



Evaluating PCOCs From Wildfires Using Case Studies

Presented by Tadd Berger

Today's Presenter



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Conceptual Site Model



Shallow soils are most likely to be impacted from a recent fire event

Chemicals in soil after wildfire can be attributed to 1 of 4 source categories

- Chemicals present **before** the fire
- Chemicals release **because of** the fire
- Chemicals **created by** the fire
- Chemicals **used to fight** the fire



Case Study Approach



- Select data from 5 fire events [116 Location Data Points Used]
 - Major wildfire in BC (63 data points used)
 - Major wildfire in Alberta (28 data points used)
 - Total Loss Fire of Ontario Industrial Facility (10 data points used)
 - Large Property Fire on Ontario Commercial and Vacant Property (3 data points used)
 - Major wildfire in BC (12 data points used)
- Filter data to only use surficial soils and ash
- Evaluate data set to remove “uninteresting data”
- Considered Conceptual Site Model to further evaluate data



A Fire Event Example

Contamination Pre-Dating the Fire



- Tanks, industrial activities, historical spills, etc.
 - Do not expect Pyro-remediation to have eliminated these issues
- Naturally Occurring Concentrations
 - Arsenic, iron, other metals



Contamination As an Indirect Result of the Fire



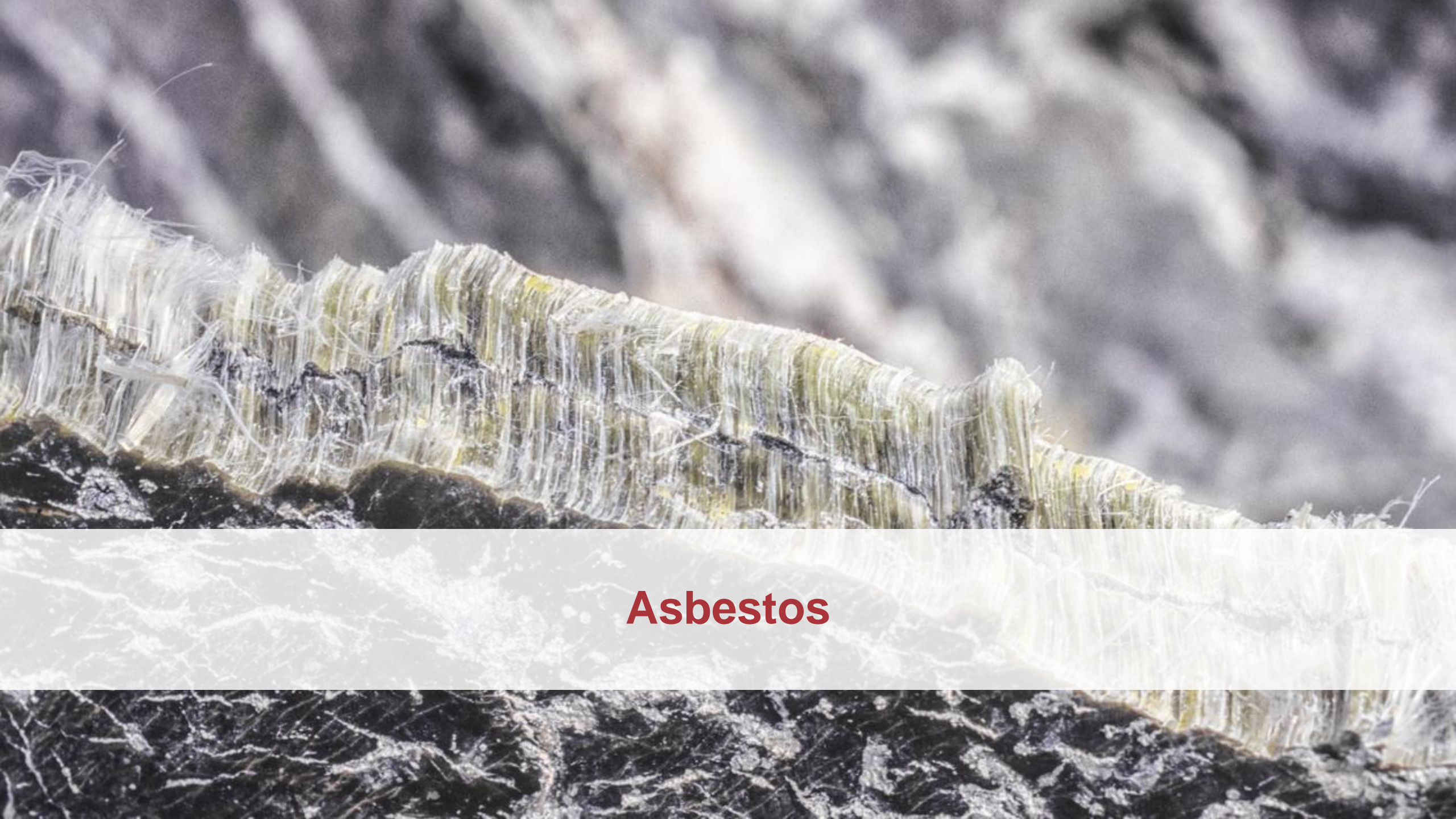
1. Containment breaches

- Hoses or totes melting, or ASTs being dropped. Especially if materials are not easily combusted

2. Asbestos, lead paint chips, falling from structures as they burn

3. PFAS present in construction materials

4. Chemicals used during fire fighting



Asbestos



PFAS

Per- and Polyfluoroalkyl Substances (PFAS)

Fire Fighting Chemicals



Phos-Chek – ammonia sulphate (fertilizer) and red dye



Class A Foams (non PFAS containing)



Water



Clay Slurry

Contamination as a Direct Effect of the Fire



Chemical reactions that occur during combustion that create toxins

- PAHs
- Dioxins

Chemicals with no detections



Chloronaphthalene, 2-	Dichloroethylene, 1,1-	Methyl ethyl ketone [MEK]	Dimethyl phthalate
Bromodichloromethane	Dichloroethylene, 1,2-cis-	Methyl Isobutyl Ketone [MIBK]	2,4-Dinitrotoluene
Bromoform	Dichloroethylene, 1,2-trans-	Ethylene Dibromide	1,2,4-Trichlorobenzene
Bromomethane	Dibromochloromethane [DBCM]	Dichlorodifluoromethane	2,6-Dinitrotoluene
Butadiene, 1,3-	Dichloromethane	Dibromoethane, 1,2-	2,4- & 2,6-Dinitrotoluene
Carbon Tetrachloride	Nonane	1,3-Dichloropropene (Total)	2-Chlorophenol
Chlorobenzene	Trichloroethylene	Cis-1,3-Dichloropropylene	2,4-Dichlorophenol
Chloroform	Trichlorofluoromethane	Trans-1,3-Dichloropropylene	2,4-Dimethylphenol
Dichlorobenzene, 1,2-	Vinyl chloride	Hexane	2,4-Dinitrophenol
Dichloroethane, 1,2-	Tetrachloroethane, 1,1,1,2-	Methylene Chloride	Pentachlorophenol
Dichloropropane, 1,2-	Trichloroethane, 1,1,1-	Bis(2-chloroisopropyl)ether	Phenol
Dichlorobenzene, 1,3-	Tetrachloroethane, 1,1,2,2-	p-Chloroaniline	2,4,5-Trichlorophenol
Dichlorobenzene, 1,4-	Trichloroethane, 1,1,2-	3,3'Dichlorobenzidine	2,4,6-Trichlorophenol
Dichloroethane, 1,1-	Trichlorobenzene, 1,2,4-	Diethyl phthalate	

Chemicals with no exceedances of lowest CSR standards



Methylnaphthalene, 1-

Methylnaphthalene, 2-

Acenaphthene

Chrysene

Fluorene

Acetone

Methyl tert-butyl ether [MTBE]

Tetrachloroethylene

Aluminum

Boron

Lithium

Mercury

Manganese

Molybdenum

Selenium

Silver

Strontium

Thallium

Tungsten

Uranium

Aroclor 1016

Aroclor 1221

Aroclor 1232

Aroclor 1242

Aroclor 1248

Aroclor 1254

Aroclor 1260

Aroclor 1262

Aroclor 1268

polychlorinated biphenyls [PCBs], total

Biphenyl

Bis(2-ethylehexyl)phthalate

Methylnaphthalene, 2-(1-)

Quinoline

Total PCDDs and PCDFs (TEQ)

Too few exceedances



Less than 2 exceedances in large datasets

VPHs /F1

Anthracene

Benzo(a)pyrene

Fluoranthene

Ethylbenzene

Toluene

Xylenes, Total

Antimony

Cobalt

Nickel

Chemicals Evaluated



LEPH/HEPH (F2, F3, F4)

Several PAHs

Benzene

Styrene

Arsenic

Barium

Beryllium

Cadmium

Chromium

Copper

Iron

Lead

Tin

Vanadium

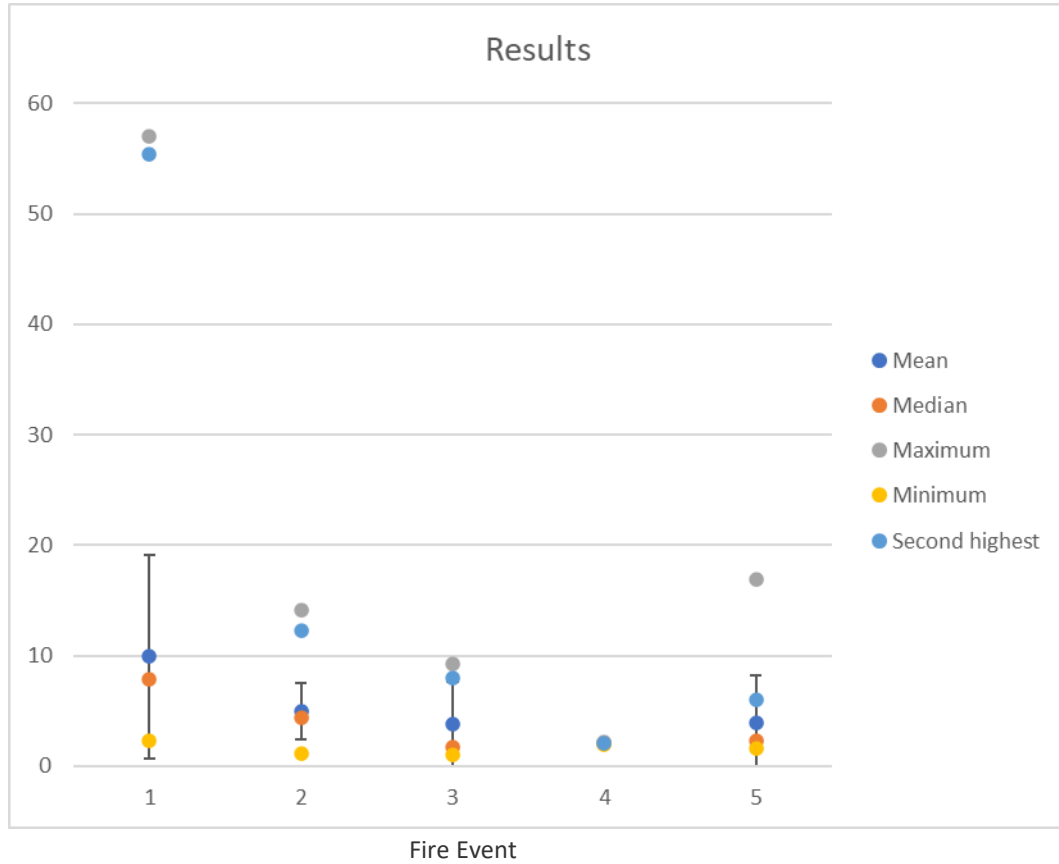
Zinc

A Reminder of the 5 Fires



- Select data from 5 fire events [116 Location Data Points Used]
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Arsenic



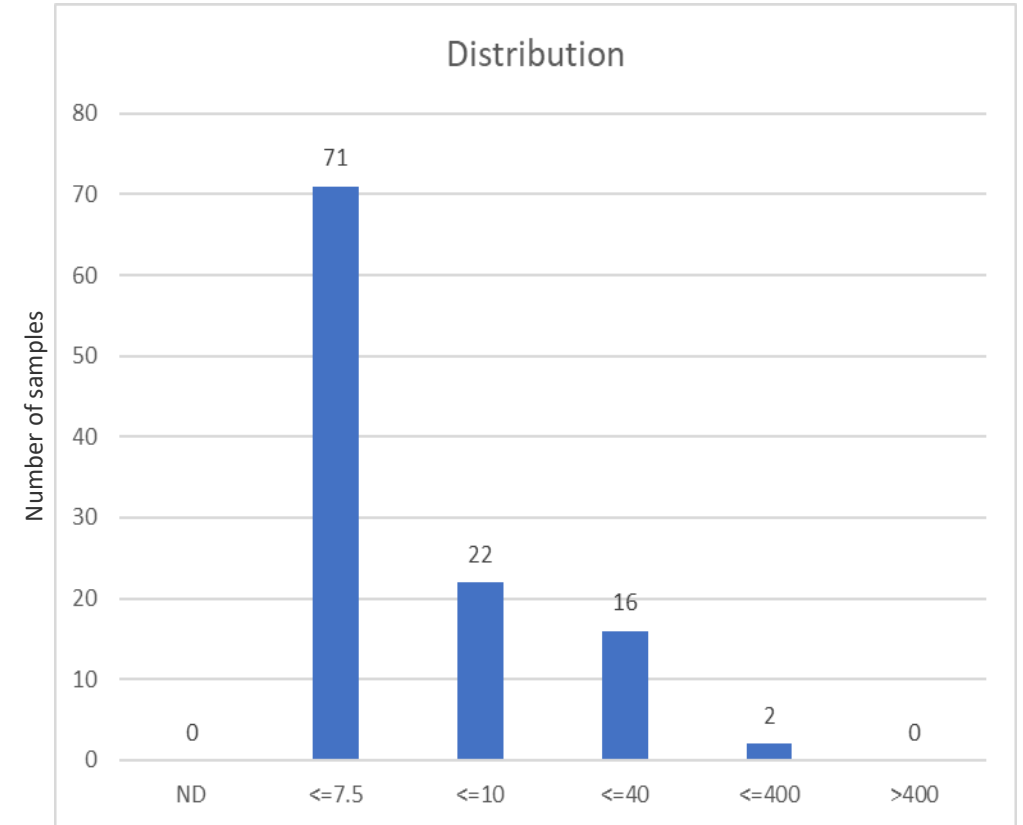
111 Samples

111 Detections

18 Exceedances

Exceedances only present at 3 fires.

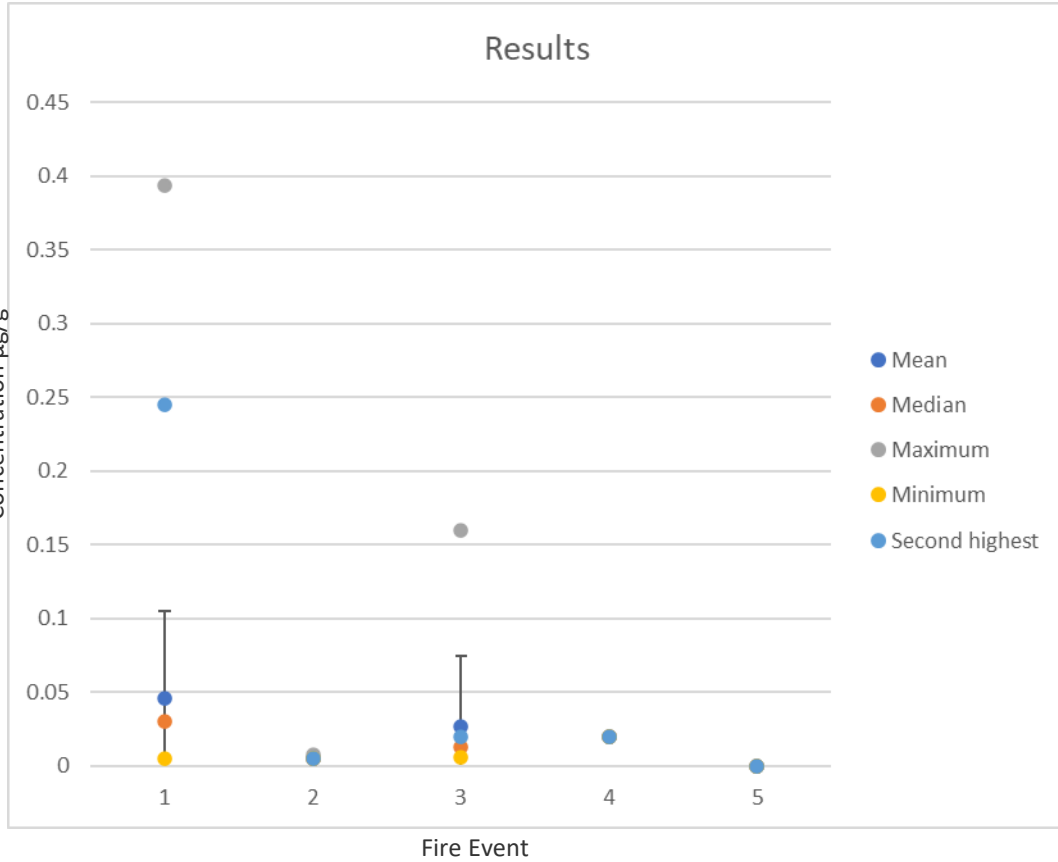
Likely natural background



CSR DW protection = 10

CSR IL Direct Contact = 400

Benzene



78 Samples

24 Detections

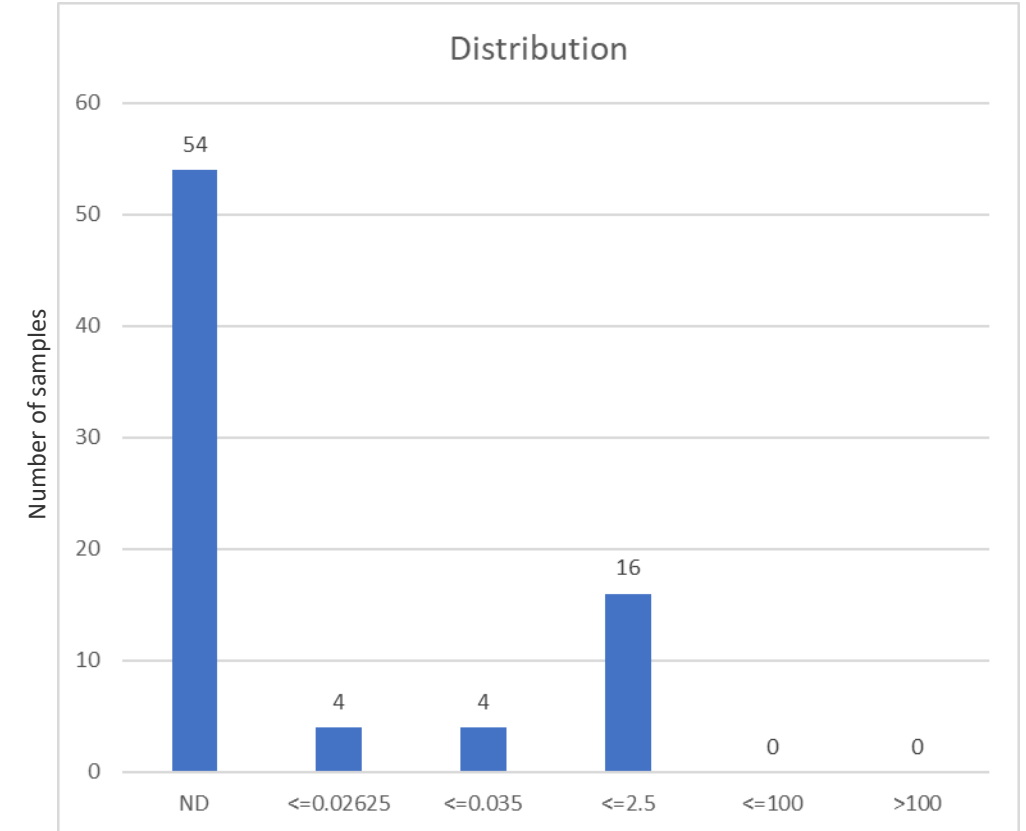
16 Exceedances

No samples for Fire 5

22 Detections from Fire 1

15 Exceedances from Fire 1

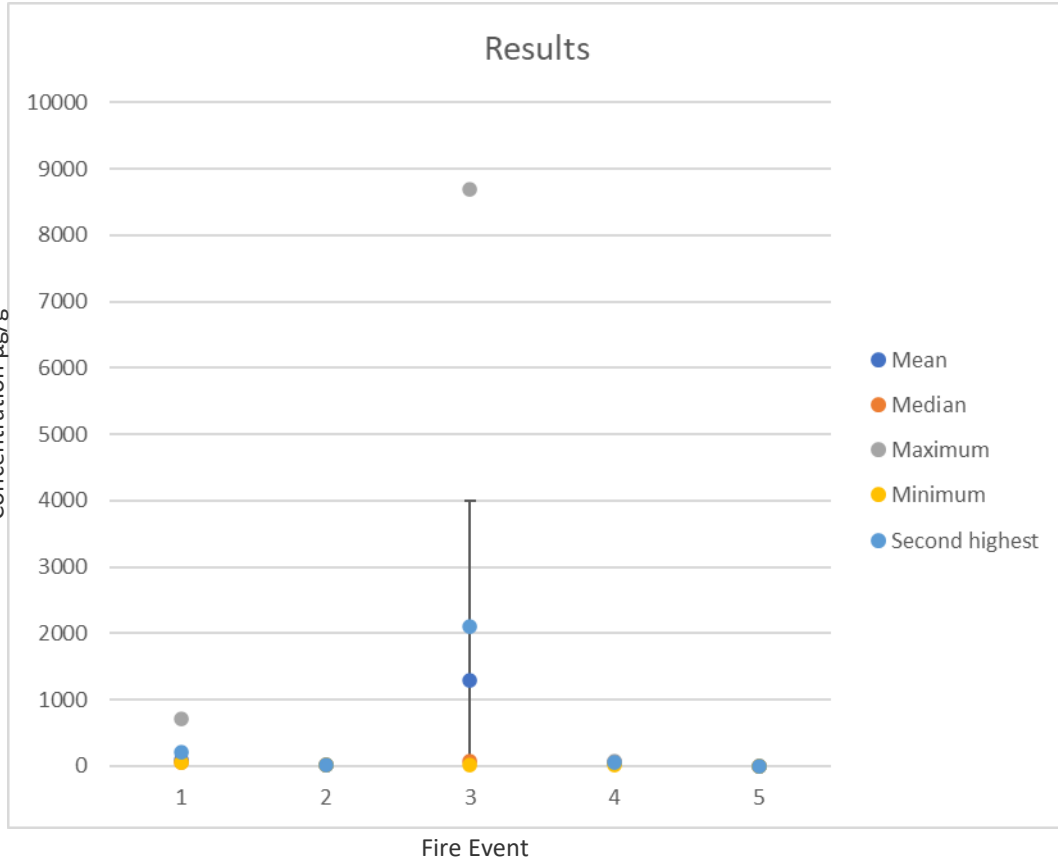
Not sure why Fire 1 had benzene issues



CSR DW protection = 0.035

CSR AW protection = 2.5

EPHs10-19 / F2



82 Samples

9 Detections

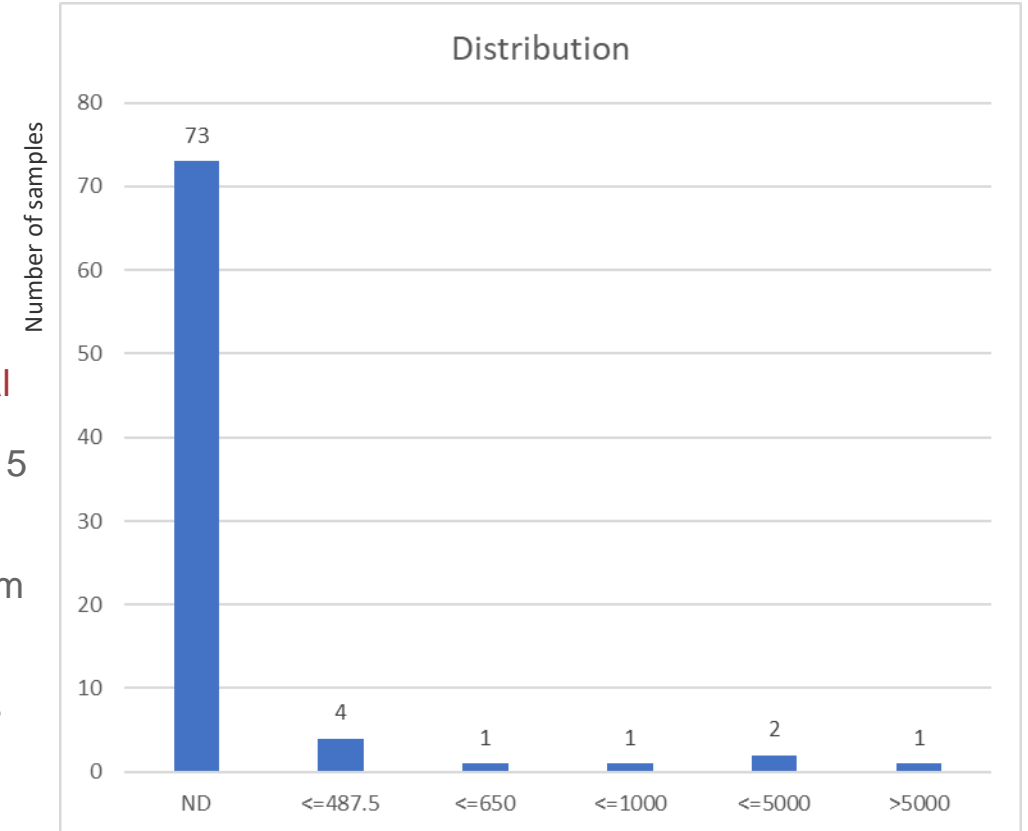
4 Exceedances

3 Above Residential

No samples for Fire 5

Residential exceedances all from Fire 3

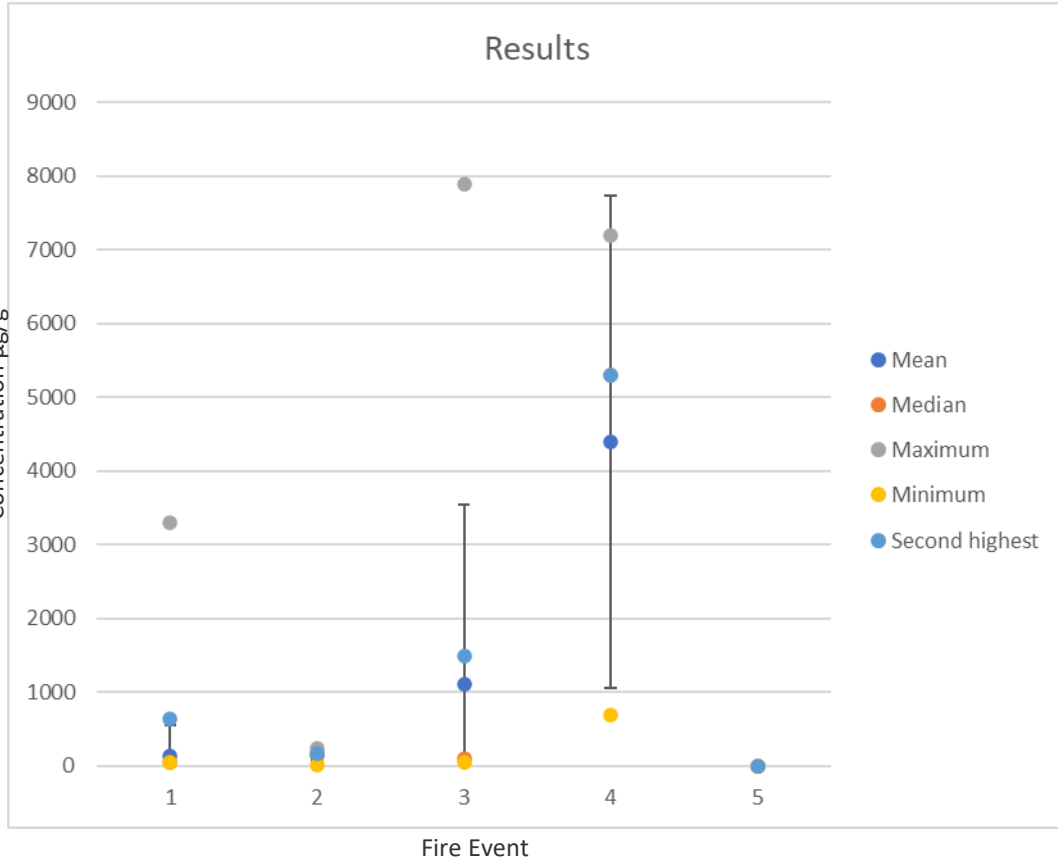
EPH concentrations likely from pre-existing conditions



CSR LEPH Wildlands = 650

CSR LEPH Residential = 1000

EPHs19-32 / F3



82 Samples

27 Detections

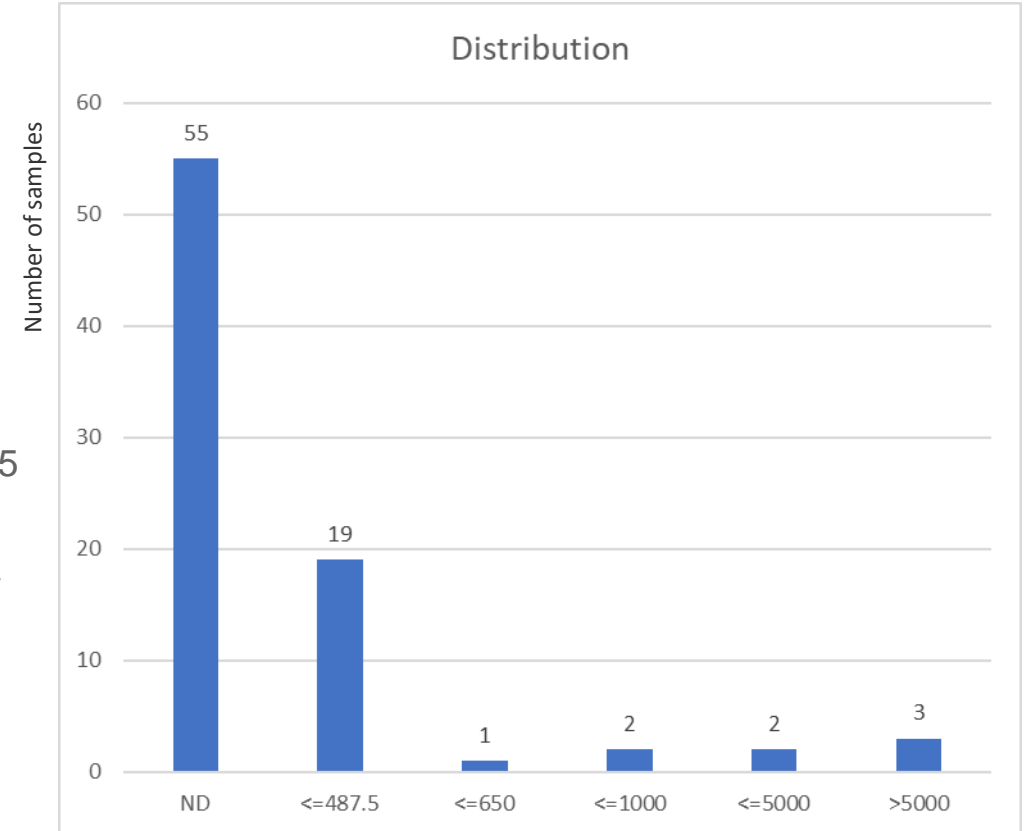
7 Exceedances

5 Above Residential

No samples for Fire 5

Residential exceedances mostly from Fire 3 & 4

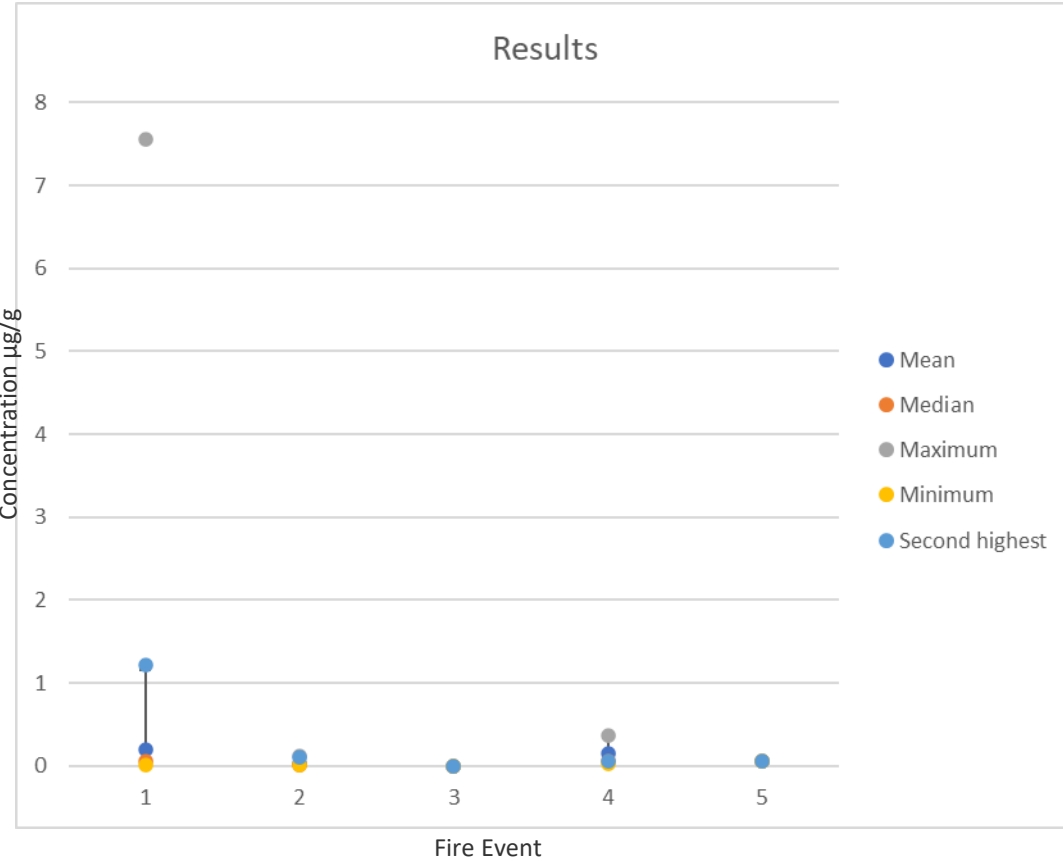
EPH concentrations likely from pre-existing conditions



CSR HEPH Wildlands = 650

CSR HEPH Residential = 1000

Naphthalene



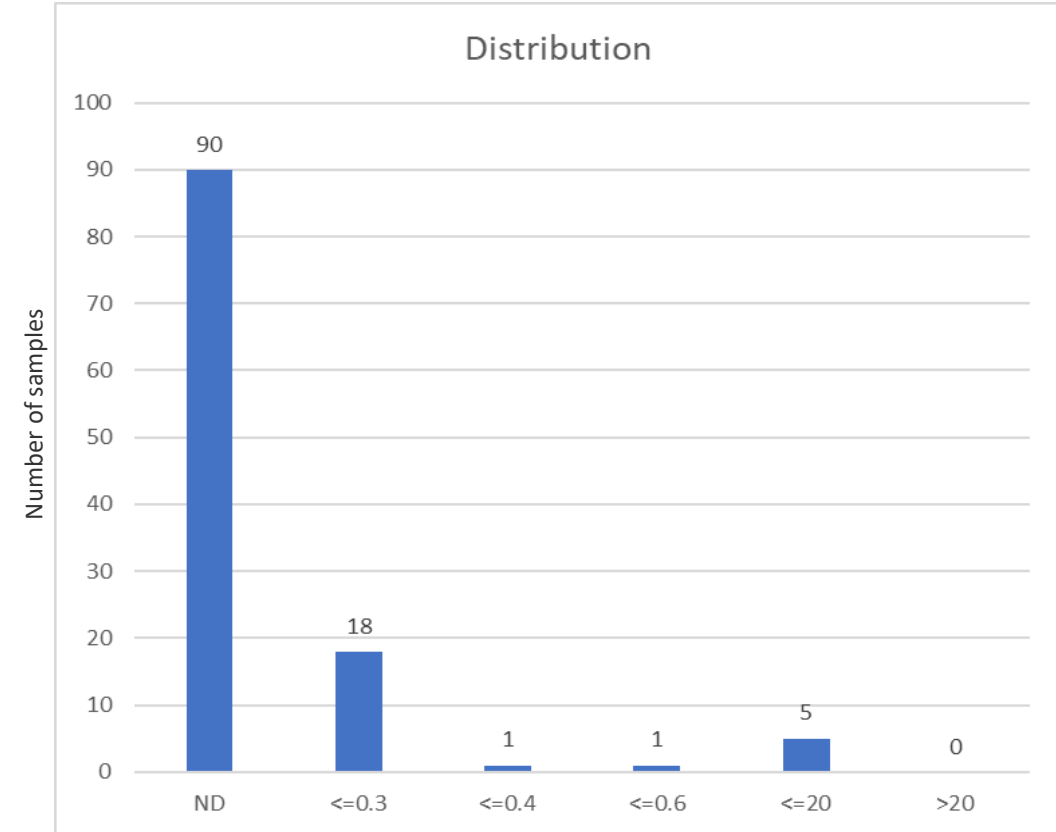
106 Samples

20 Detections

6 Exceedances

All exceedances are from Fire 1.

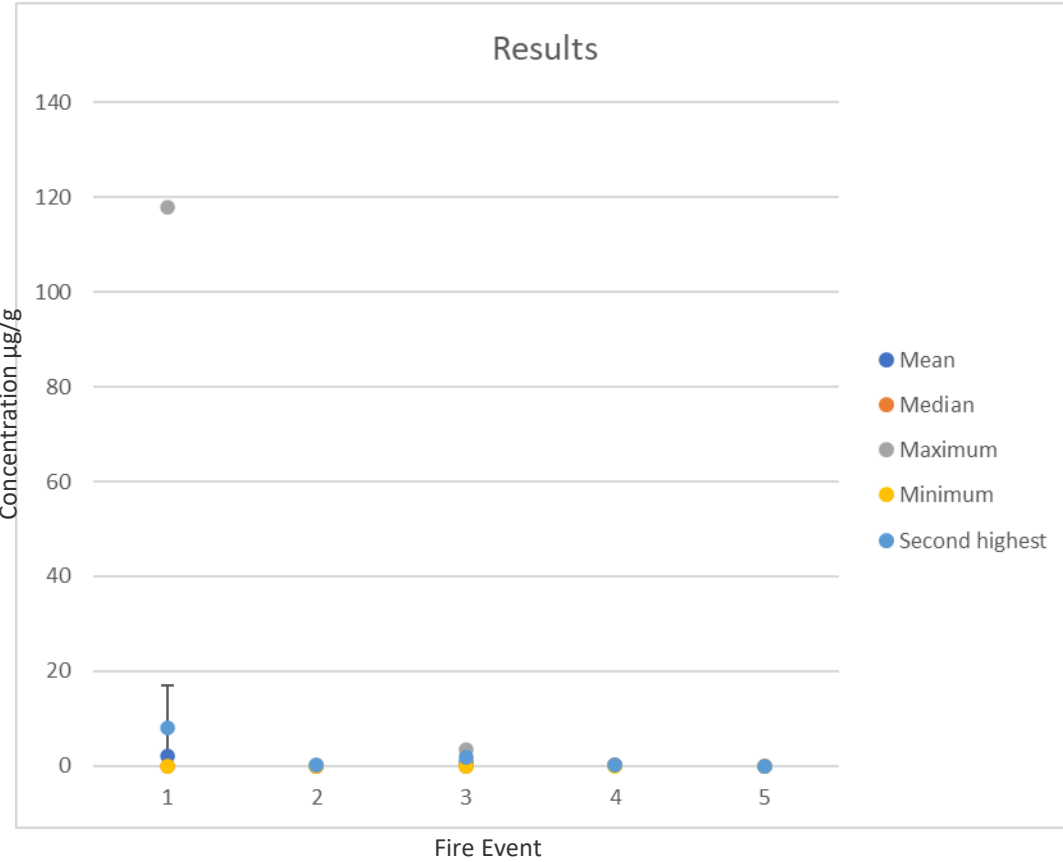
Likely from pre-existing conditions



CSR Wildlands = 0.4

CSR Commercial = 20

Phenanthrene



115 Samples

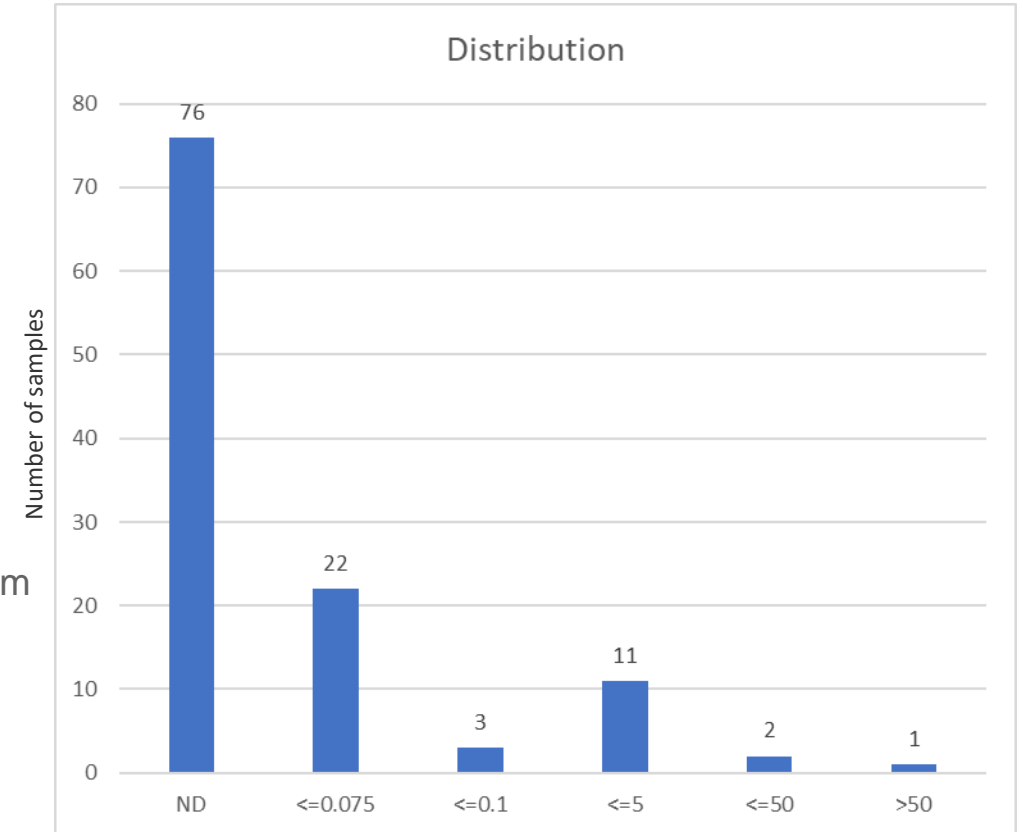
38 Detections

14 Exceedances

Only 3 above Residential

All residential exceedances are from Fire 1.

Likely from pre-existing conditions



CSR AG = 0.1

CSR Residential = 5

Conclusions



Benzene – Maybe?

Dioxins – Probably not

PAHs – Uncertain, but not overly likely



But do not forget pre-existing conditions!!!

A photograph of a group of people in a meeting or conference. Several hands are raised, with index fingers pointing upwards, indicating a question or a point to be made. The background is blurred, showing a dark blue wall with some bokeh light effects. A prominent red horizontal banner is overlaid across the center of the image, containing the word "QUESTIONS?" in white, bold, uppercase letters.

QUESTIONS?