



# Checking Data for Type I and Type II Errors

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# The Lab Reported it so it has to be!



## Data Validation

- First step in getting data from a lab is validating it.
  - Just because we can measure to the part per billion does not mean it is right.
  - Cross contamination in field
  - Sample carry over in lab
  - Stuff Happens
- Key is to be able to evaluate and where necessary confirm your data.



# What are Type I and II Errors

# Type II Error

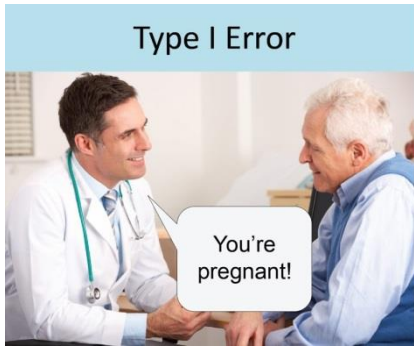
## False Negative



- Sent in a characterization sample from a gasoline station remediation that caught fire.
- Lab says Non Detect sample
- So high lab has a blown column

# Type I Error

## False Positive

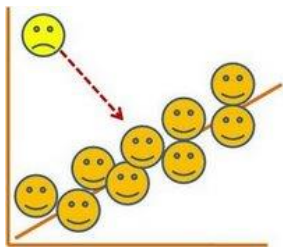


- Soil – One area of contamination that does not fit the Conceptual Site Model.
- Groundwater – Sediment in the sample.
- Vapour – Background Sources.

A scenic landscape featuring a wide river flowing through a lush green valley. The valley is surrounded by dense evergreen forests, and in the distance, rolling mountains are visible under a bright blue sky with scattered white clouds. In the foreground, two hikers are seen from behind, standing on a trail. One hiker is wearing a silver helmet and an orange backpack, while the other is wearing a blue cap and a dark backpack. A semi-transparent green banner is overlaid at the bottom of the image, containing the text "False Positive - Soil".

**False Positive - Soil**

# Classic Situation – What is That?



## Complete a Conceptual Site Model and findings are not consistent with it?

- Usually there is one soil sample that is way outside of the expected:
  - The CSM is wrong and an area of contamination was missed.
  - The lab result is incorrect.
- Follow TG 12-8:
  - Show sample result is an outlier
  - Sample within 1 m of original sample
    - Reconfirm result – have contamination
    - Cannot confirm result – Original data is a false positive


# Typical Question



## Typical Soil Question?

- What if the soil concentration is confirmed with the second sample?
  - Try Statistics
  - Try Risk Assessment
  - Remediate it





**False Positive - Groundwater**

# Classic Situation – Sediment in Sample



## Sampling the Correct Media?

- Water samples are for groundwater not groundwater entrained with large amounts of sediment.
  - Usually addressed with well development
  - Sometimes a very low producing well does not develop clear.
  - Shallow wells use low flow sampling where appropriate.
  - Does not work when need to overcome one atmosphere (10 m) for peristaltic pump.
- One solution is the snap sampler.

# Snap Sampler

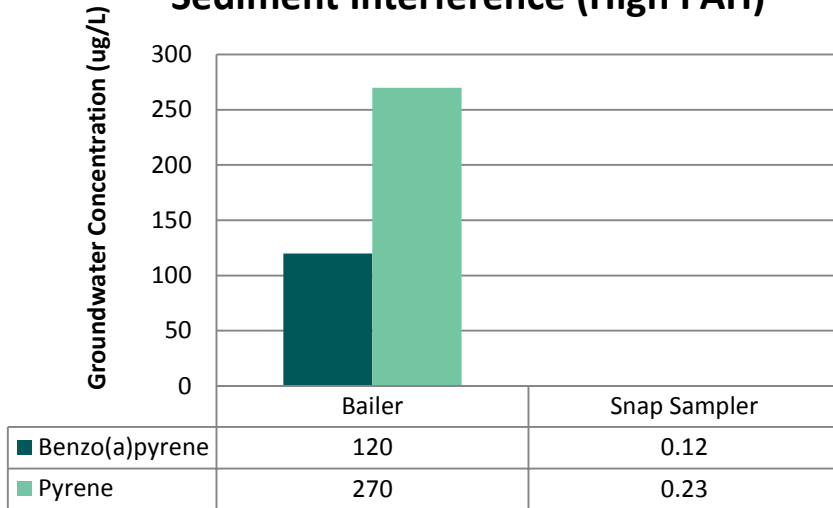
## What is a Snap Sampler?



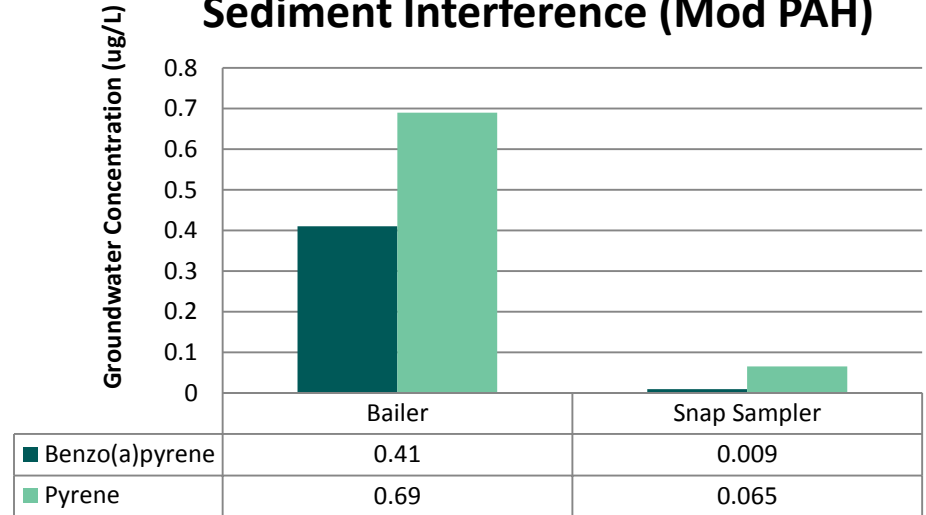
- Dedicated in well sampler with double-end-opening bottle and snap sealing caps.
- Insert in well open.
- Leave it for an ample amount of time for sediment to settle out from insertion.
- Snap the bottle shut and remove.
- Forward bottles to the lab for analysis.
- Can be installed at depths up to 2,000 feet.

# Snap Sampler Results - PAH

## Sediment Interference (High PAH)



## Sediment Interference (Mod PAH)



Solubility from BC Water Quality Guidelines:

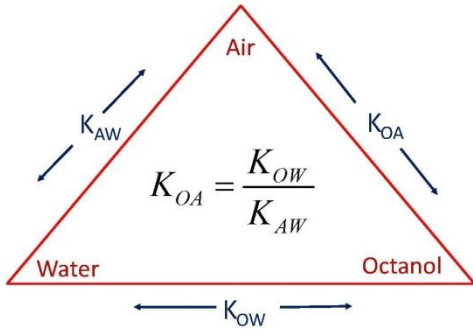
- Benzo(a)pyrene: 3.8 ug/L
- Pyrene: 133 ug/L

Koc from BC Water Quality Guidelines:

- Benzo(a)pyrene: 550,000
- Pyrene: 38,000

- There is going to be much more PAH compounds in soil than water

# Why is this the Case?

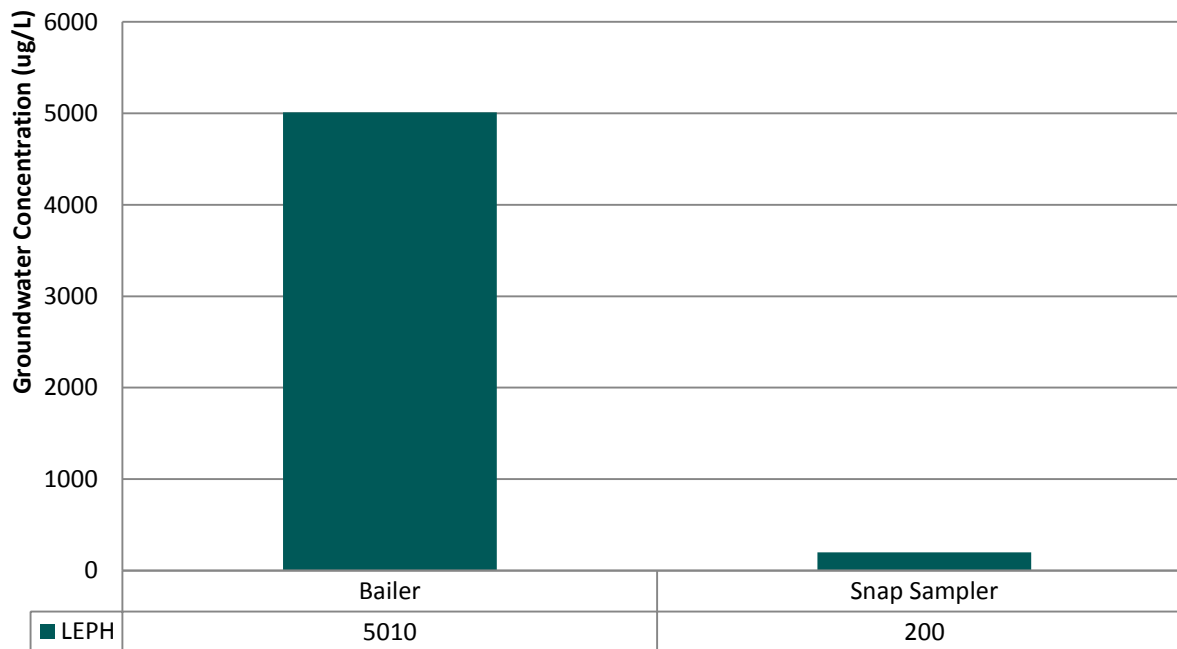


## Chemical/Physical Properties of Compounds

- Solubility from BC Water Quality Guidelines:
  - Benzo(a)pyrene: 3.8 ug/L
  - Pyrene: 133 ug/L
- Koc from BC Water Quality Guidelines:
  - Benzo(a)pyrene: 550,000
  - Pyrene: 38,000
- There is going to be much greater PAH compounds in soil than water

# Snap Sampler Results – LEPH

## Sediment Interference (LEPHw)



# Typical Questions



## Typical Groundwater Questions?

- Has the MOE approved of the snap sampler?
  - Yes
- How many clean samples do you need with the Snap sampler?
  - Have been getting 2, but would like to just be one.



**False Positive - Vapour**



# False Positive Vapour



- Vapour is newest media to be sampled regularly.
- All guidance comments on the importance of assessing false positives from secondary sources, ie vehicle exhaust etc., but not a lot on what to do when found.
- Clear case for professional judgement.

# Ambient Air Entering Sample



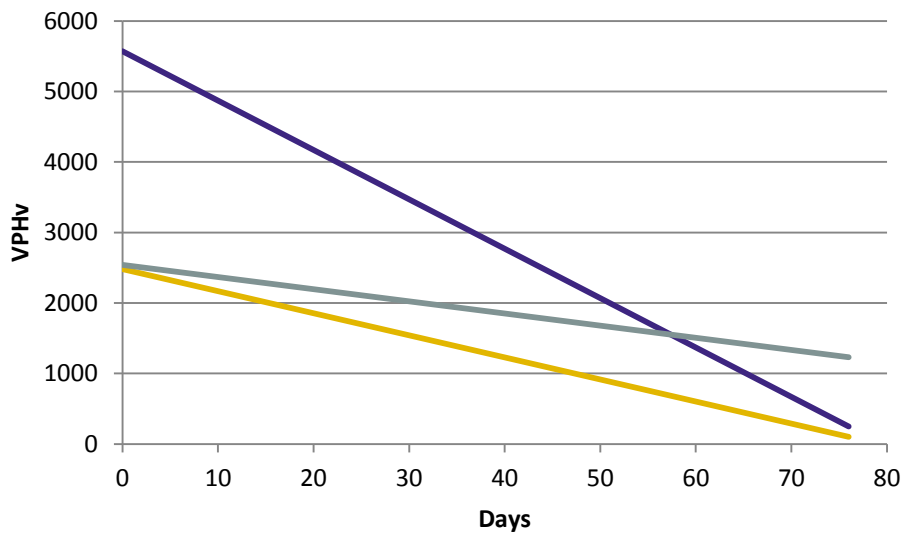
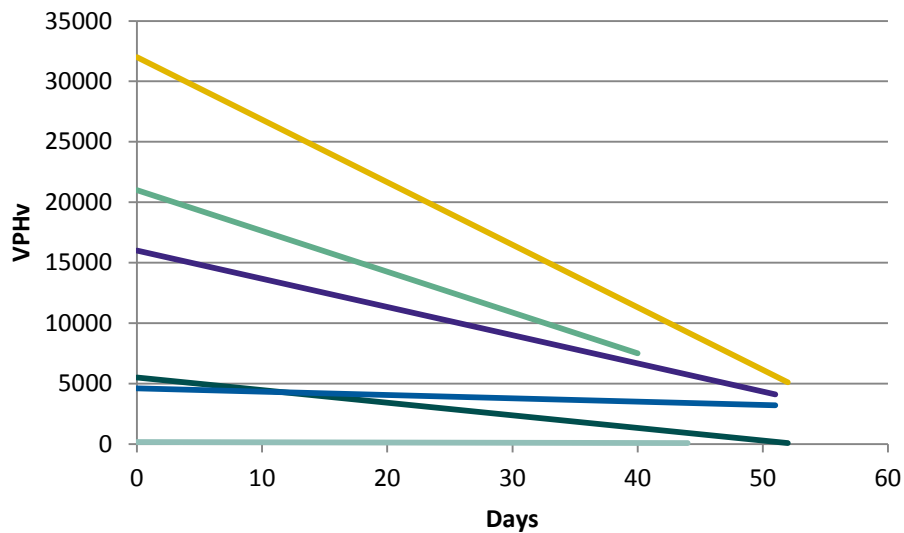
- We all try to eliminate ambient vapours by using a helium shroud. Make sure the sampling apparatus is tight.
- But on unpaved sites, ambient air can be pushed into the ground when pressure changes from low pressure to high pressure.
- What do we do then?

# Ambient Air Entering Borehole

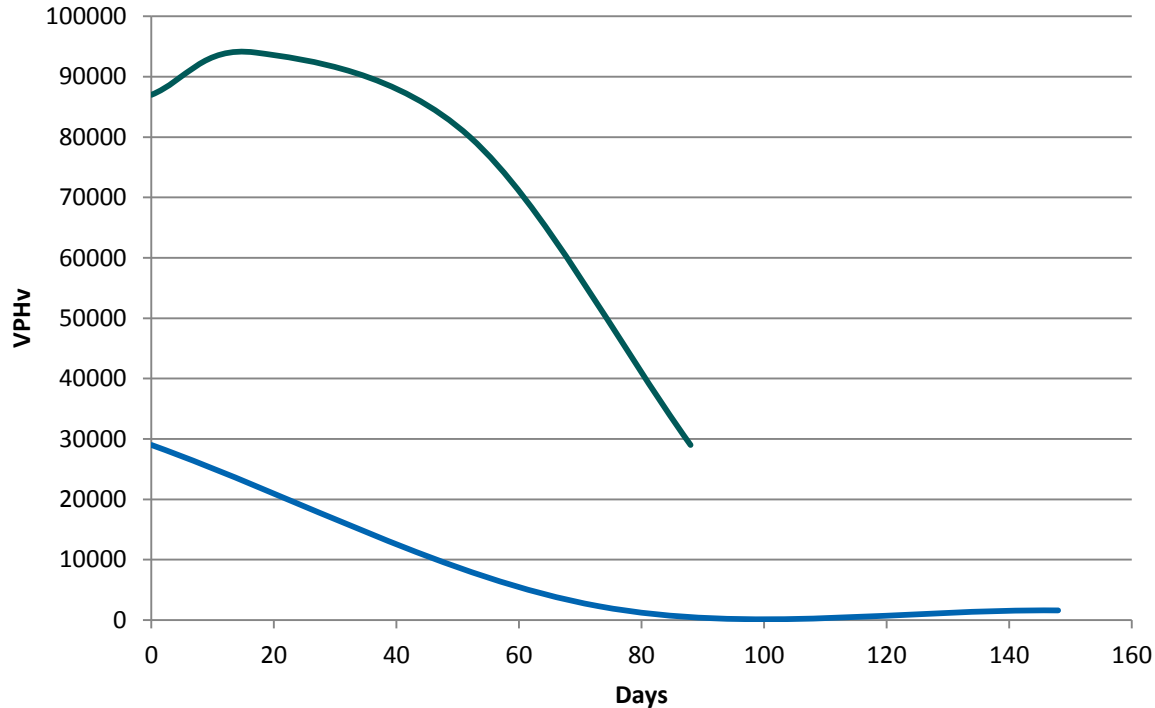


- During drilling we can have ambient air plus exhaust from the drill rig enter the borehole void.
- Once in the borehole it needs to be flushed out. With a much higher purge rate ambient air can be drawn into the hole.
- What does the data show?

# Differences in VPHv over time

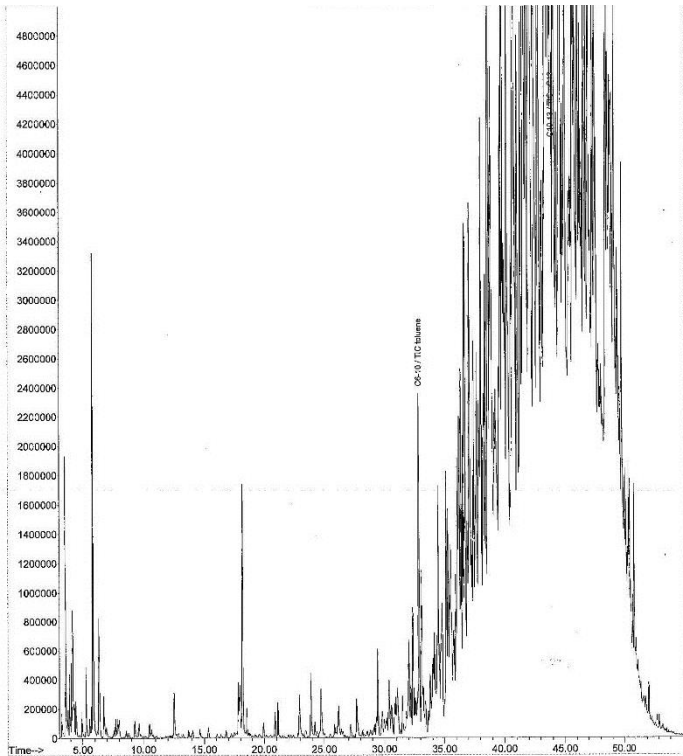


# Differences in VPHv over time



Higher concentrations may oscillate first then decrease rapidly.

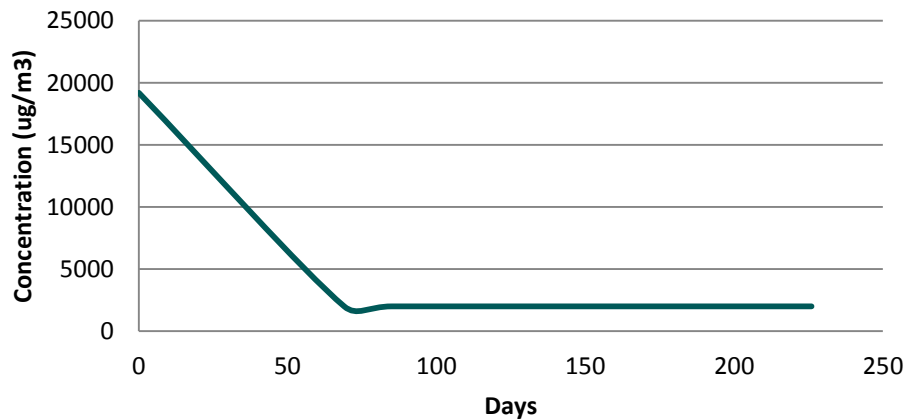
# What say the Chromatographs?



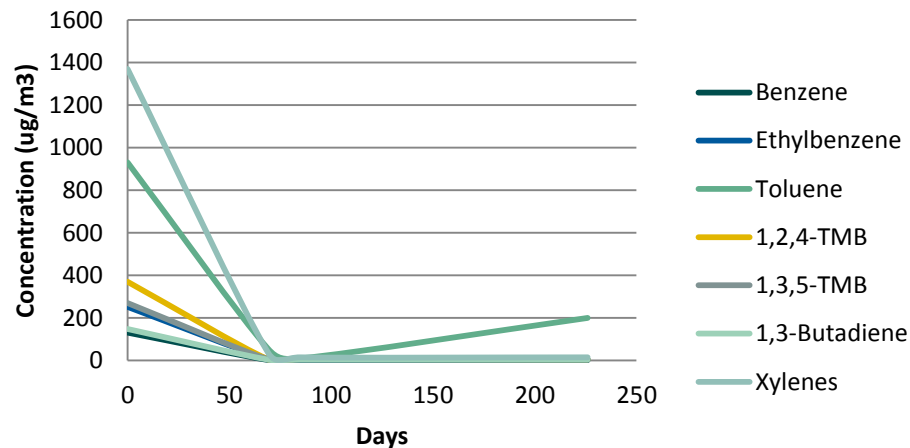
- Mass solvent plume excavation.
- 20+ soil limit sample, non detect VPHs <10 mg/kg.
- 4 groundwater post remedial, non detect VPHw (<300 ug/L)
- VPHv (144,000 and 72,000 ug/m<sup>3</sup>)
- Chromatograph very similar to diesel.
- Yellow iron worked on site for one month backfilling and compacting.

# All Hydrocarbon Parameters over time

## VPHv



## Individuals



# What to do?

What  
Do I Do  
Now



- If there is time resample the wells to see if the initial sample can be determined to be compromised.
- Calculate theoretical from soil and groundwater.
- Get the chromatographs from the lab to see if it makes sense.
- Only use the data if it is good.
- Write up using professional judgement.



# Typical Questions



## Typical Vapour Questions?

- Is there a study that has looked at this?
  - Not that I know of. Mentioned in guidance as a possible issue but nothing quantified.
- Are these just seasonality trends?
  - No, some are summer to winter, others are winter to summer
- What about the ground cover?
  - These are all non-asphalt
- Was the barometric pressure rising or falling during the events?
  - Pressure was rising during drilling
- What do we do now?
  - Need to collect more data. Do you data we could include in a study?

A modern blue and silver train is shown on tracks, moving away from the viewer. The train has a sleek, aerodynamic design with a large front window and two red lights. The tracks are elevated and run through a scenic area with mountains in the background. The sky is clear and blue. The overall scene is bright and sunny.

**Thank you. Questions?**

 **HEMMERA**