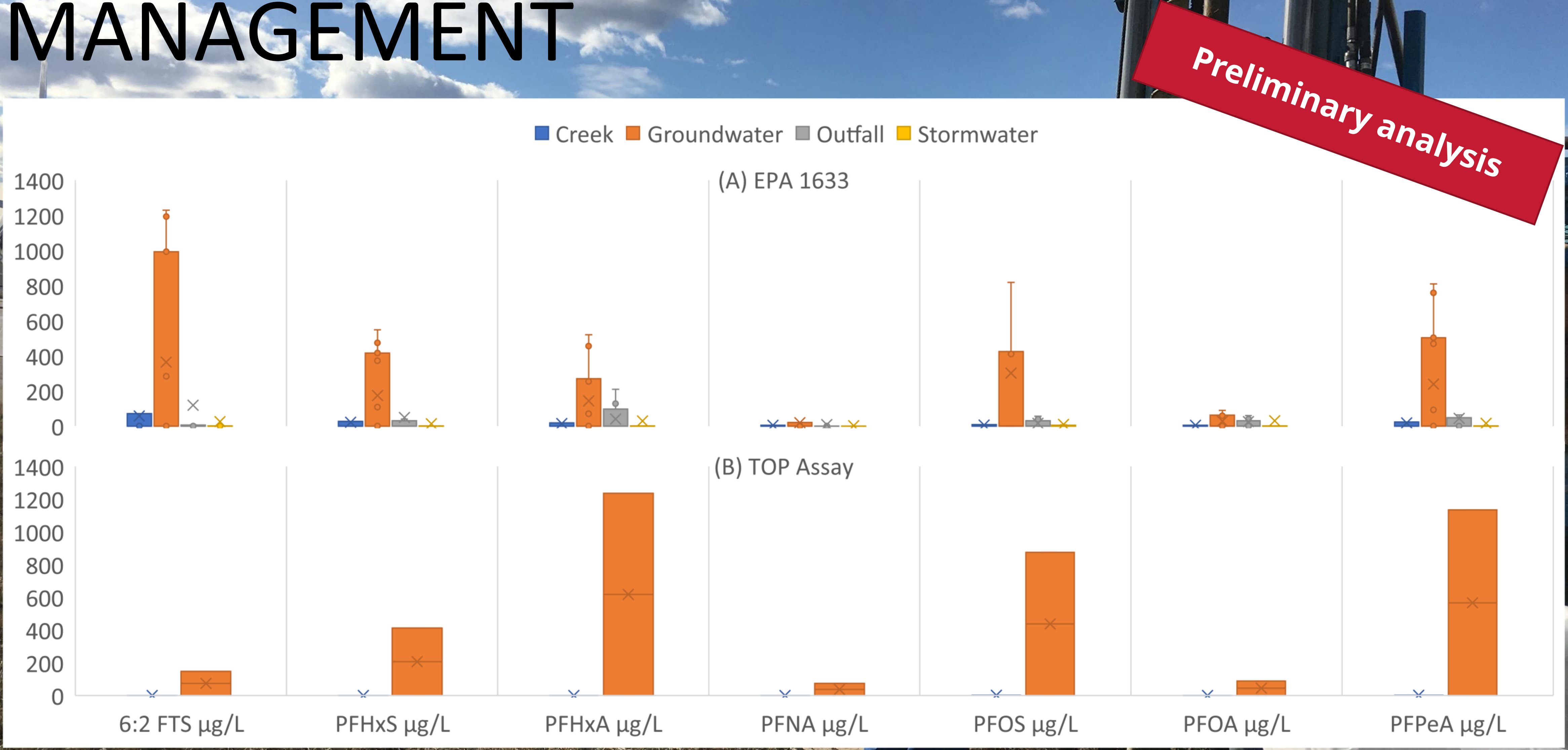
Risk Management Considerations:

- Cumulative effect on receptors (i.e., ‘funneling’ by drainage infrastructure).
  - Multiple sources of PFAS
  - Multiple types of PFAS compounds at each source
  - Multiple pathways for transport
  - Residual along transport pathways
- Groundwater-surface water interactions associated with drainage ponds and deep utilities.
- Construction projects that move and disturb soil have the potential to spread and transform PFAS constituents.

Present in environmental media (of 40 PFAS compounds in EPA 1633:

11Cl-PF3OUdS	PFOS
PFBA	PFPeA
PFHxS	6:2 FTS
PFHxA	PFBS
PFNA	PFOS

CONTAMINATED SITE MANAGEMENT



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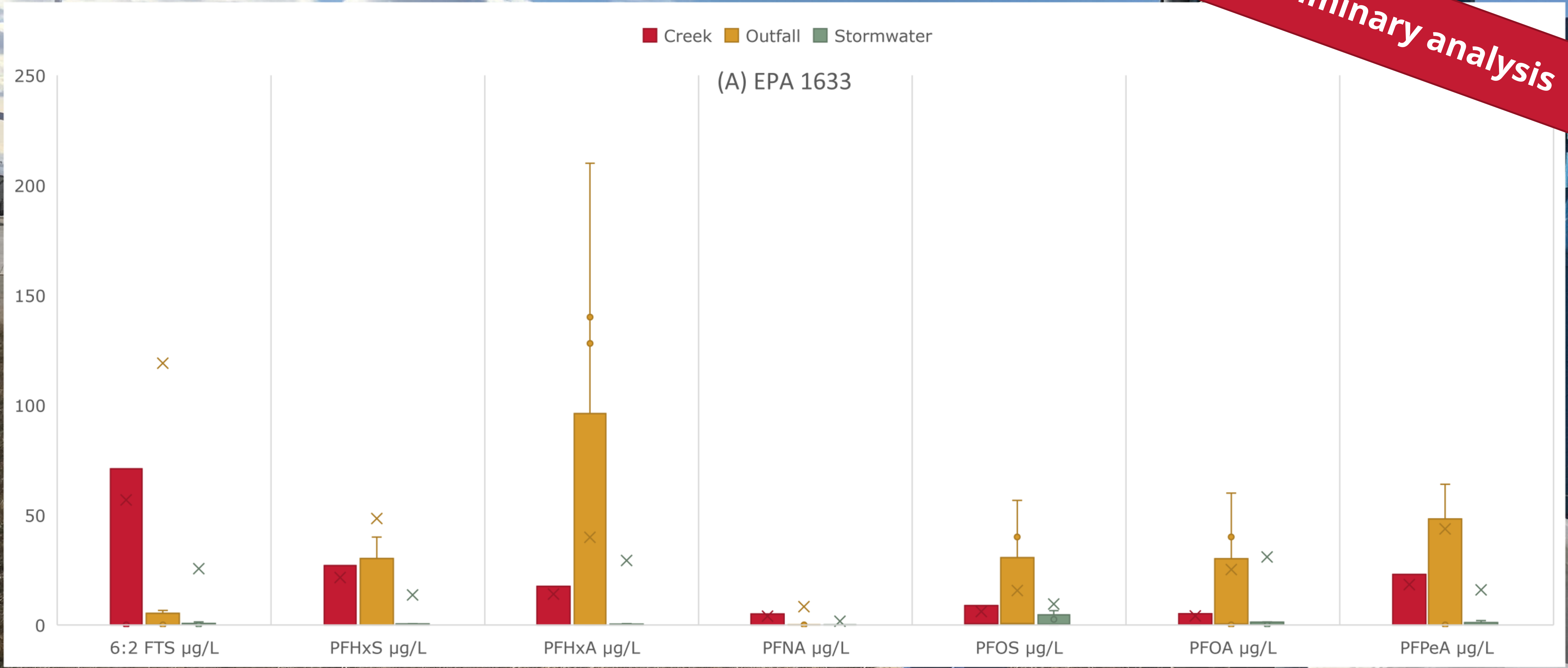
CONTAMINATED SITE MANAGEMENT

Preliminary analysis



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LESSONS LEARNT

- **Identify potential sources – past and present (integrate PFAS into phased ESA process).**
- **Longitudinal sampling is critical to identify trends. Single sampling events are difficult to interpret.**
- **Sample results show effects related to cumulative nature of PFAS contaminants.**
- **Switch to fluorine-free alternatives wherever possible as soon as possible.**
- **Obtain as much "upstream" supply chain information as possible.**

KEY QUESTIONS

- **How clean is clean enough (for assets and environmental media)?**
- **What is the best indicator of PFAS risk (TOF, Total PFAS, Total TOP?)**
- **What do we make of TOP Assay data?**
- **How will insurance companies and regulators handle “residual” or incidental PFAS?**
- **Can isotopes be used to trace PFAS compounds?**
- **How can we partner on a watershed basis to address PFAS sources and cumulative effects?**

THANK YOU!

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