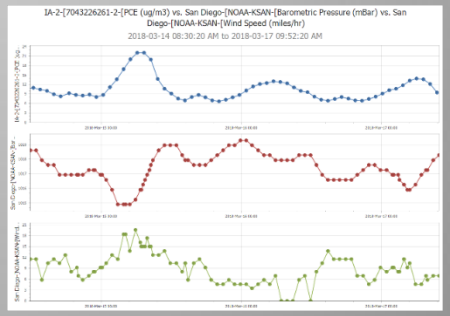
Resolving Vapor Intrusion Challenges via Automated Continuous Real-Time Monitoring

Mass DEP
Waste Site Cleanup
Advisory Committee



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HARTMAN
ENVIRONMENTAL GEOSCIENCE

Presentation Summary

- Brief System Description
- IA Temporal Variation
- Applications of Monitoring

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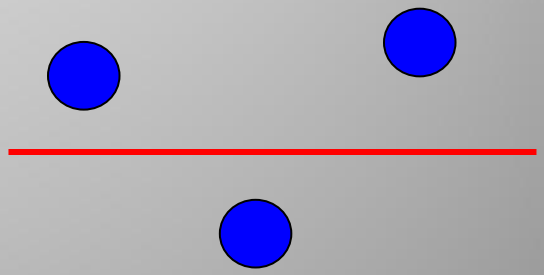
The Fundamental Problem with VI Assessments & Remedies:

With These:

You Get:



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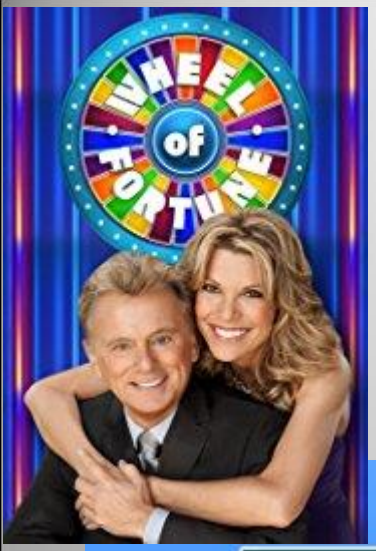
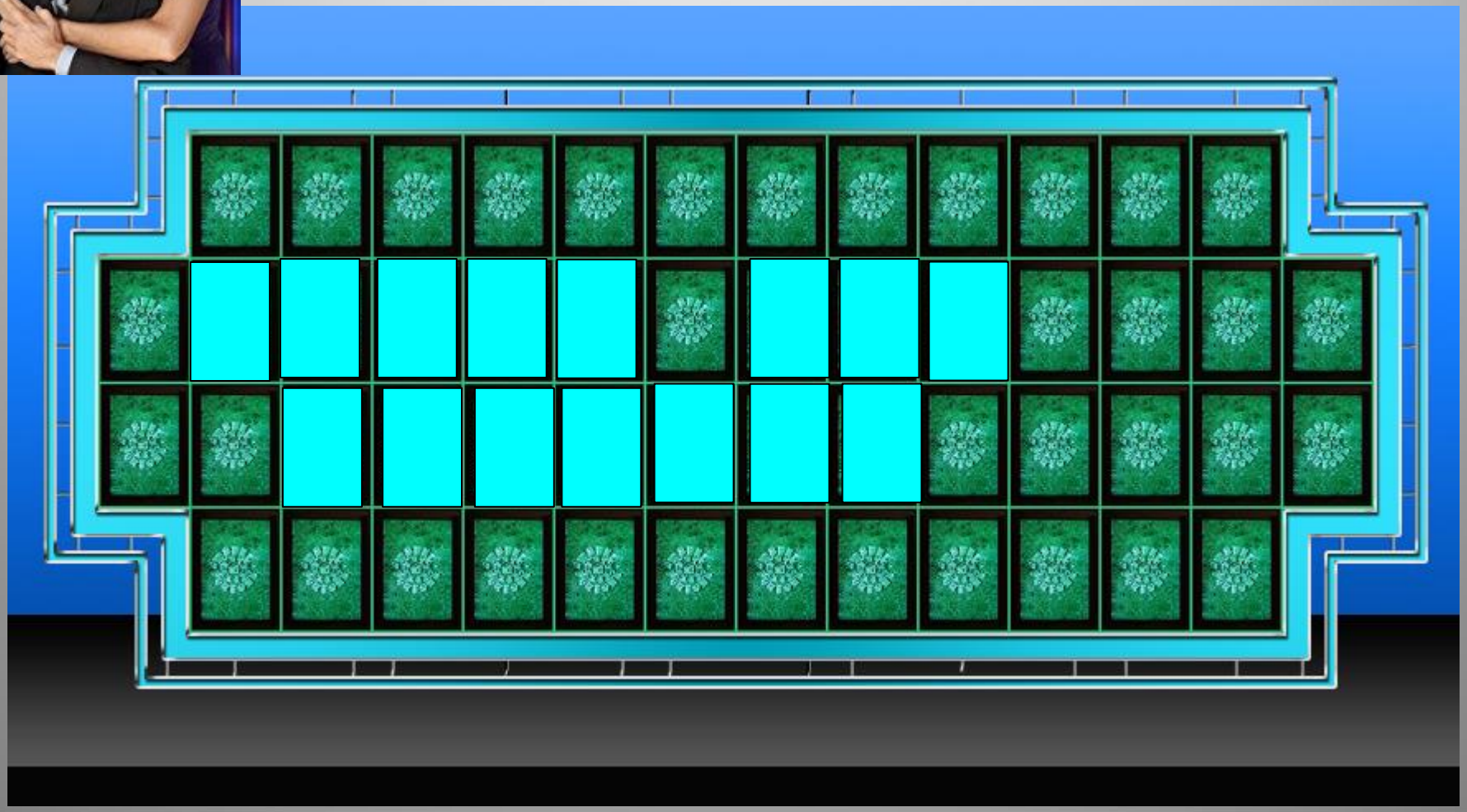
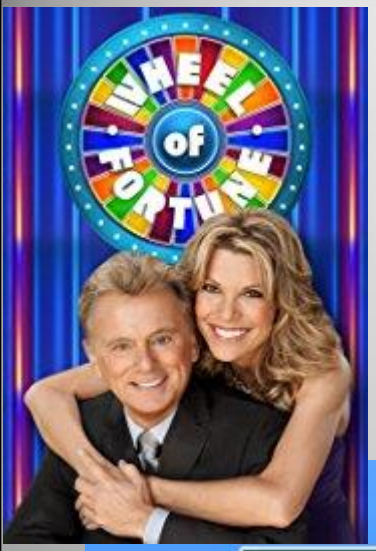
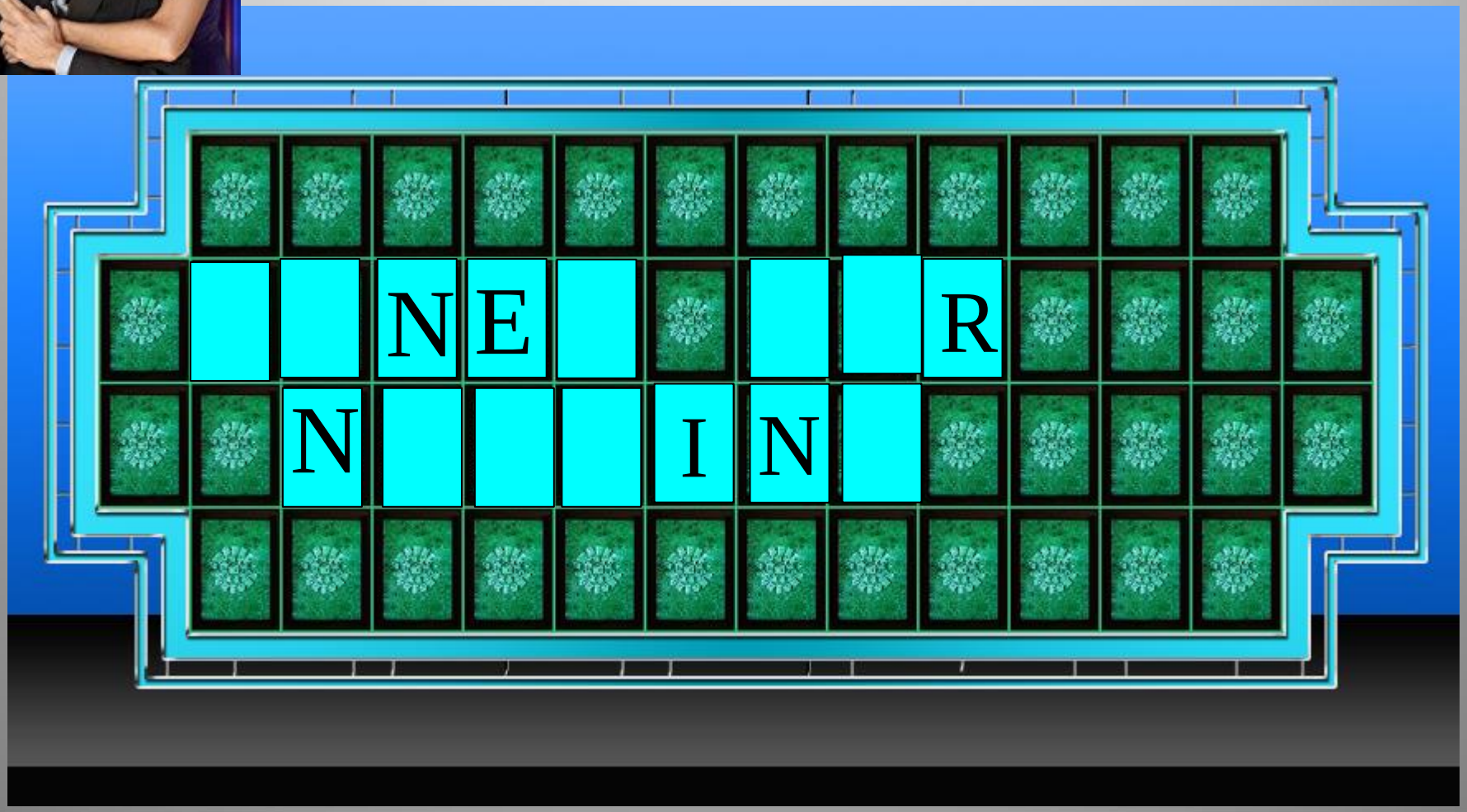

WHEEL
of
FORTUNE





Category: Song



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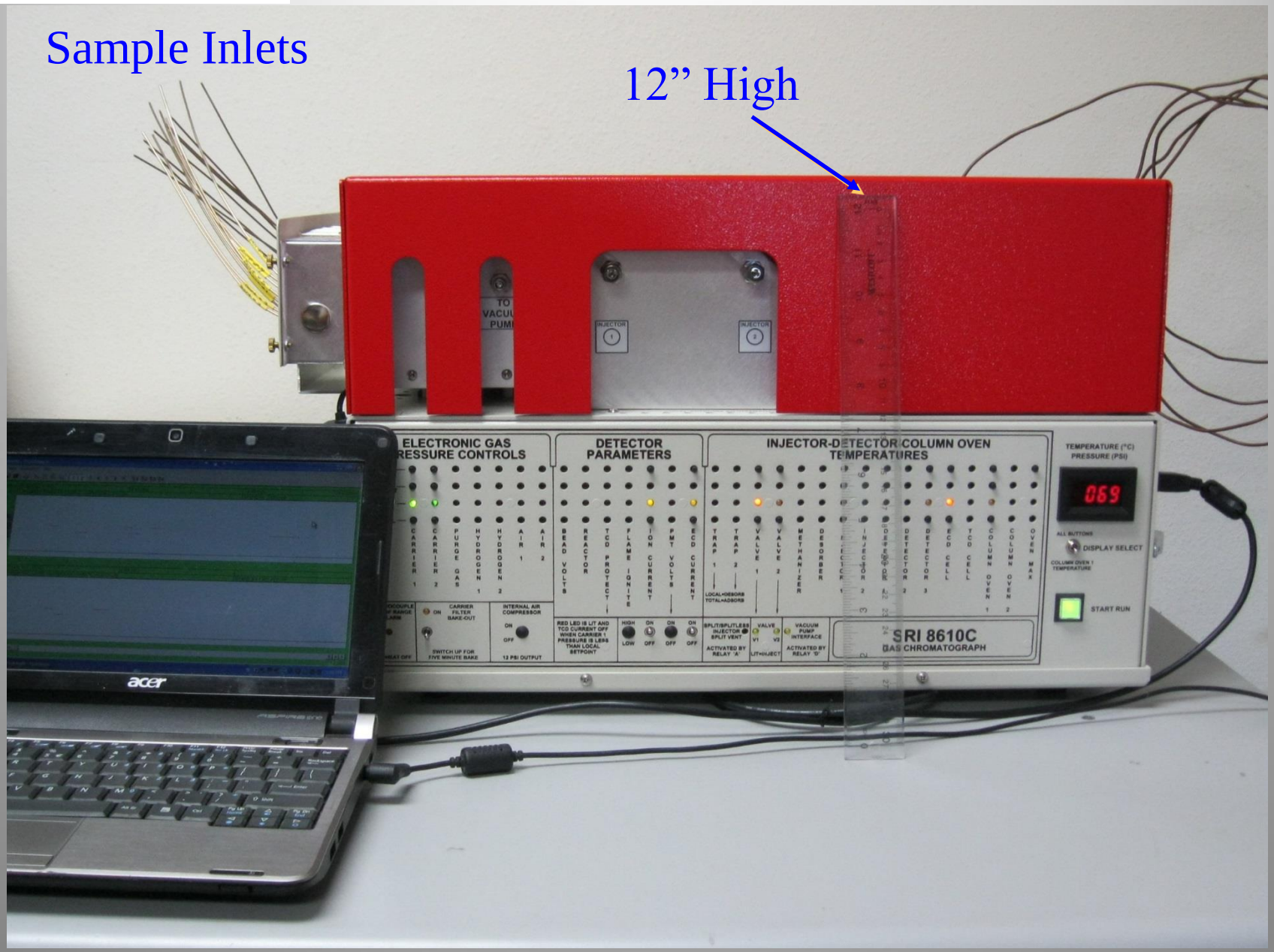
Continuous Monitoring System



System Capability

- Fully Quantitative! EPA Method TO-14
- Can Reach Ultra-Low Levels (<1 ug/m3) for TCE, PCE, Vinyl Chloride & others
- <10 min Analysis Time for TCE & PCE
- Multiple Sample Locations (16 to 30)
- Very Stable - holds calibration for months
- Real-Time Data – Web-Based Dashboard
- Discrete Sampling Mode

Data

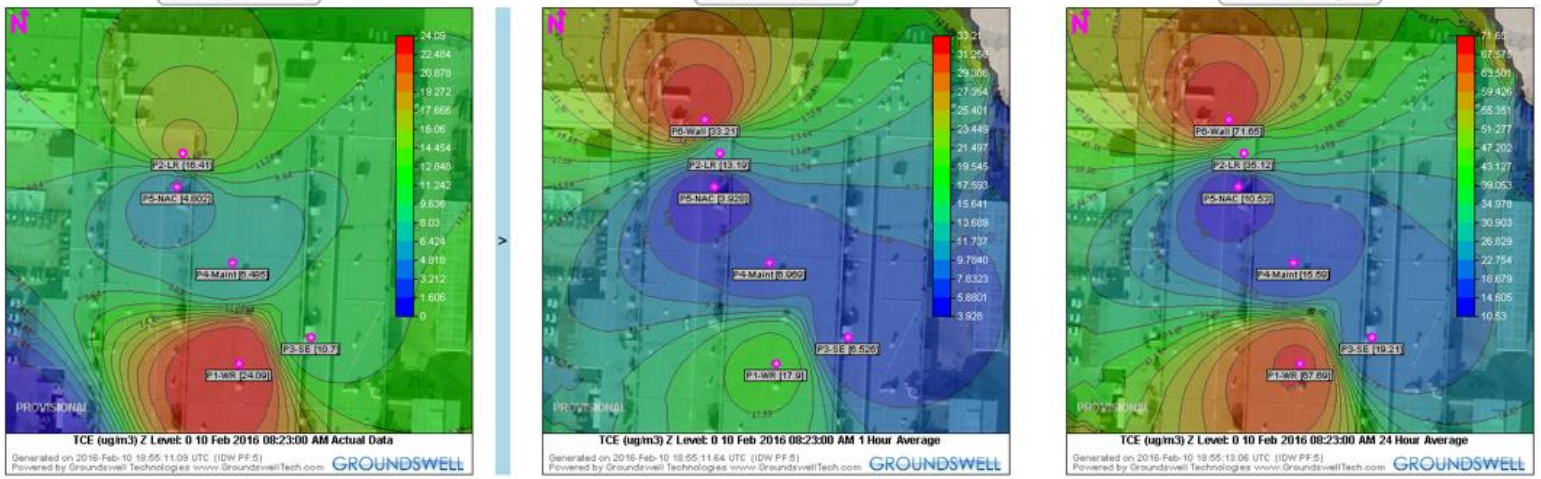
- Concentrations
- Pressure Differential
- Barometric, Temp., Wind Speed, etc.
- Daily Summary Reports (by e-mail)
- Trigger Relays
- User Friendly Dashboard
  - VOC Conc vs Time
  - Contour/Isopleth Images
  - Moving Averages
  - Plots in Seconds

User Friendly Web-Based Data

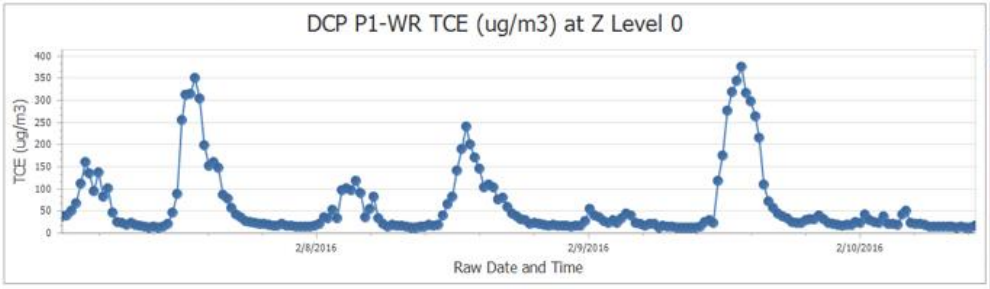
Data Channel TCE (ug/m3) 2016-02-10 10:22:29 AM Jump to Time S Jump to Most Recent Tir Z Level: 0

Show DCP Labels Show DCP Markers Map Type Aerial Map Opacity 55% Visualization Type IDW Bin This Time Step

Actual Data | 1 Hour Average | 24 Hour Average



DCP: P1-WR



123 Alerts in the Last 24 Hours (View All)

Raw Date Time	Norm Date Time	DCP	Alert Value
2016-02-10 10:34:38	2016-02-10 08:23:00	P1-WR	24.0905 TCE ug/m3
2016-02-10 10:30:35	2016-02-10 07:59:00	P6-Wall	34.1741 TCE ug/m3
2016-02-10 10:06:16	2016-02-10 07:35:00	P6-Wall	32.2501 TCE ug/m3
2016-02-10 08:28:59	2016-02-10 05:59:00	P6-Wall	25.5198 TCE ug/m3

Page 1 of 16 (123 items) < Prev 1 2 3 4 5 6 7 ... 14 15 16 Next >

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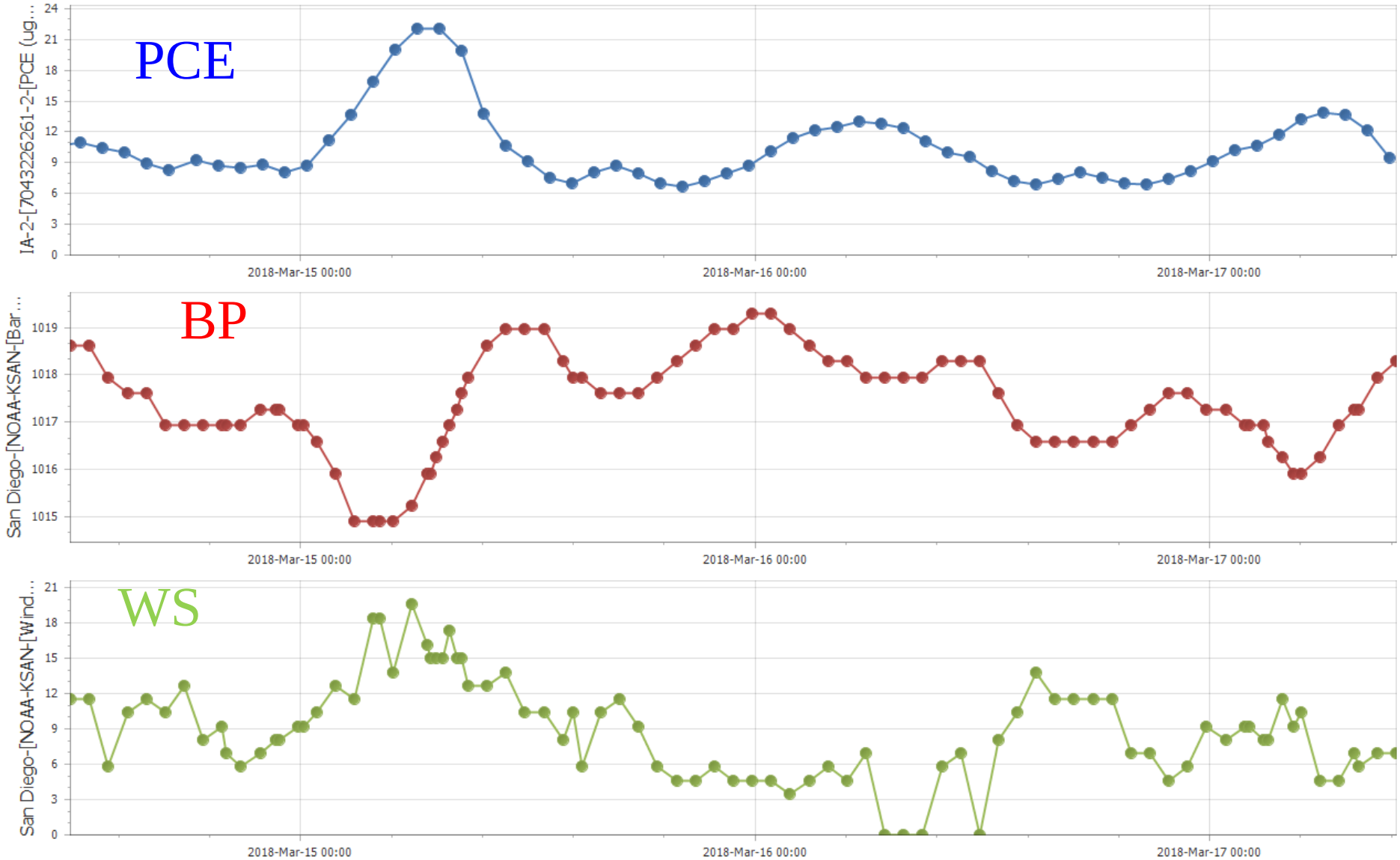
Former Dry Cleaner



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System QA/QC

- EPA Method TO-14
- Calibrated with Validated Gas Standards
- Minimum of 5 Calibration Points
- Can Run Calibration Gas Every Cycle of Ports
- Precision on EPA Indy Site: <10% over 100 Days
- Accuracy vs off-site TO-15: 17%

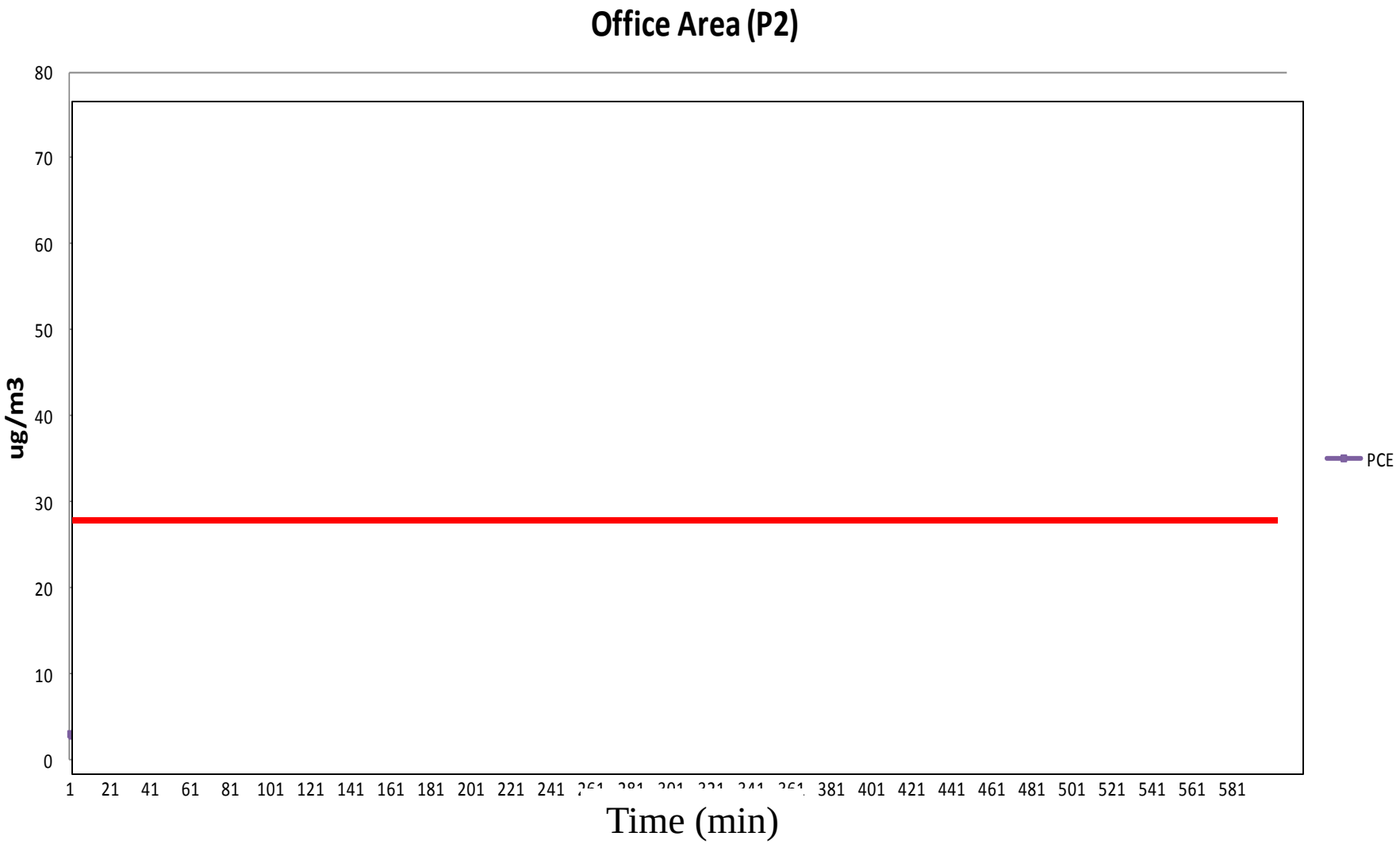
EPA Documented:

https://clu-in.org/download/issues/vi/VI-EPA-600-R-13-241.pdf
(EPA/600/R-13/241 | June 2015 | www.epa.gov/research)

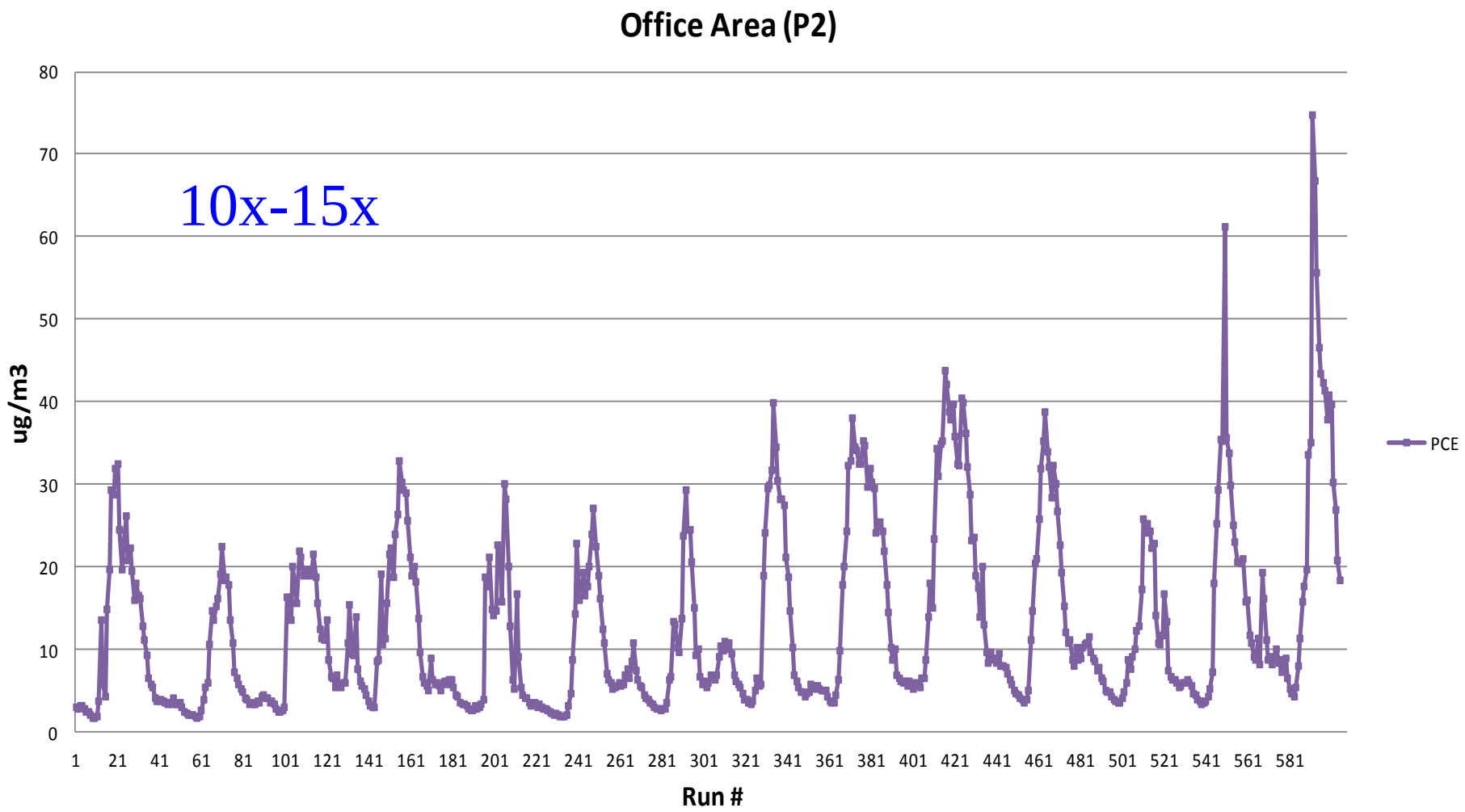
Simple Set-Up Logistics

- GC Setup
  - Small footprint (~2’ x 4’ table required)
  - Standard wall power (115v)
  - Room with some temperature control
- Sampling Lines
  - Up to 100m from instrument possible
  - Small diameter tubing (1/8” or ¼”)
- O&M
  - Change nitrogen every 3 to 5 months
- Internet Connectivity
  - Ethernet cable, site Wifi or cellular modem

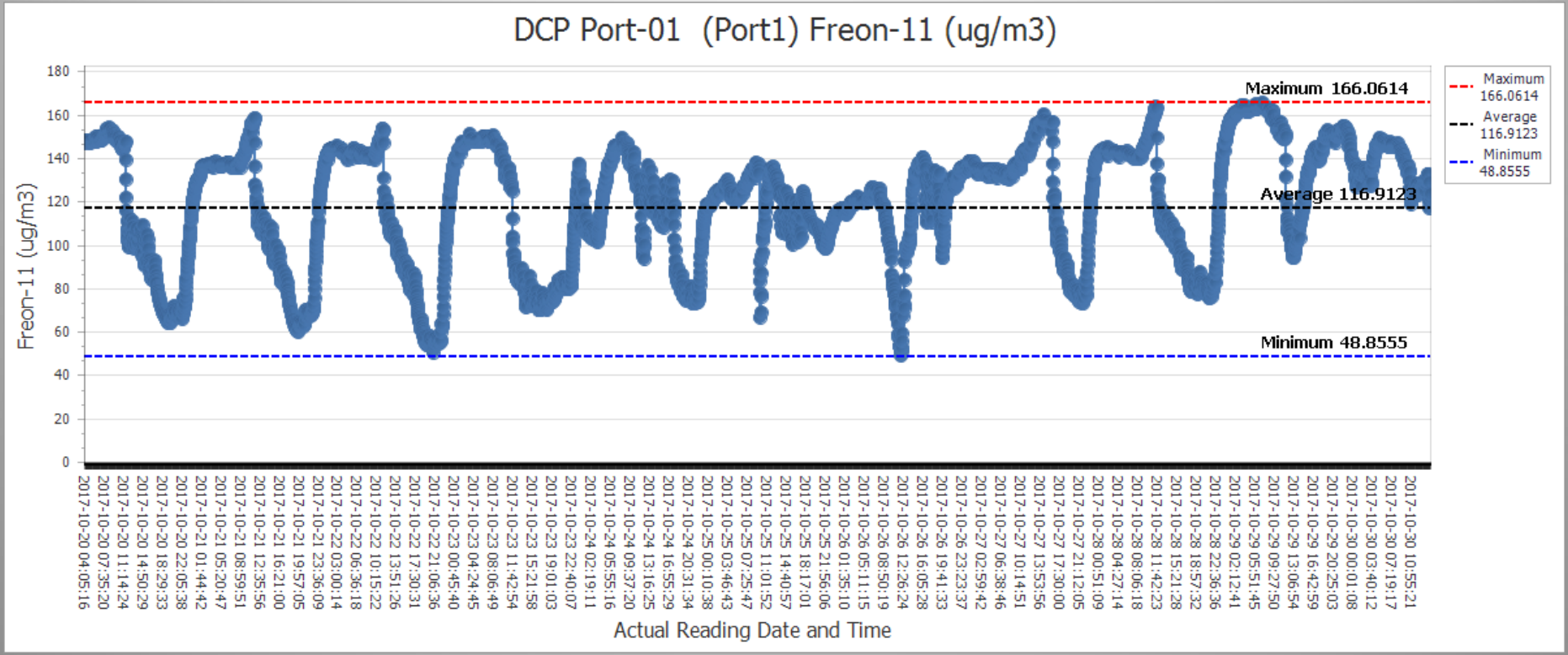
IA Values Are Not Like This



Print Shop Air - PCE– June 2014



Freon 11 - Office Bldg – 10 Days



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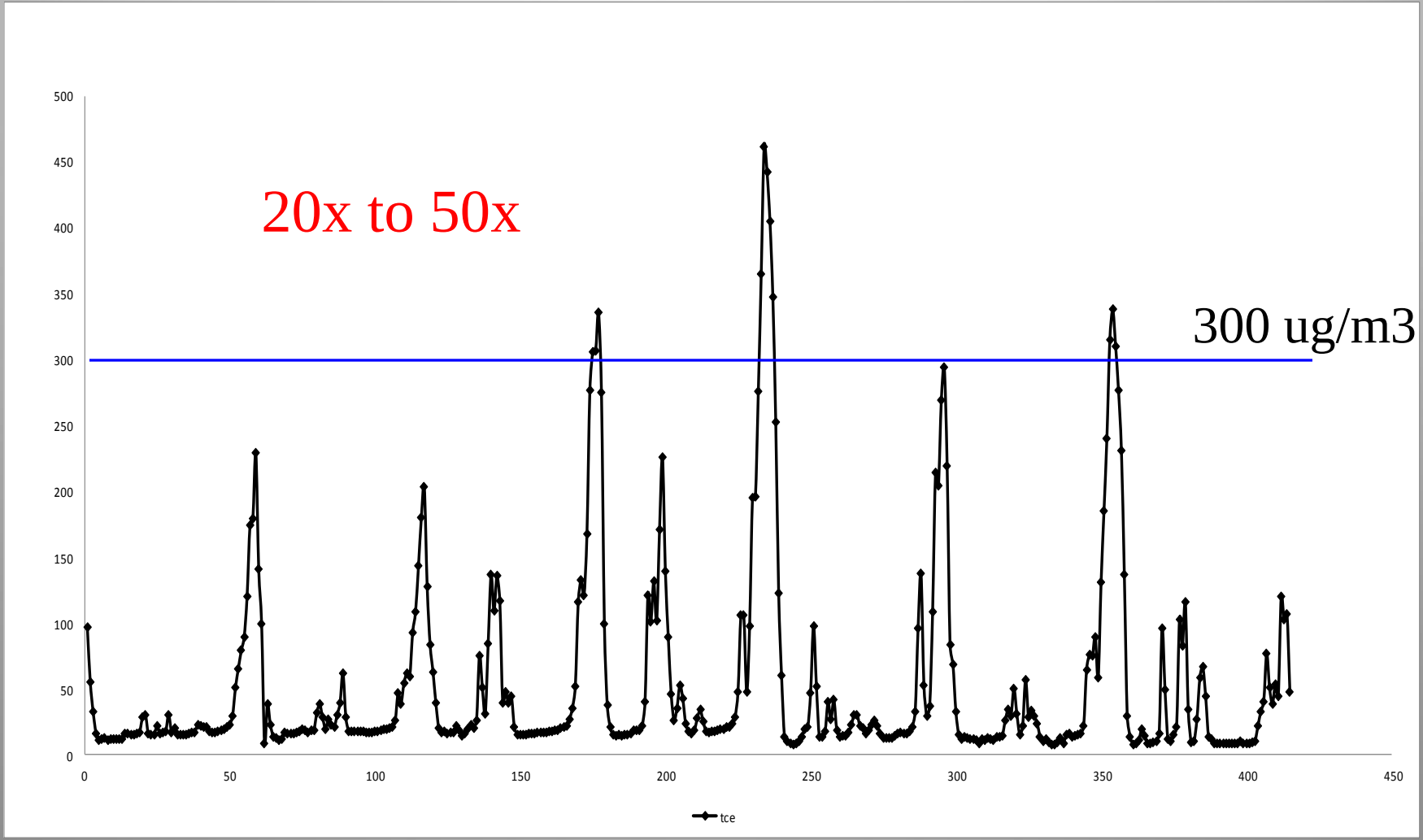
Large Industrial Building



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Determining Exposures to VOCs

How High?

How Often?

For How Long?

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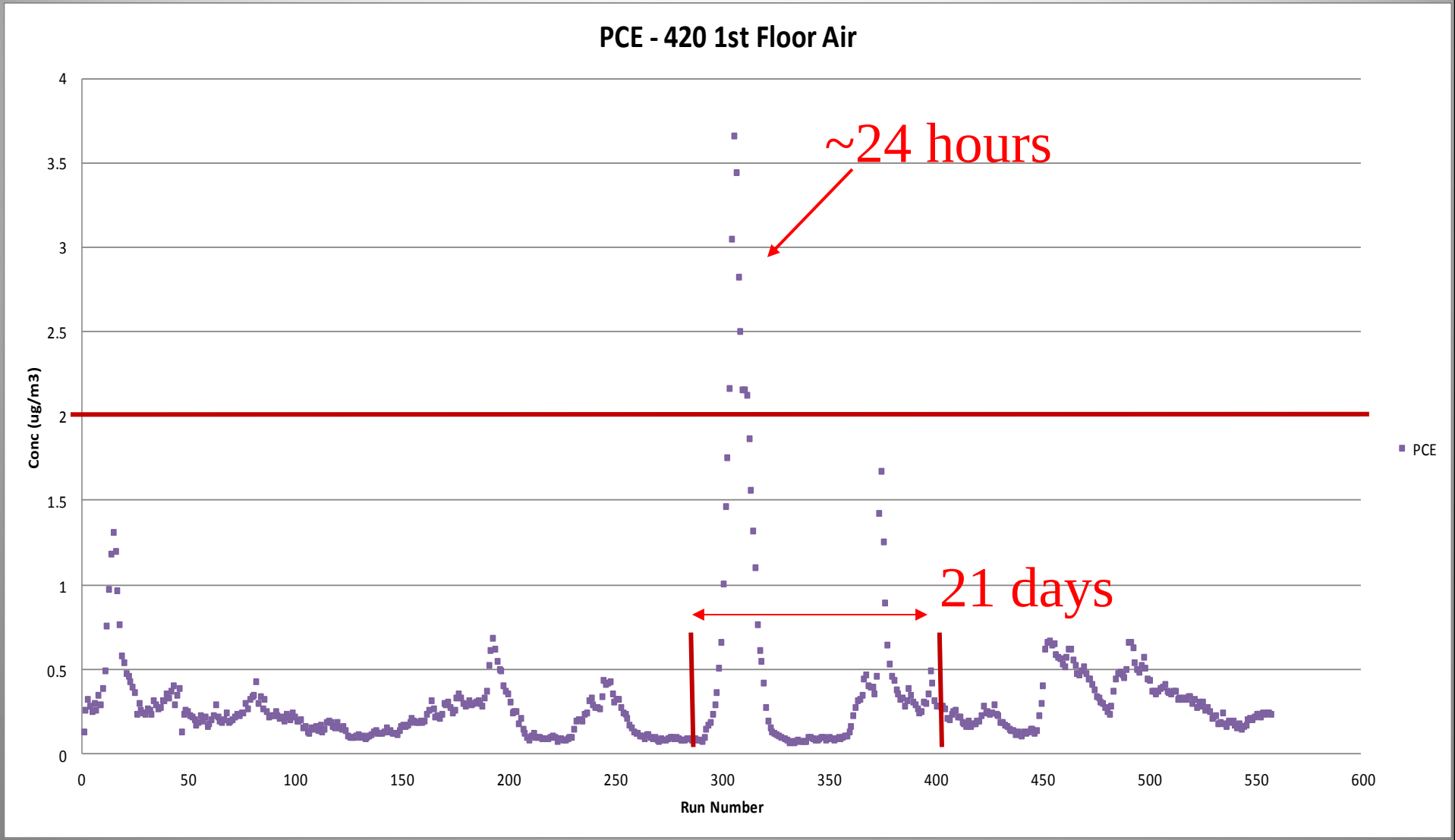
Monitoring Indoor Air VOCs



12/2012 1/2013 2/2013 3/2013

Finding VOC Entry Points

- Discrete Sample Mode: 40-50 samples/day
- Continuous Mode: 16 locations at a time

Minimizes False Negatives

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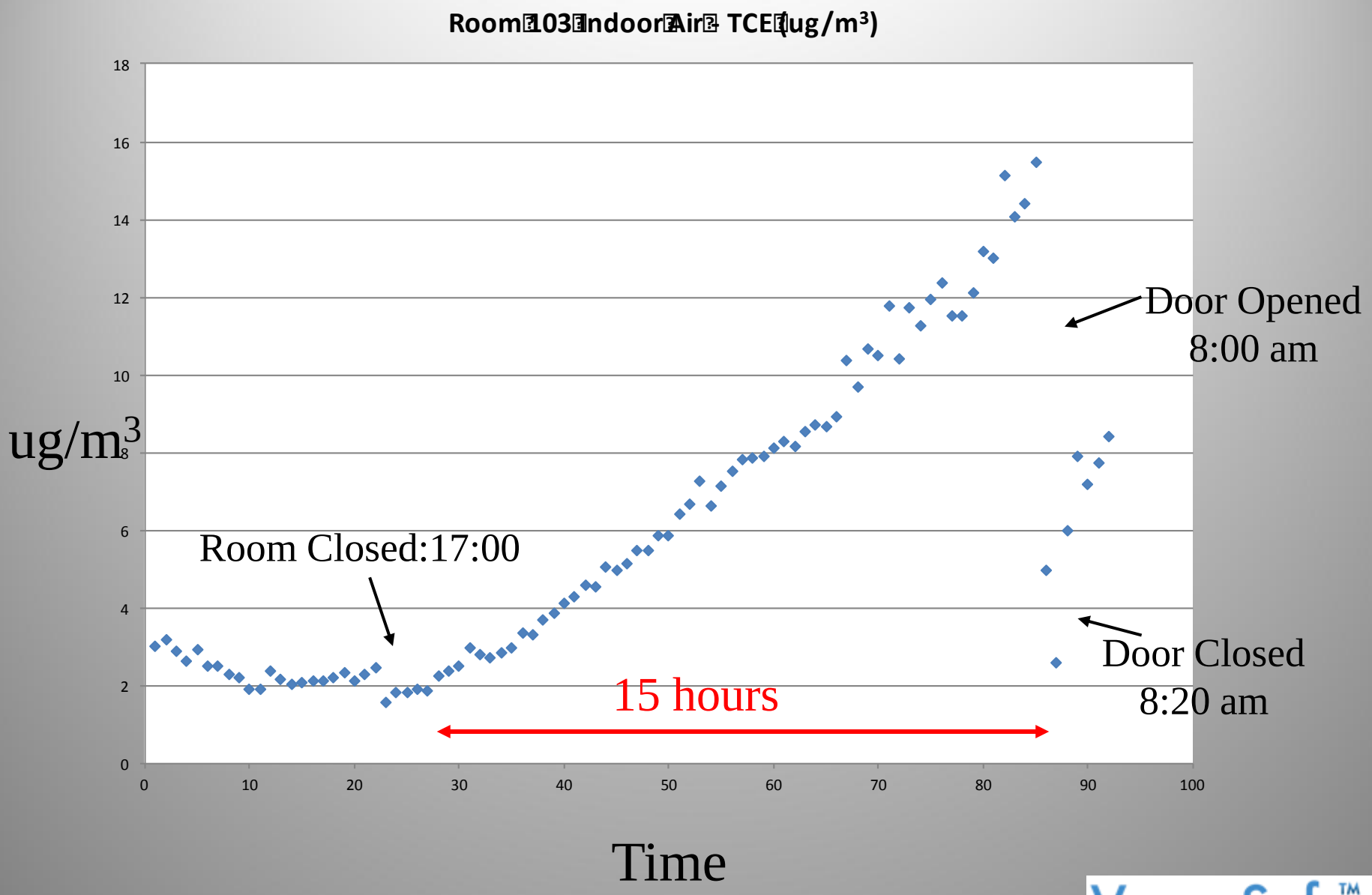
VOC Entry Point Determination



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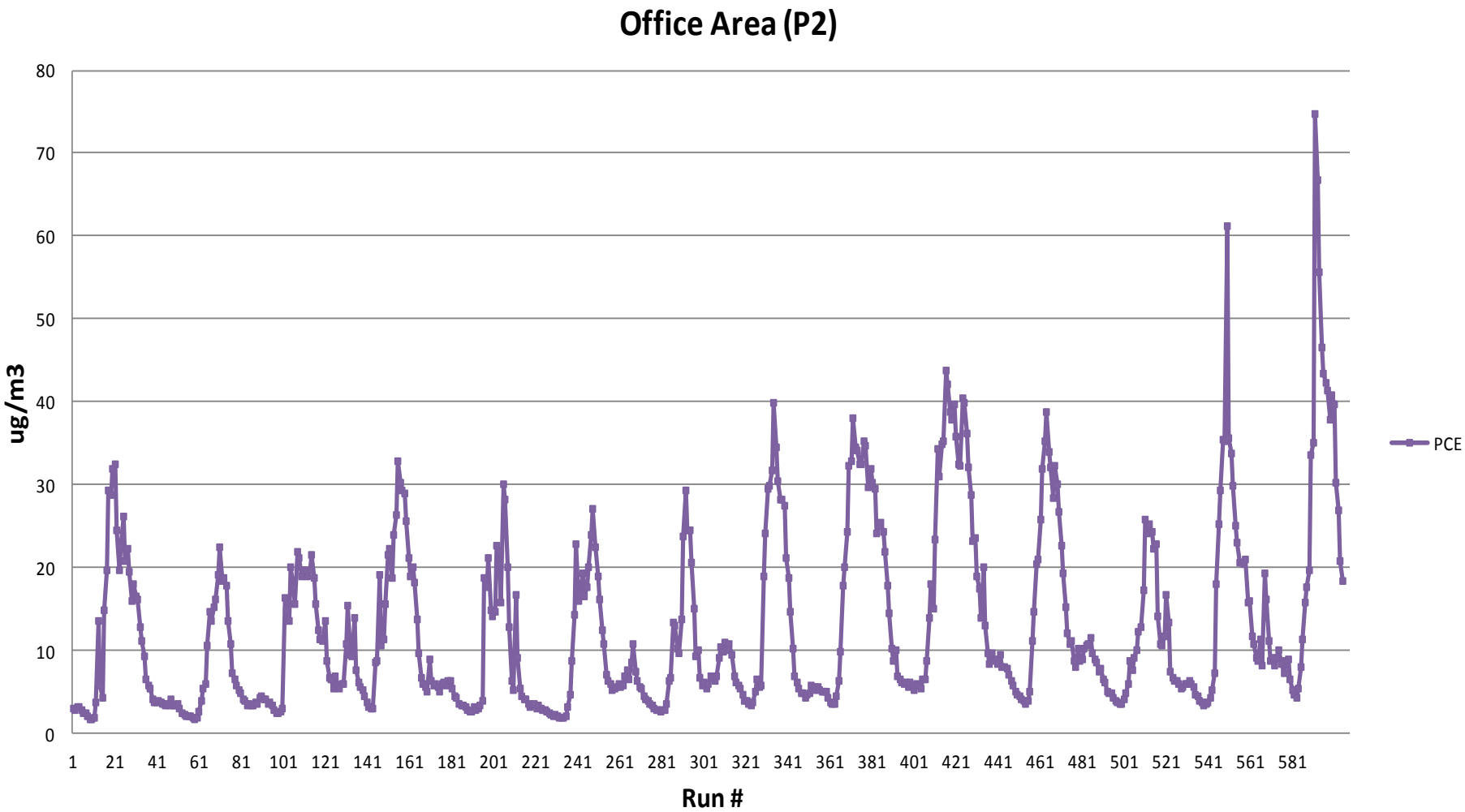
Determining IA vs VI Source



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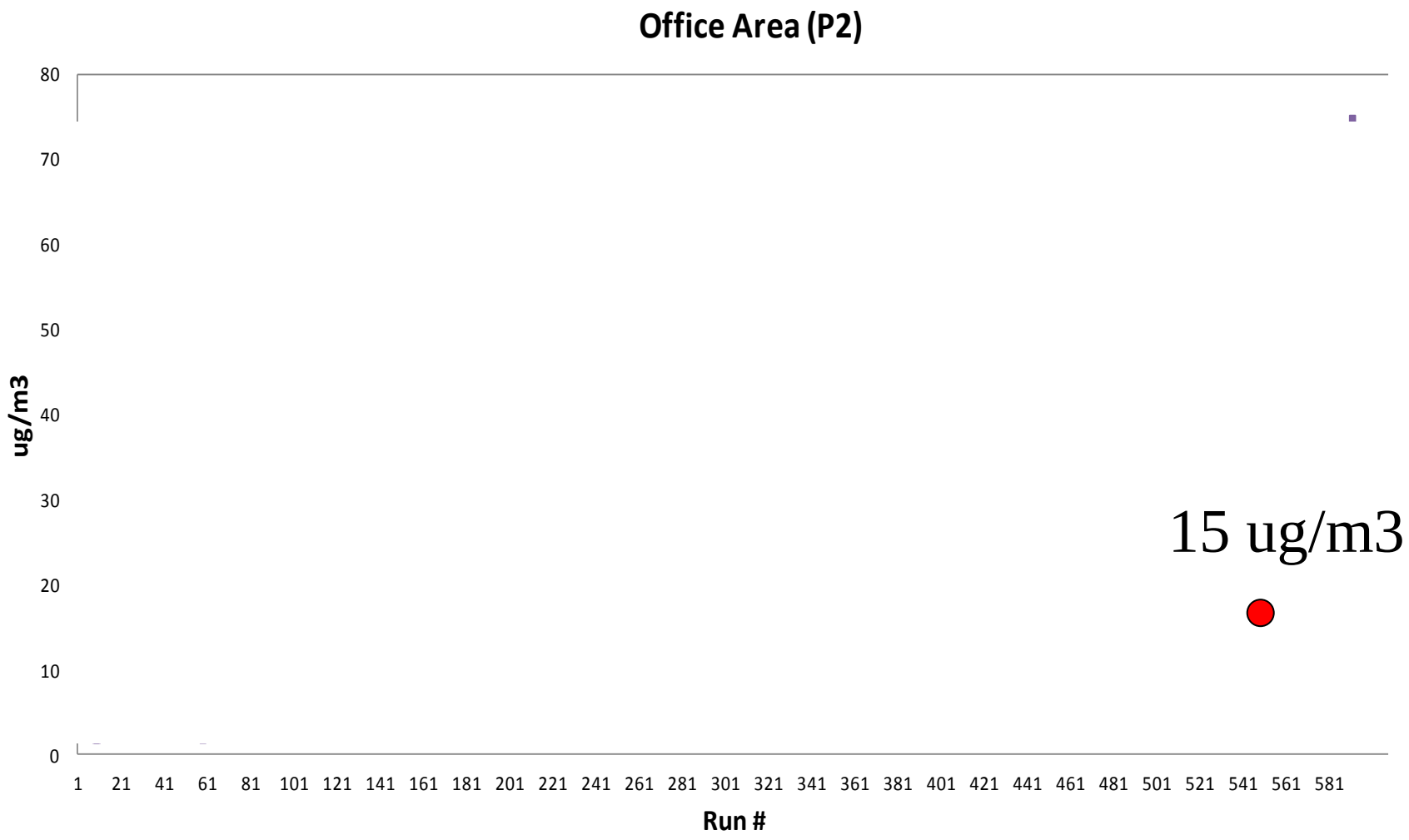
Typical Data After 14 Days



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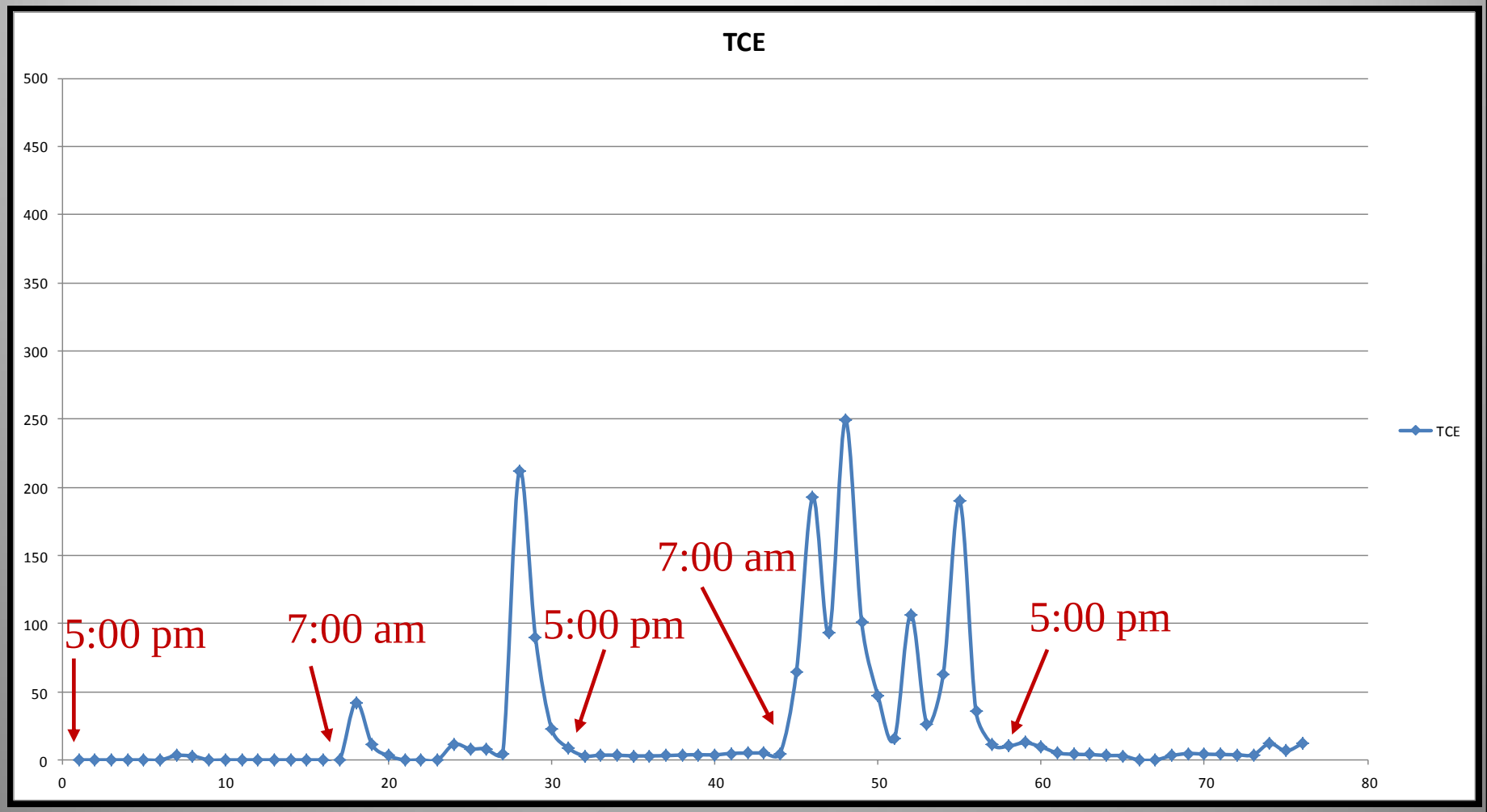
Determining IA vs VI Source



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Assessing Effectiveness of Remedies

- Can Try Various Remedies & See Effects
  - HVAC modifications
  - Fans on/off
  - Air filtration units
  - Sealing sumps & cracks
  - Optimizing vapor recovery systems

Can put VI Issue to Rest in Days Rather than Months or Years!!

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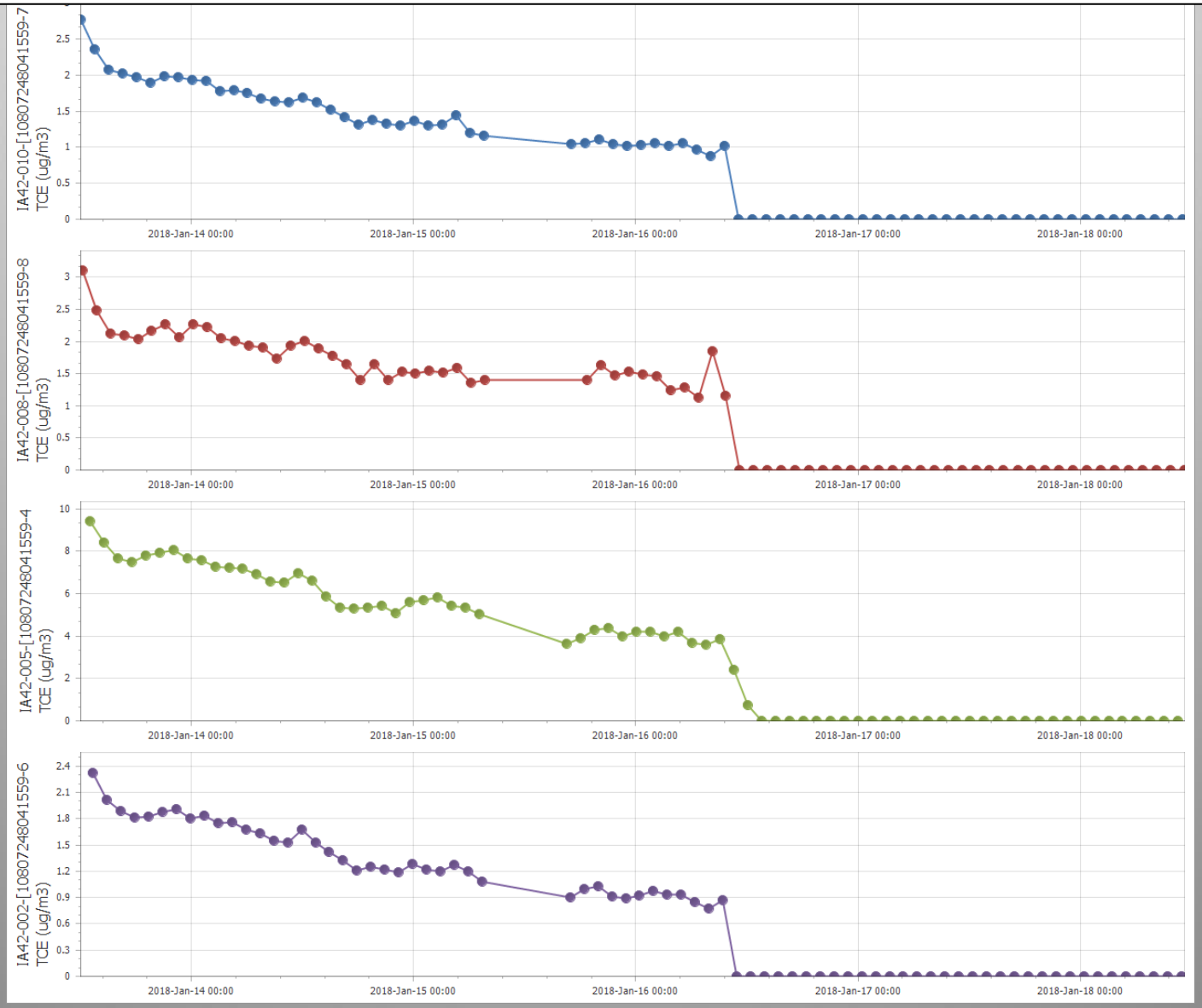
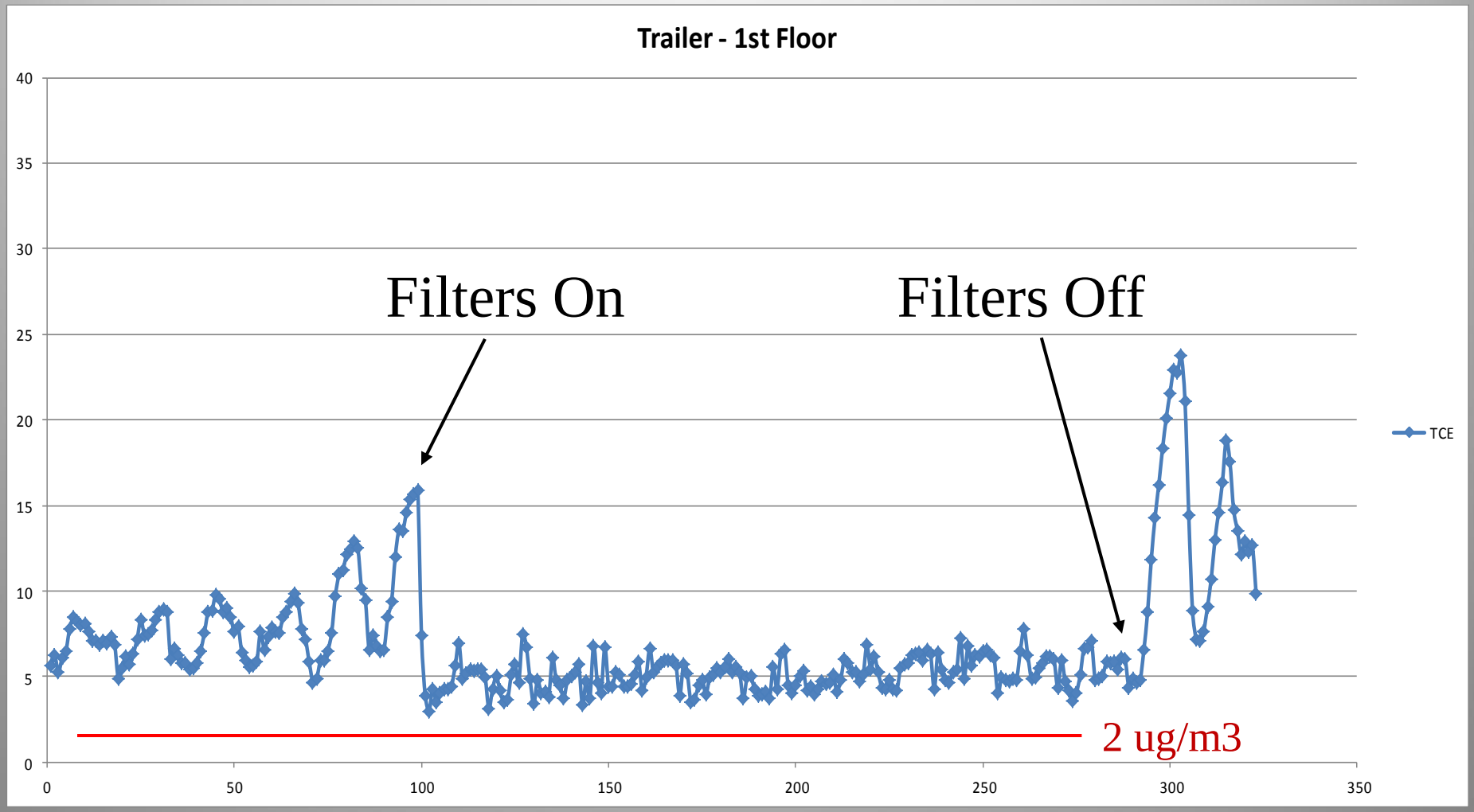
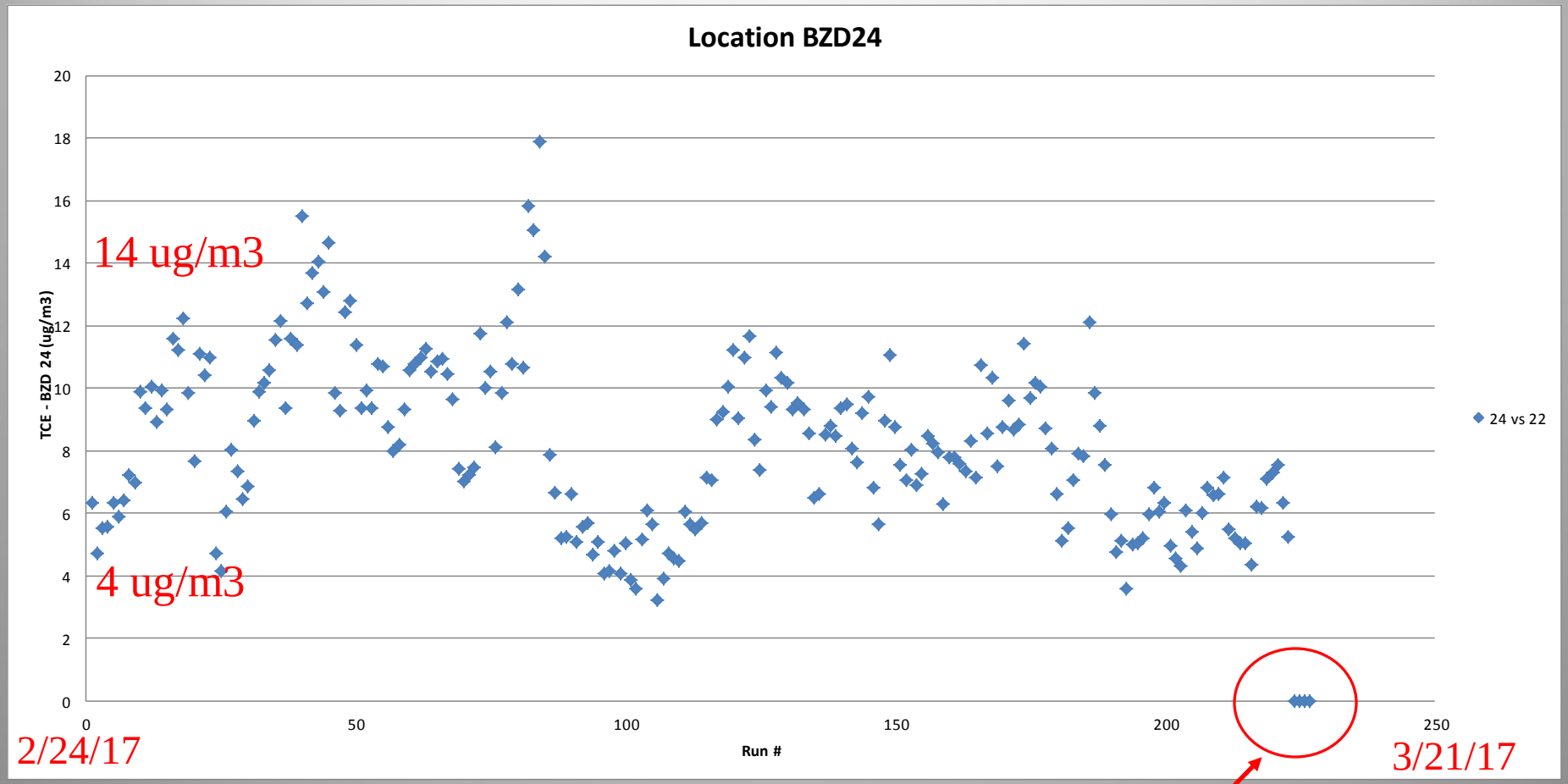
Proving the Effectiveness of a Remedy SSD System



Remedy Effectiveness
Air Filtration Units



Remedy Effectiveness



Seal Sumps

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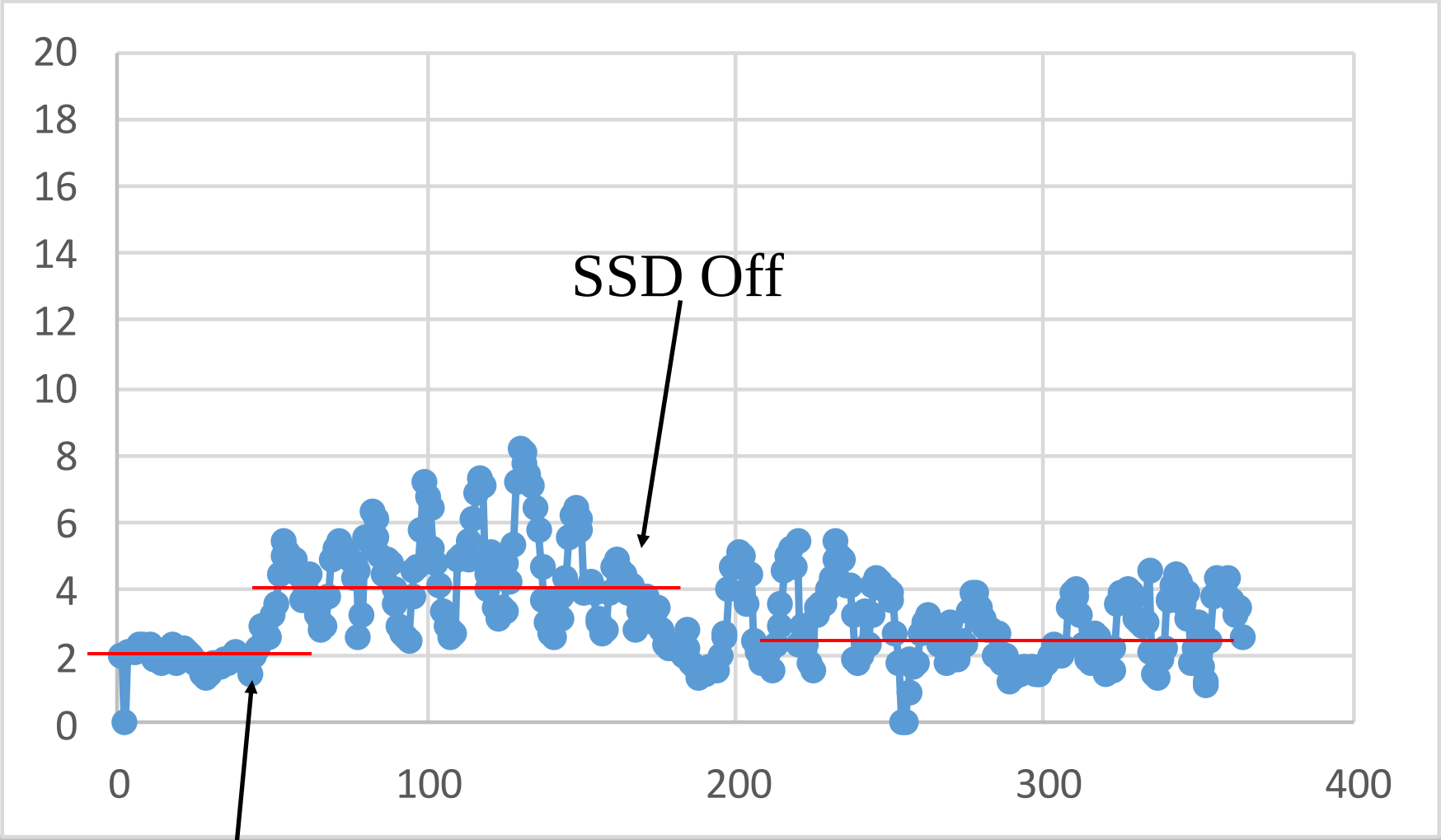
Remedy Effectiveness
Residential SSD



Air filtration units off

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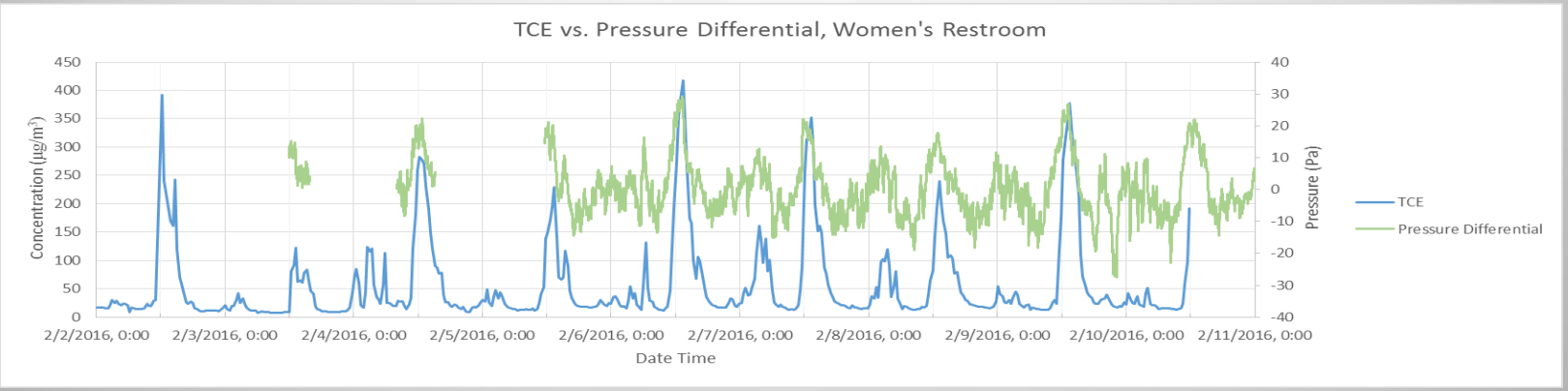
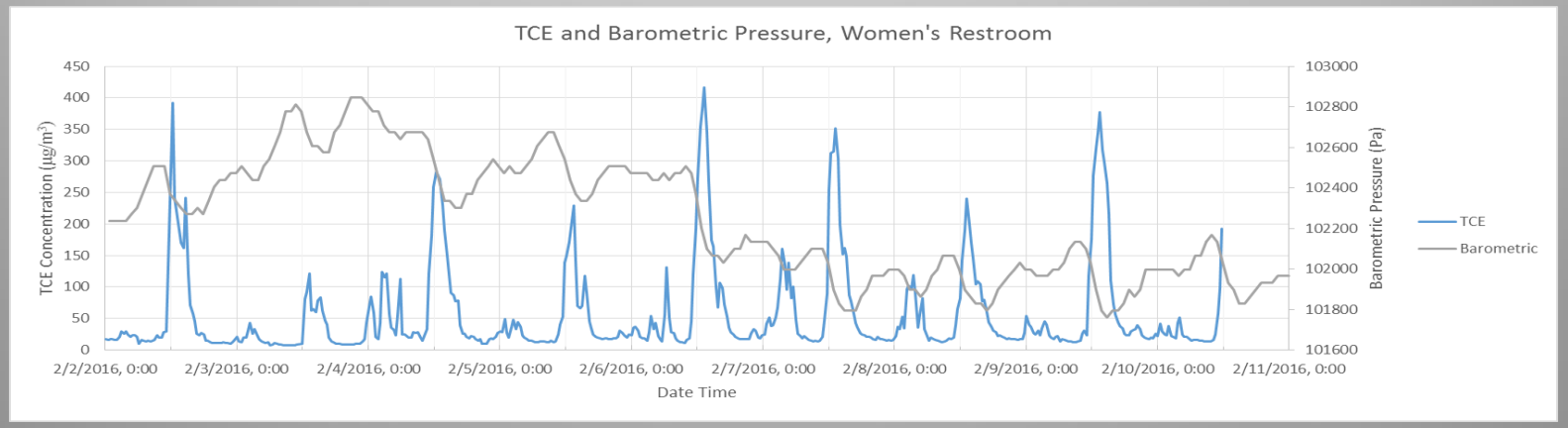
Determining Cause & Effect

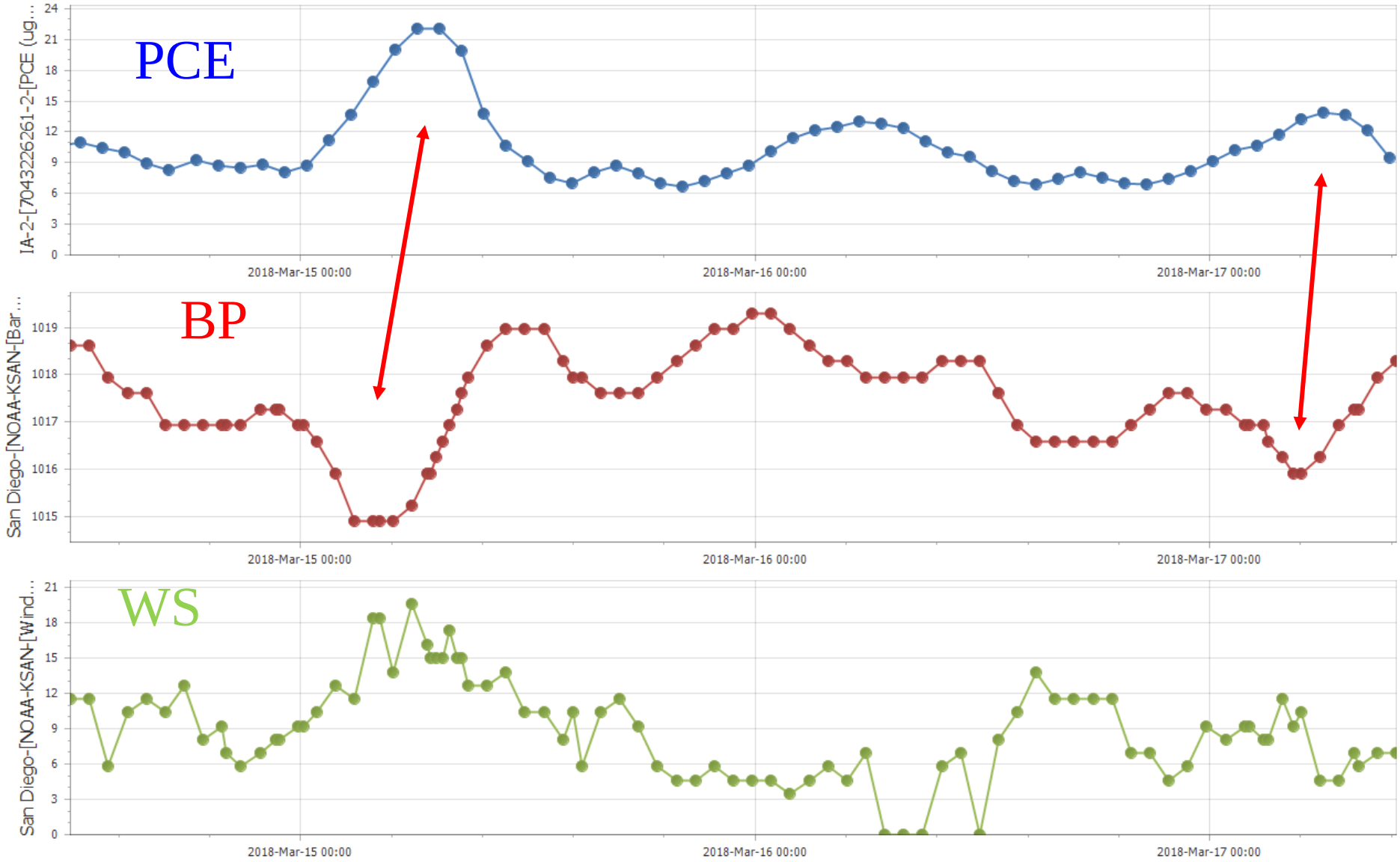


Correlation with Differential Pressure



Correlation with Barometric Pressure Change

Determining Cause & Effect



Monitoring Remediation

- Remediation & Mitigation System Monitoring
  - Thermal Heating - ERH
  - In-Situ GW/Soil Remediation - Peroxide
  - Sub-Slab Depressurization Systems

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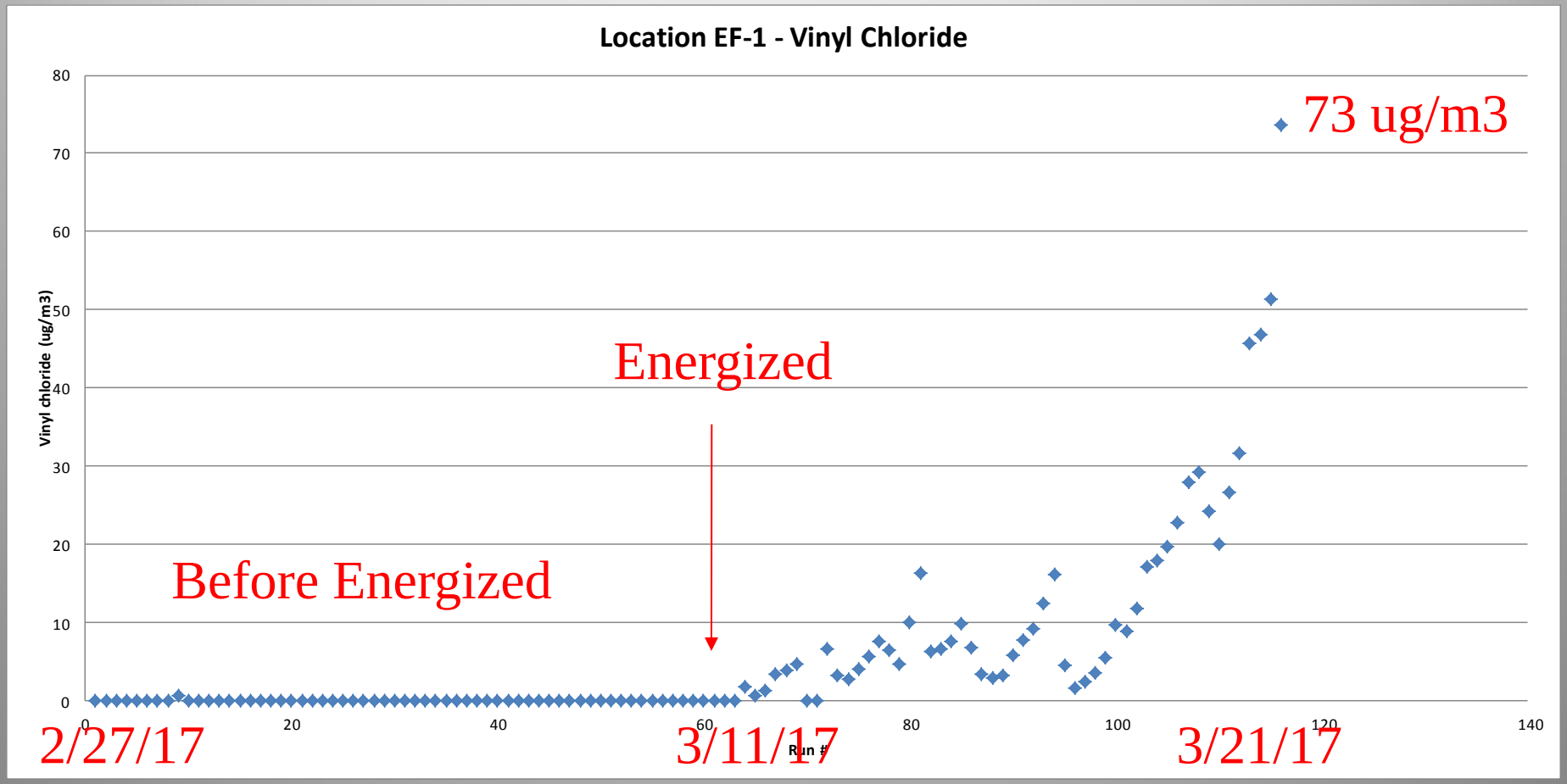
Remediation Monitoring
Vinyl Chloride Effluent



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Summary

- High Resolution Data Gives Pattern
- Pattern = Opportunity
- Opportunity to:
  - Differentiate Indoor vs Subsurface Source
  - Find VOC entry locations, preferential pathways
  - Determine best remedy
  - Evaluate effectiveness of mitigation systems
  - Evaluate effectiveness of remediation systems

Within Days!

The Obvious Questions:

- What Does it Cost?
  - ✓ $1000 - $2000/day (~$10/analysis)
  - ✓ 10 canisters: $5000
- Do Agencies Accept?
  - ✓ EPA Regions 1, 9, 10
  - ✓ MA, CA, NH, IN, AZ, OH, Navy
  - ✓ Upcoming: EPA-R5, NC, USACE
- How do Results Compare to TO-15?
  - ✓ No complaints to date

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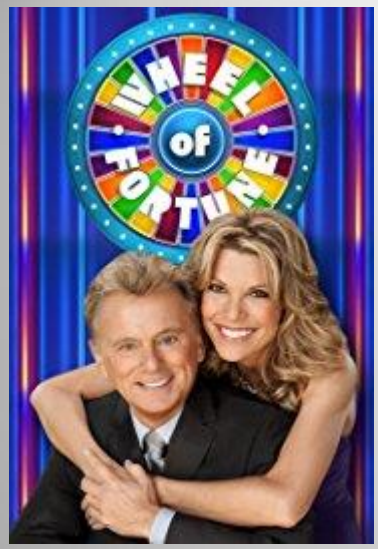

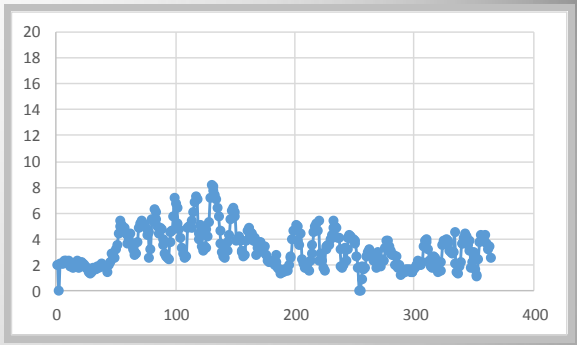

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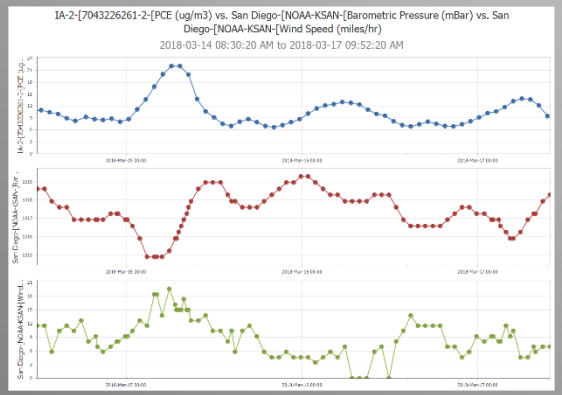
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