

Designing a Real-Time Fence Line Monitoring Program

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- Fence Line
- Real-Time
- Program



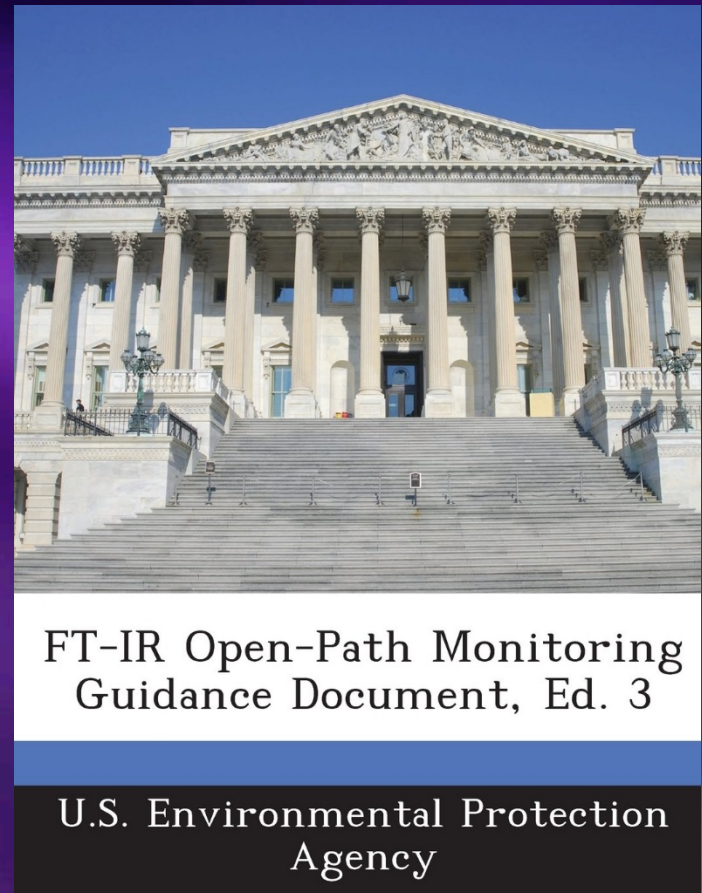
History

- ROSE – Remote Optical Sensing
 - Late 1970s, early 1980s
 - Phillip Hanst, Steve Levine, Bill Herget, et al.
- OP-FTIR – Open Path FTIR
 - 1990s
 - Michael Yost, Lori Todd, Ram Hashmonay, et al.



History

- The “Guidance Document”
 - 1993-1994
 - George Russworm and Jeff Childers – RTP
- Compendium Method “TO-16”
 - 1997
 - EPA



Transition from Past to Present

- Commercialization of OP-FTIR 1990s
 - Variety of applications
 - High price
 - Overpromising
- Commercialization of UV-DOAS
 - Fewer compounds
 - Greater focus of application
 - Fewer concerns – water vapor
- Publication Lull
- Use Overseas

Present Applications – Still Here

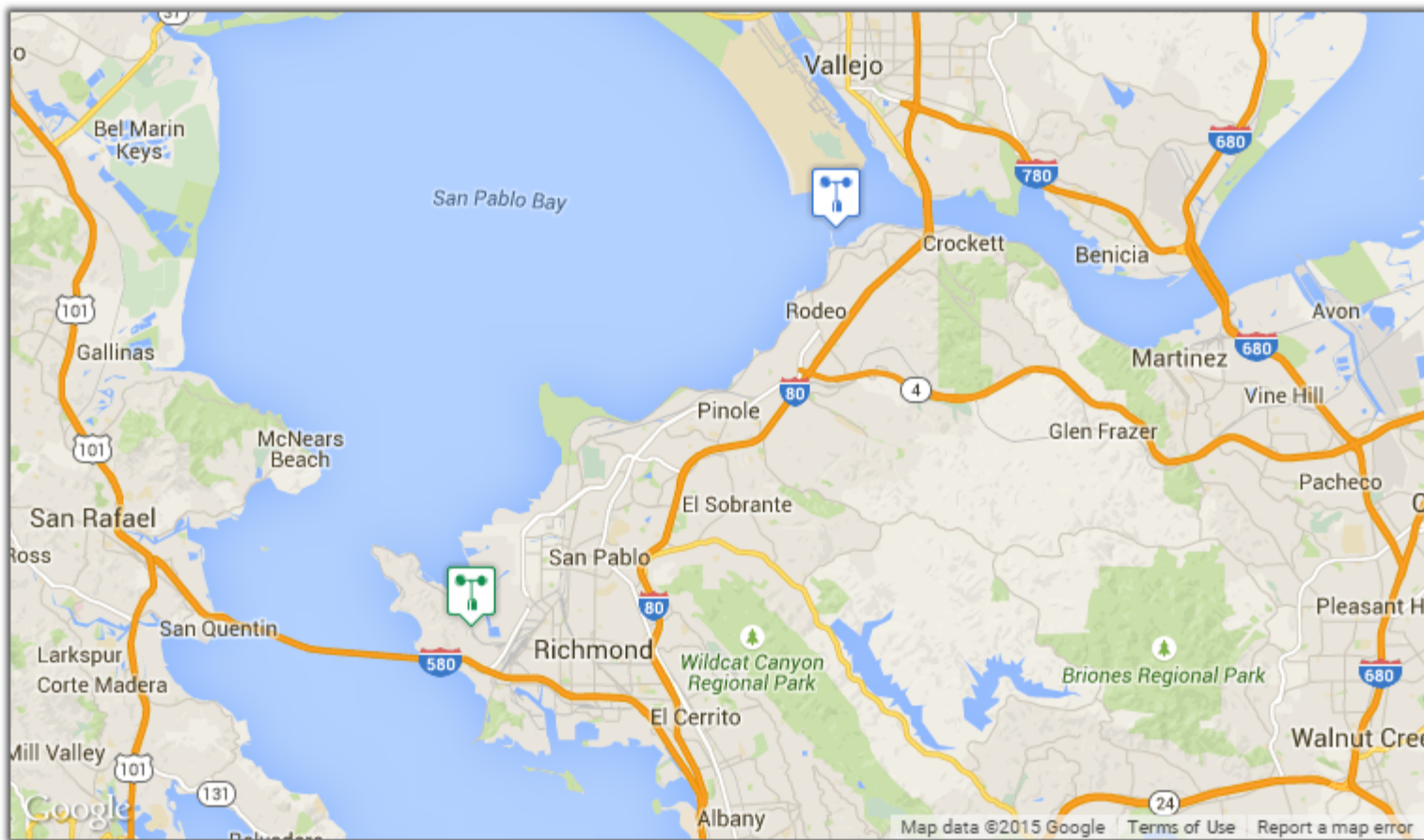
- Fence Line Monitoring
 - “Nothing crosses our fence....”
 - Industrial “Parks” – communities nearby
- Fixed Installations at Major Facilities
 - Early warning system
 - Communicating with the people

This website is a portal to data and information from a network of real-time air monitors located in the California Bay Area.

The bouncing markers on the map below pinpoint the locations of multiple air monitoring stations installed across the east bay. Clicking on the markers provides more information about these monitoring stations.

We invite you to explore the resources provided, including brief tutorials about what instruments are being used, where the readings come from, what they mean, and how you can learn more.

Thanks for stopping by!



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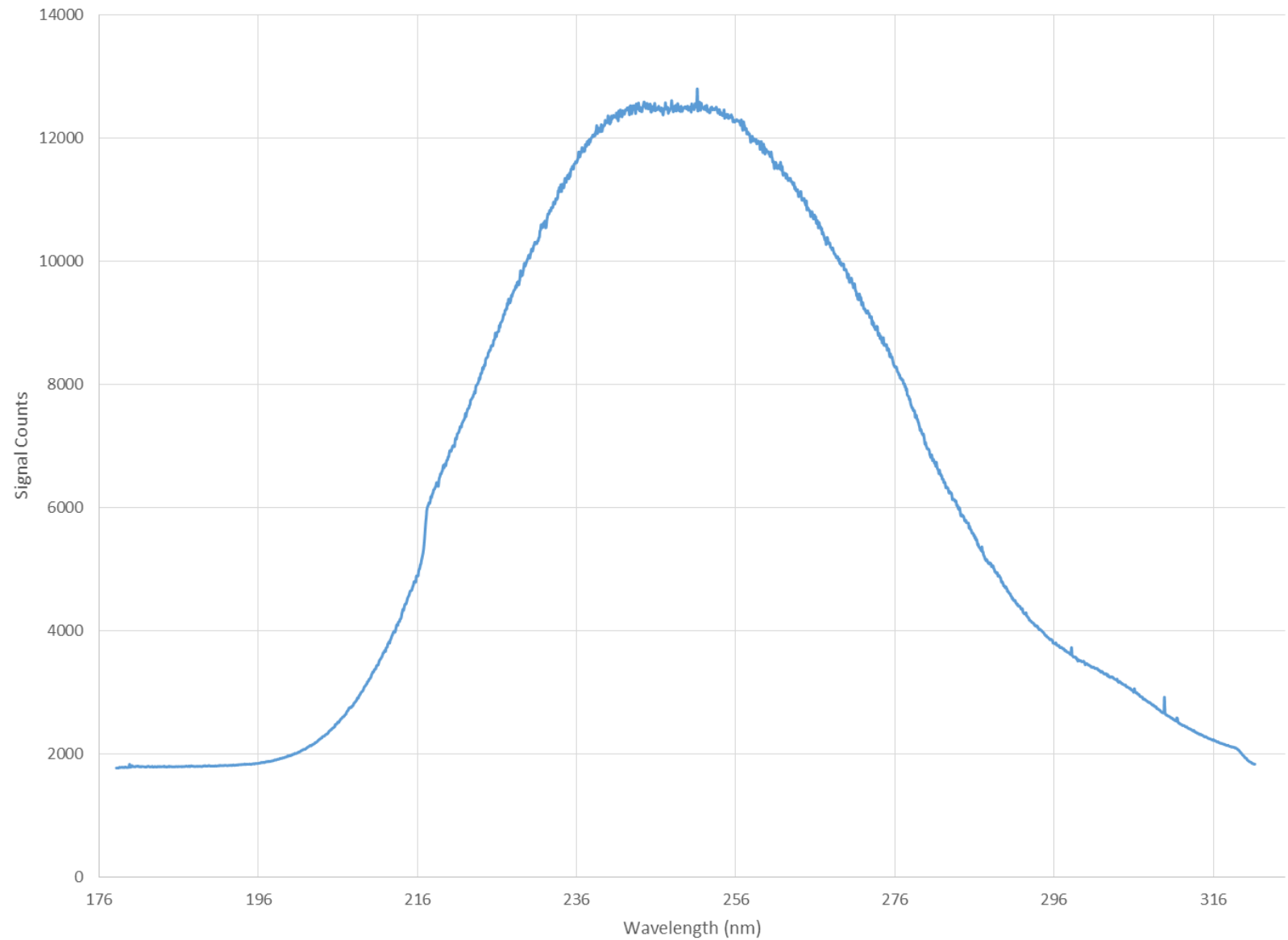
Examples (but not theoretical)



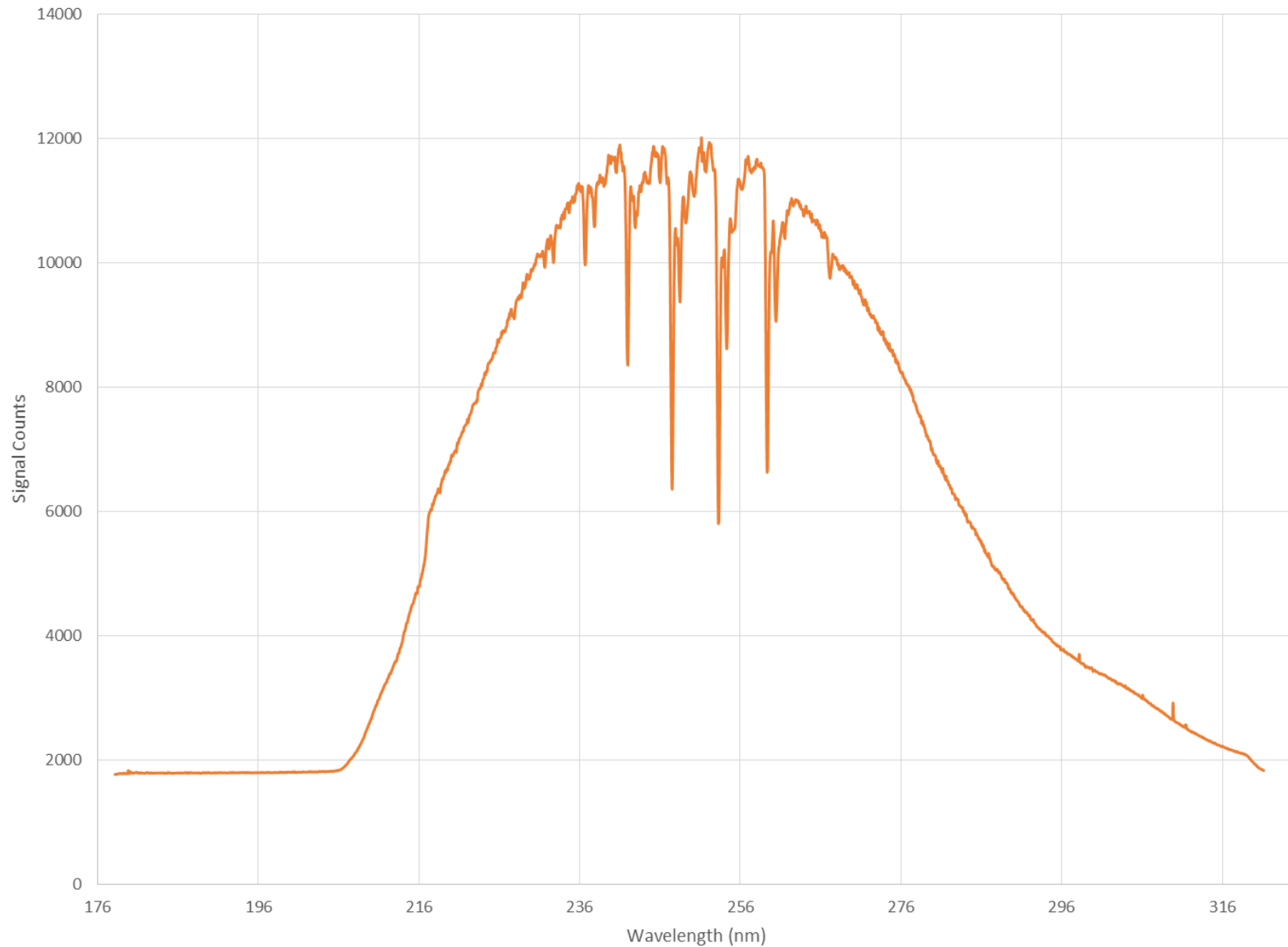
Examples (not theoretical)



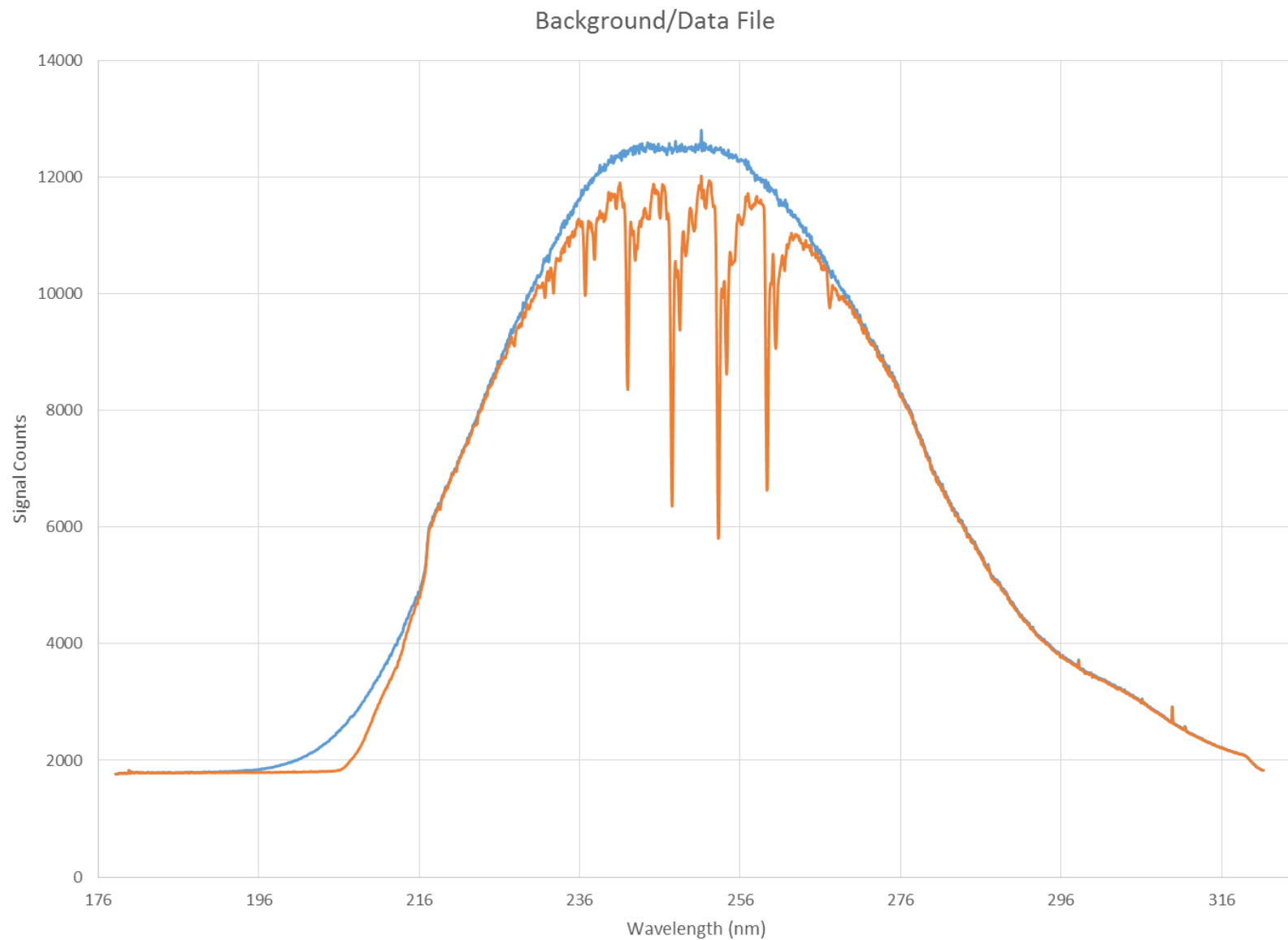
Background Spectrum



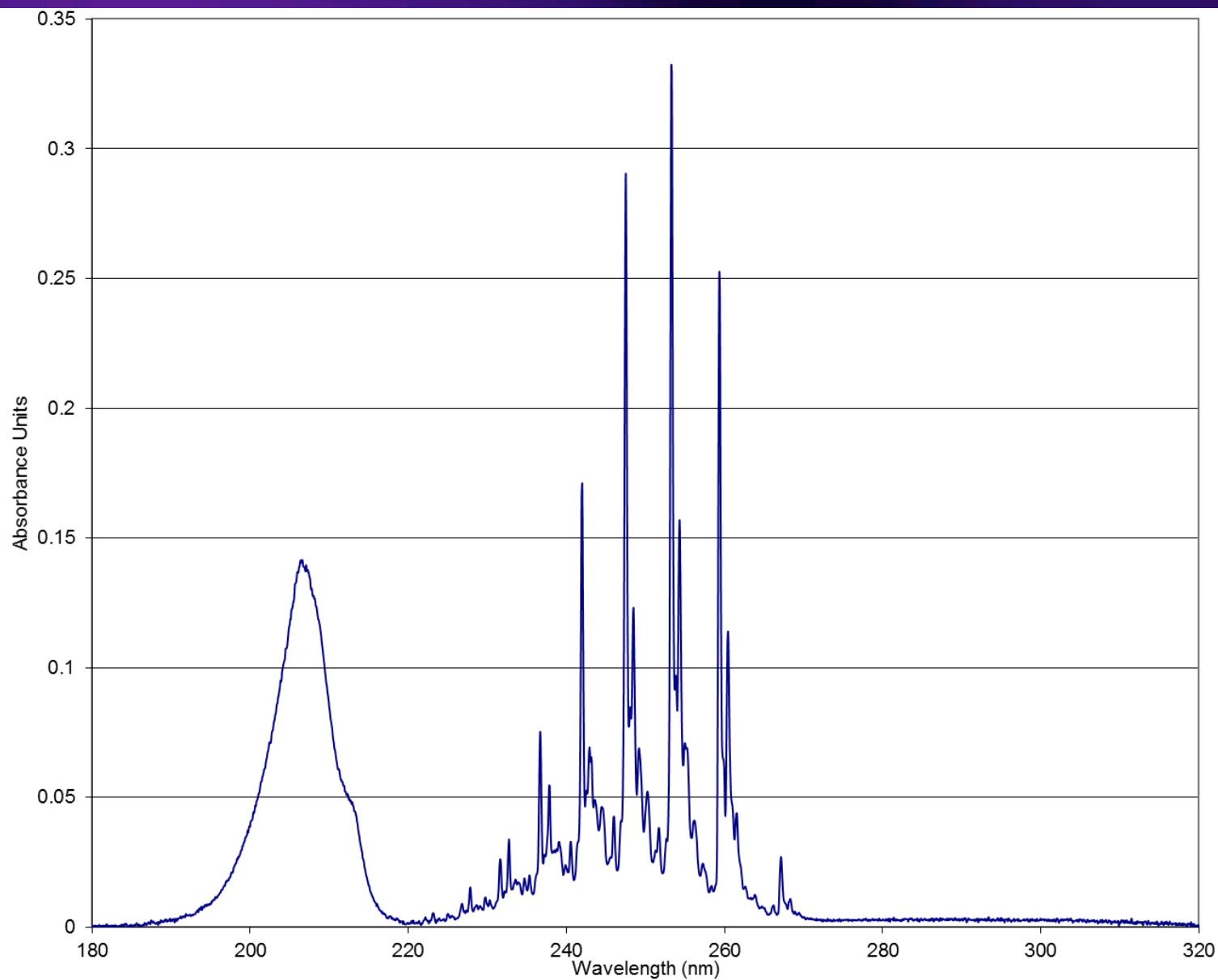
Data Spectrum



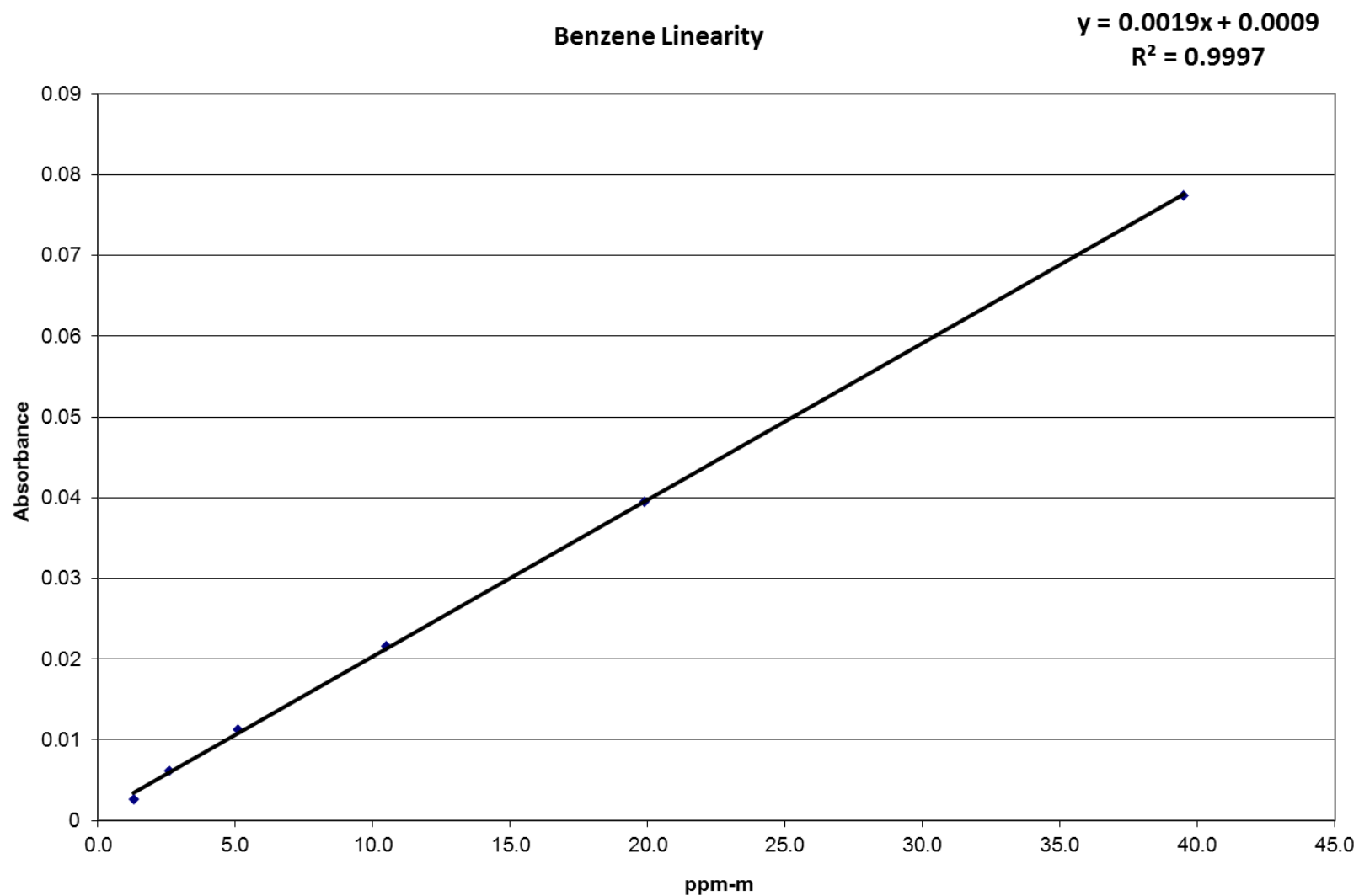
Background vs Data Spectrum



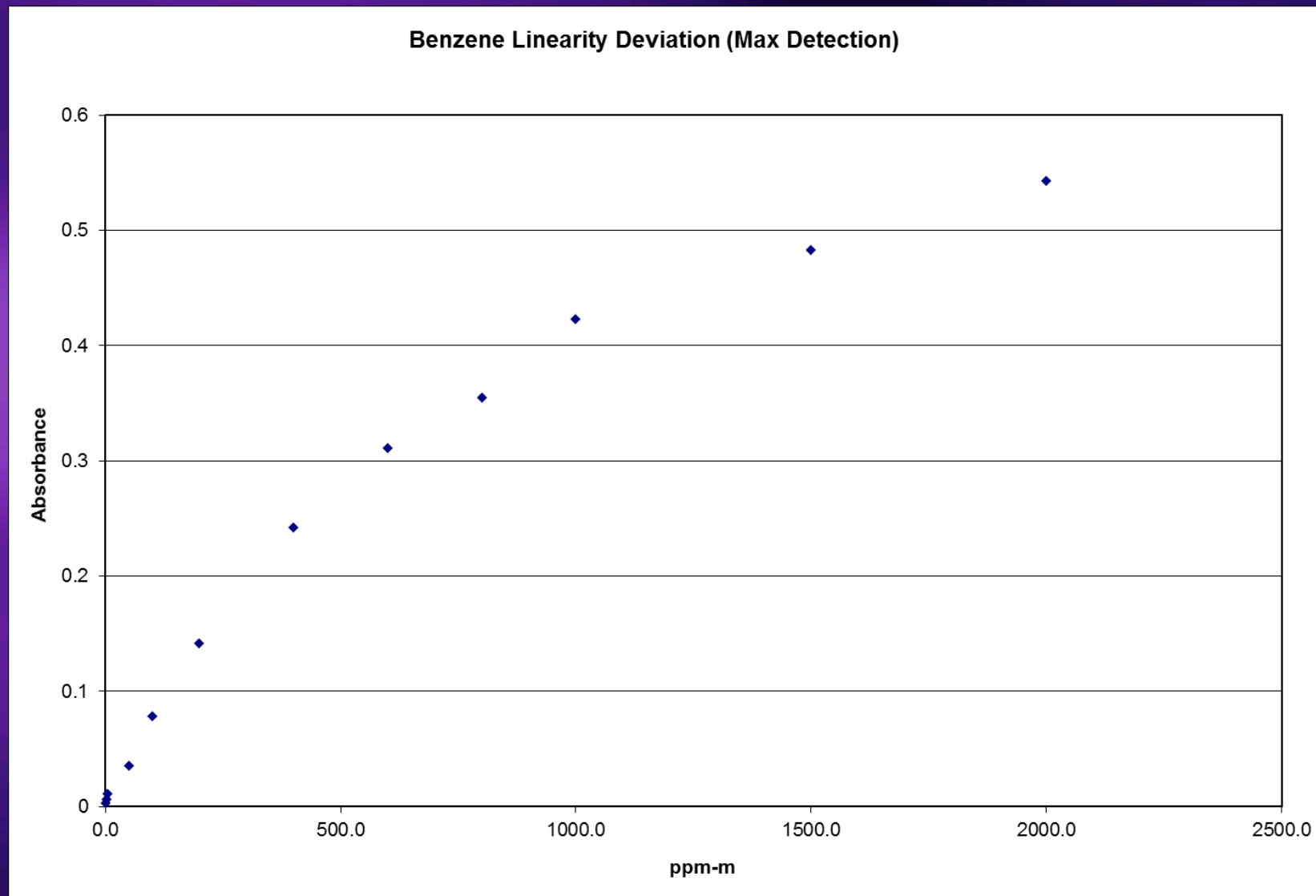
Absorbance Spectrum



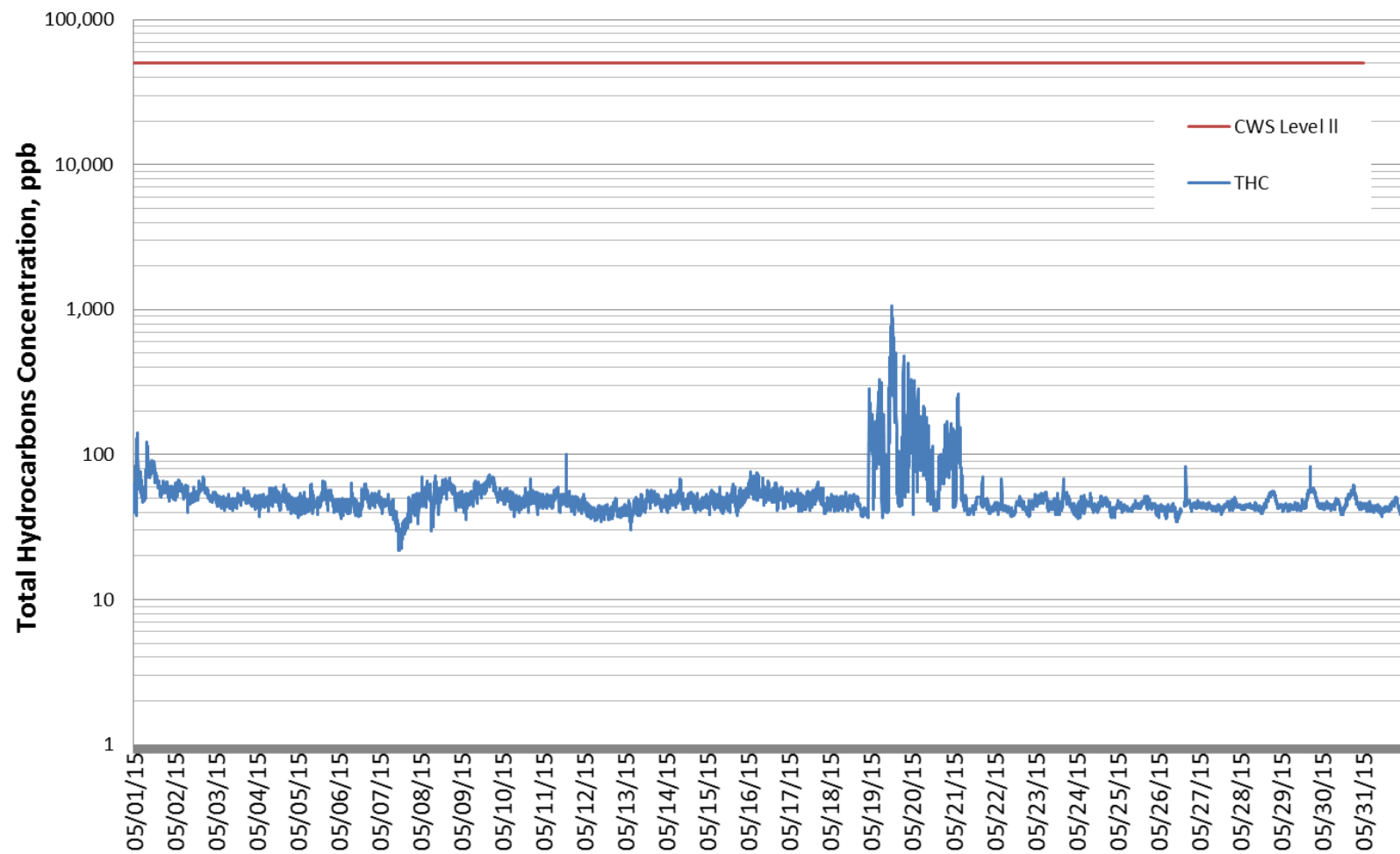
Example Detector Linearity



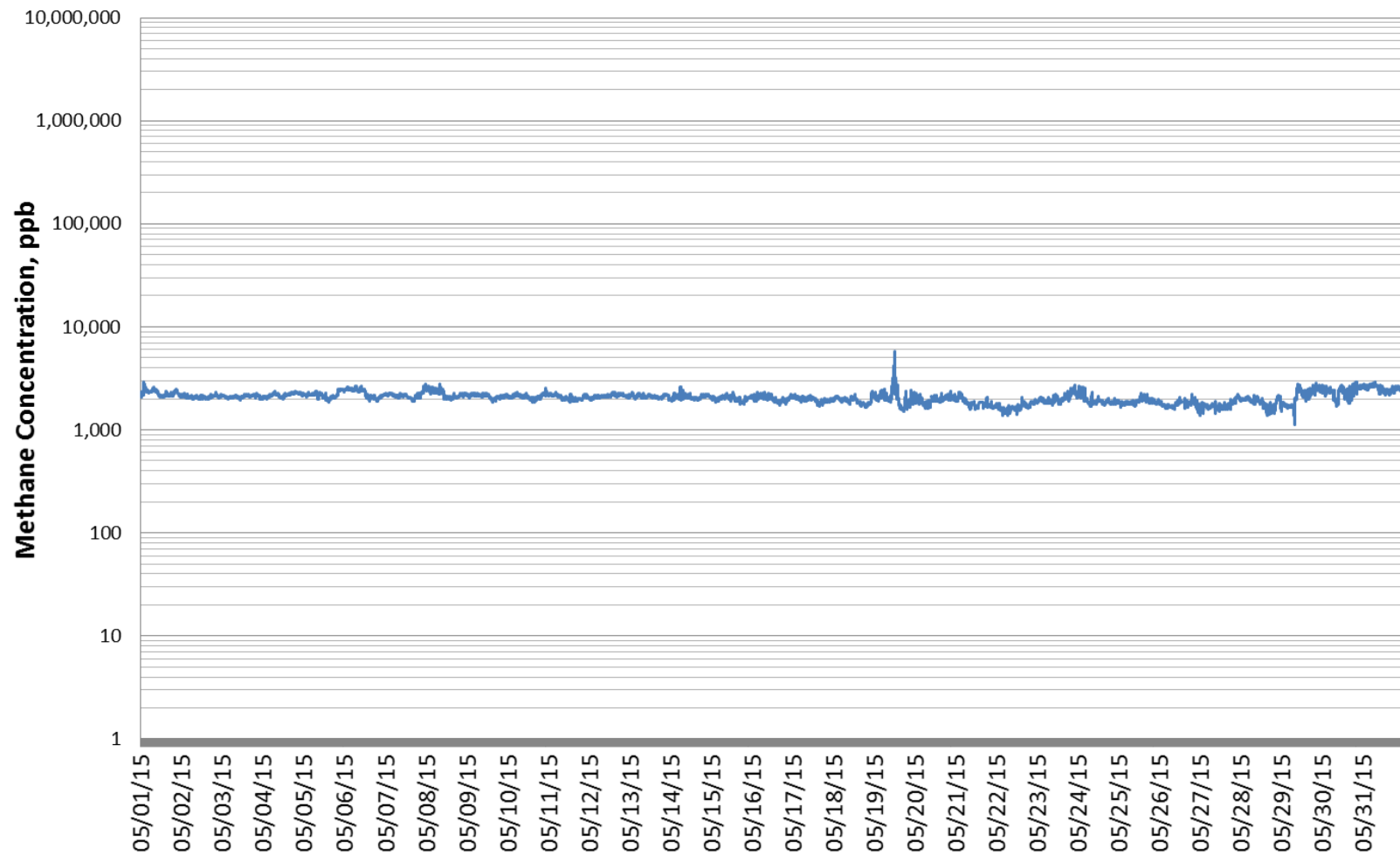
Example Deviation from Linearity



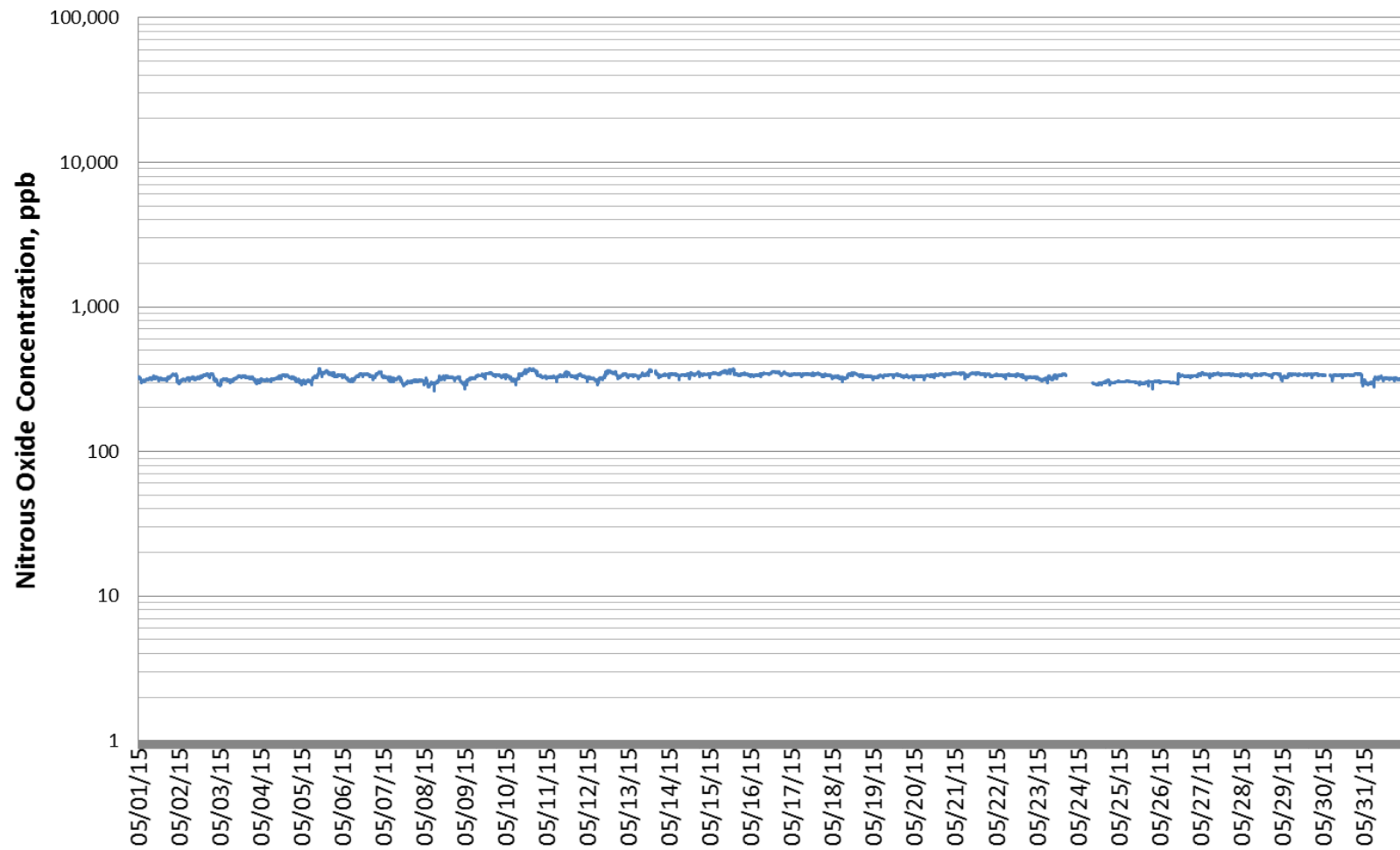
Example Real-Time Hydrocarbons



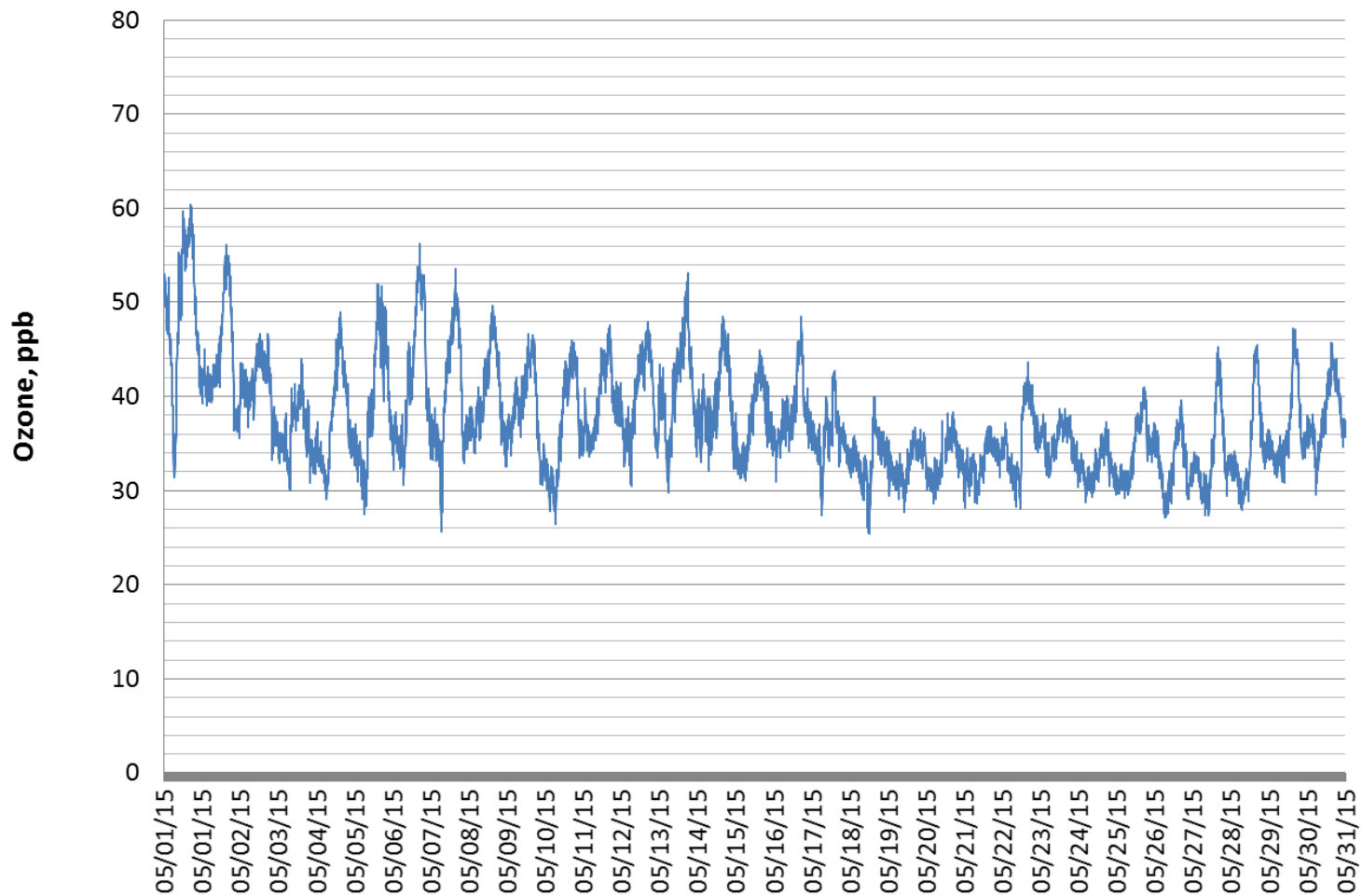
Example Real-Time Methane



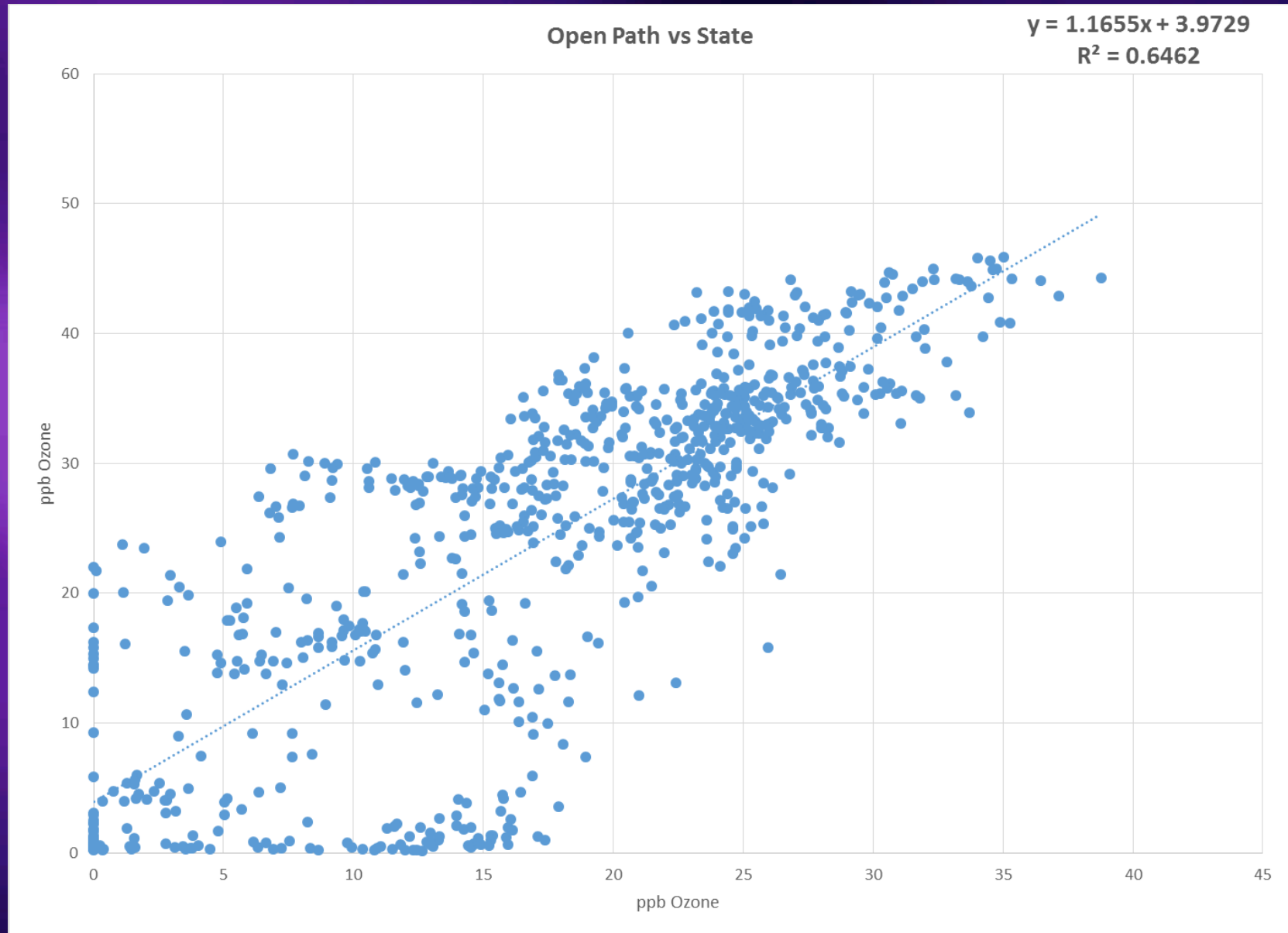
Example Real-Time N₂O



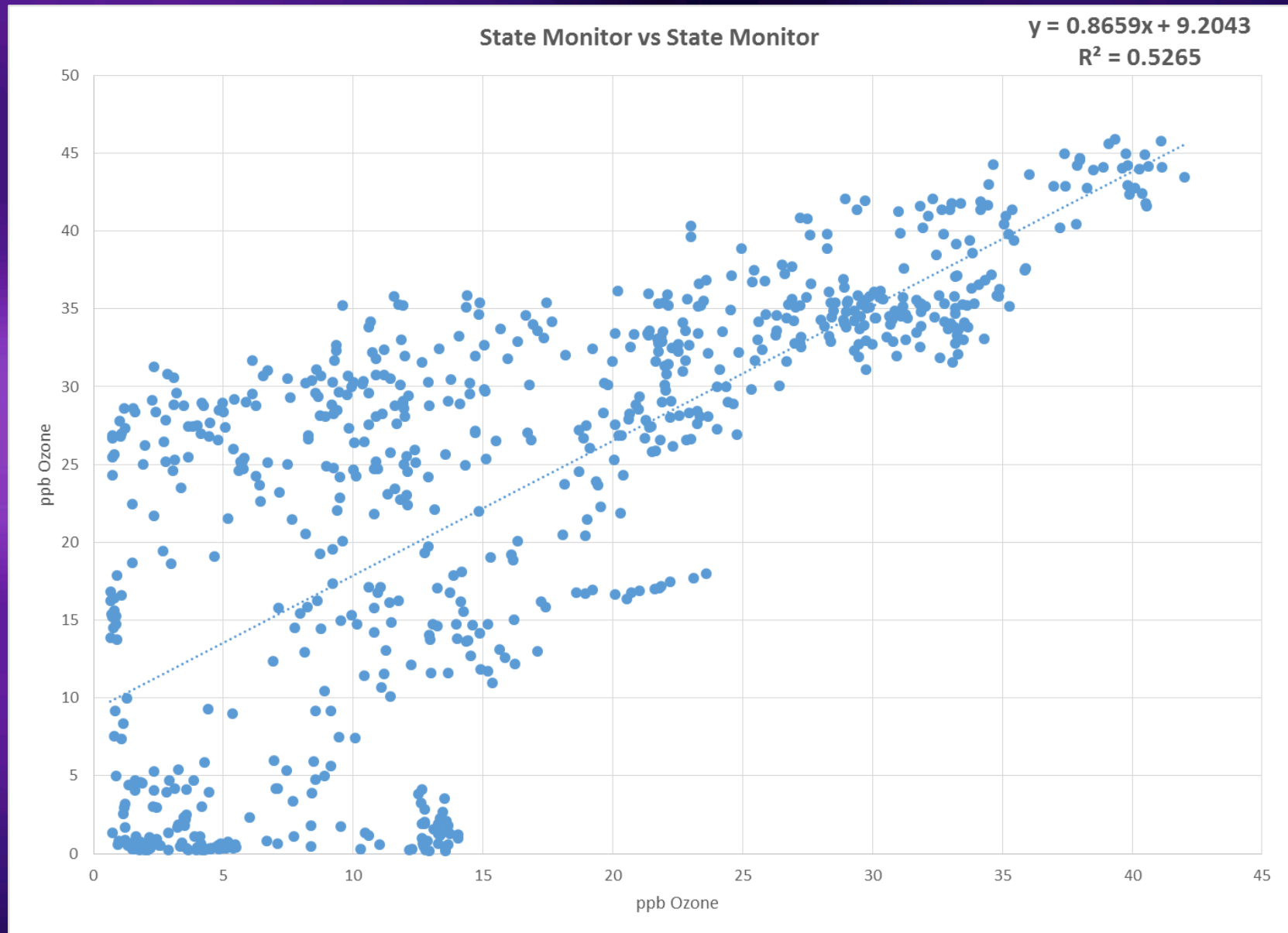
Example Real-Time Ozone



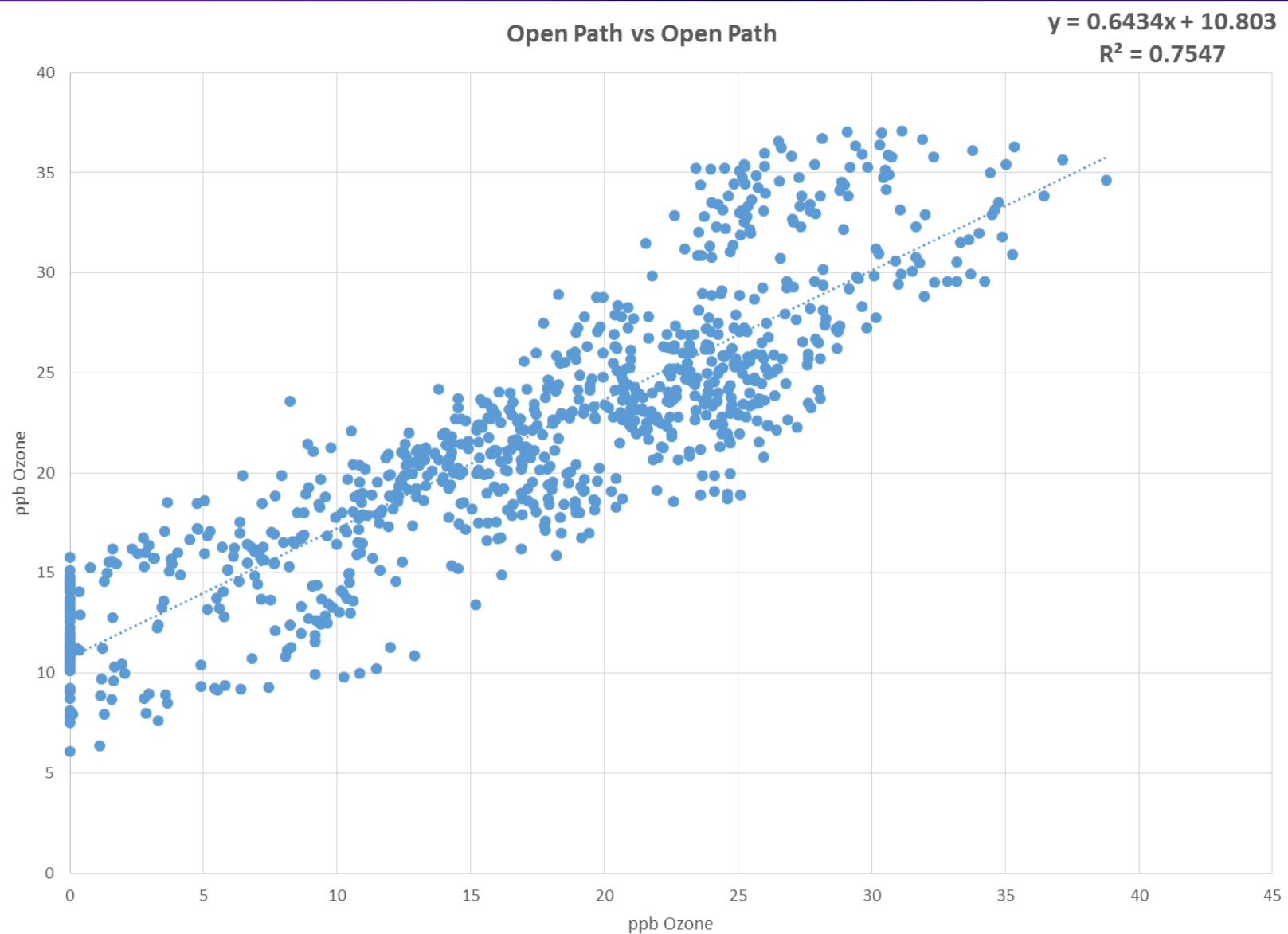
Open Path Ozone vs State Ozone



State Ozone vs State Ozone



Open Path Ozone vs Open Path

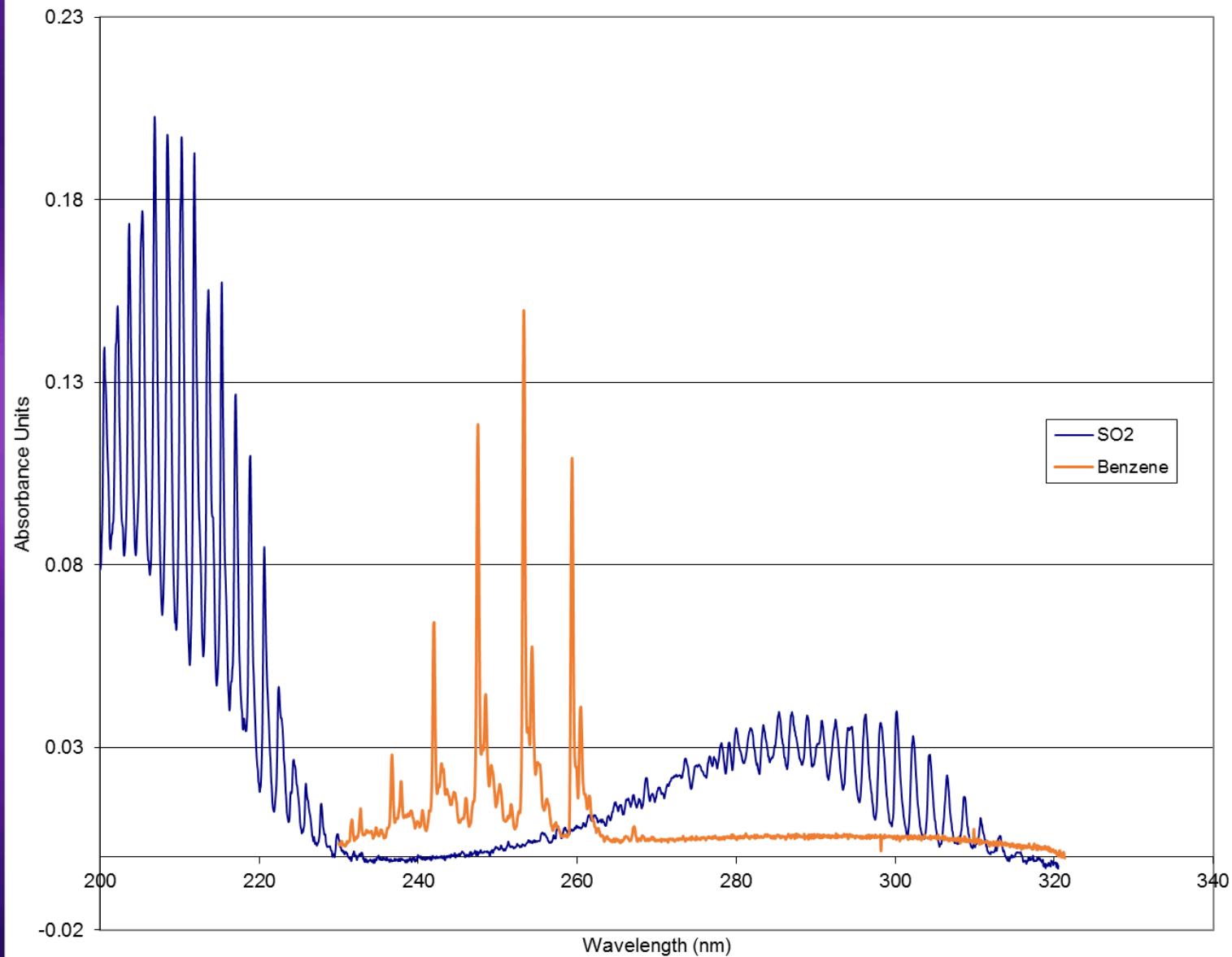


QA/QC “Bump Tests”

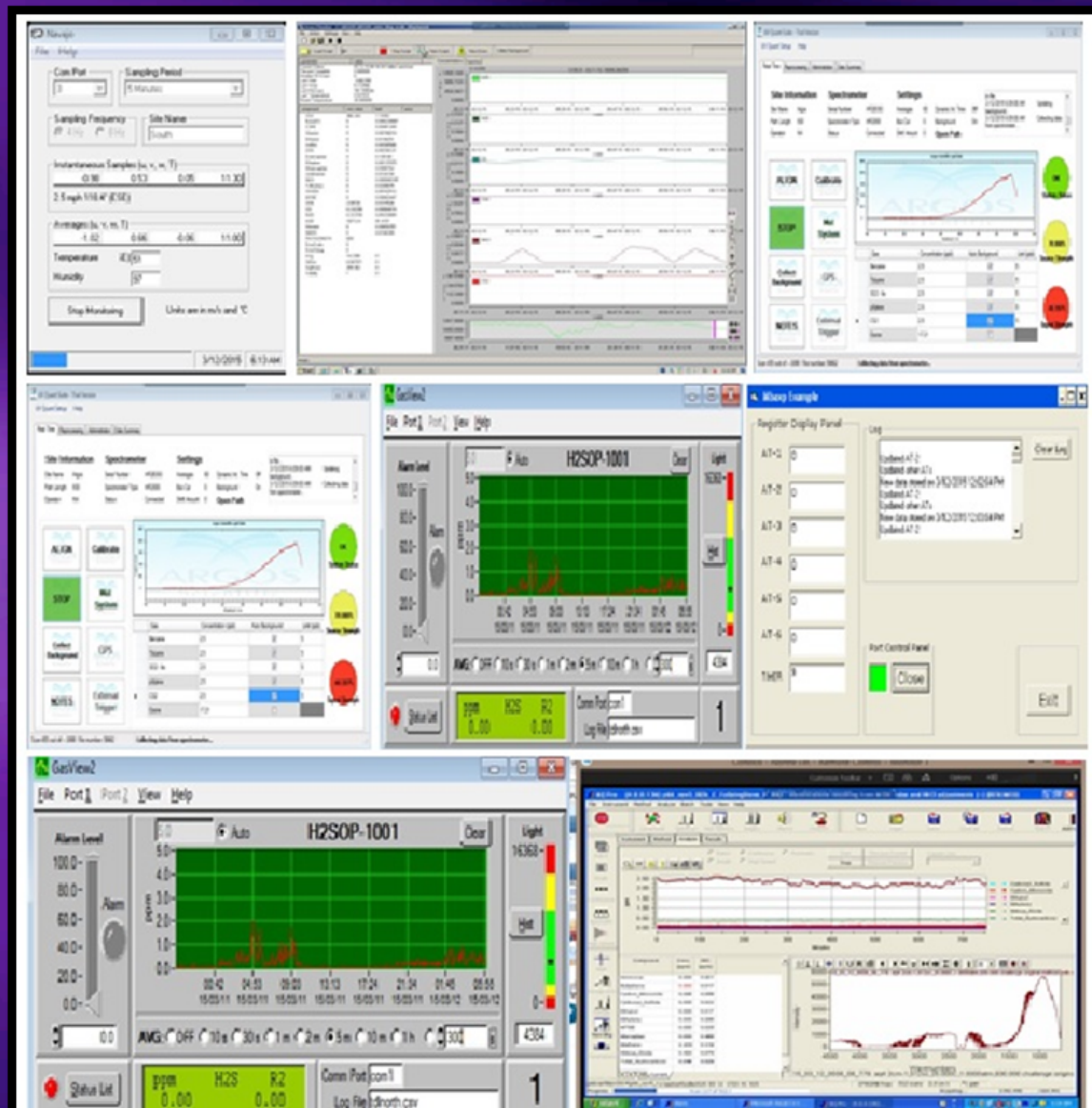
- Sealed quartz cells
 - “Lollipops”
 - Benzene
 - Sulfur Dioxide
 - Toluene
 - Xylene
 - Carbon Disulfide



QA/QC – Benzene/SO₂ Mixture



Alerting the Community



[Document Download Center](#)

[Message Archive](#)

FTIR Systems		
Chemical (values in PPB)	South Fence Line	North Fence Line
System Status	Online	Online
Date	2015-08-30	2015-08-30
Time	10:22:59	10:20:13
1,3 Butadiene	ND	ND
Carbonyl Sulfide	ND	ND
Total Hydrocarbons	15	56
Carbon Monoxide	139	132
Ethanol	ND	ND
Ethylene	ND	ND
Nitrous Oxide	287	307
Ammonia	ND	ND
Mercaptan	ND	ND
Methane	1812	1702
MTBE	ND	ND

Organic Gas Detectors (OGDs)		
Instrument (values in %LEL)	% Level	
System Status	Online	
Data Date	2015-08-30	
Data Time	10:24:14	
AT-1	0	●
AT-2	0	●
AT-3	0	●
AT-4	0	●
AT-5	1.16	●
AT-6	0	●

Subscribe to the mailing list		
First Name	<input type="text"/>	<input type="text"/>
Last Name	<input type="text"/>	<input type="text"/>
Email	<input type="text"/>	<input type="text"/>
<input type="button" value="Submit"/>		

UV Systems		
Chemical (values in PPB)	South Fence Line	North Fence Line
System Status	Online	Online
Signal Strength	1562	1408
Date	2015-08-30	2015-08-30
Time	10:24:19	10:24:48
Benzene	ND	ND
Carbon Disulfide	ND	ND
Ozone	13	20
Sulfur Dioxide	ND	ND
Toluene	ND	ND
Xylene	ND	ND

TDL Systems		
System Status	Online	Online
Data Date	2015-08-30	2015-08-30
Data Time	10:20:10	10:20:14
Signal Strength	5156	2456
Hydrogen Sulfide	ND	ND

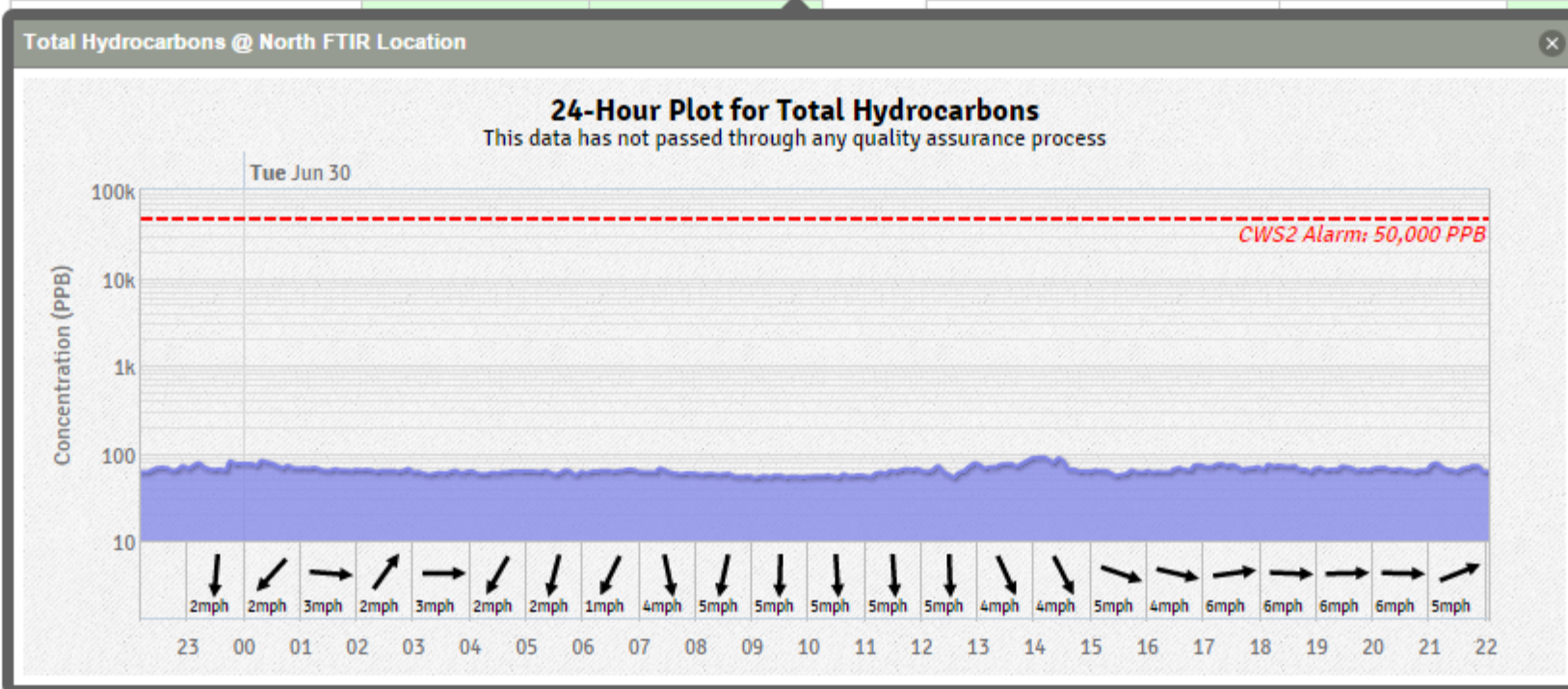
Weather Conditions	
System Status	Online
Date	2015-08-30
Time	10:24:59
Temperature (°F)	69
Humidity (%)	66
Dew Point (°F)	57
Wind Speed (MPH)	5

Wind is blowing from the N (359°)



FTIR Systems		
Chemical (values in PPB)	South Fence Line	North Fence Line
System Status	Online	Online
Date	2015-06-30	2015-06-30
Time	22:08:42	22:02:45
1,3 Butadiene	ND	ND
Carbonyl Sulfide	ND	ND
Total Hydrocarbons	26	61

UV Systems		
Chemical (values in PPB)	South Fence Line	North Fence Line
System Status	Online	Online
Signal Strength	1911	1604
Date	2015-06-30	2015-06-30
Time	22:09:25	22:07:12
Benzene	ND	ND
Carbon Disulfide	ND	ND



Data Date	2015-06-30
Data Time	22:09:26
AT-1	0
AT-2	0
AT-3	0

Temperature (°F)	81
Humidity (%)	36
Dew Point (°F)	52
Wind Speed (MPH)	3
Wind is blowing from the WSW (248°)	

35
ND
ND
ND
Online
2015-06-30
22:06:09
3630
ND

Online
2015-06-30
22:05:54

Message Board

- 05/18/2015 13:46 - On site to perform monthly maintenance and QA. UV, TDL, FTIR, and MET systems may be temporarily off-line. The message board will be updated once work has been completed.
- 05/18/2015 16:40 - QA/QC and maintenance work have been completed.
- 05/21/2015 16:40 - The website has been updated with the following changes. The 24 hour graphs for chemicals were updated to indicate gaps in the trend line when equipment has been offline and generated the e-mail notifications. The graphs were also updated to show the CWS Level 2 values to provide improved perspective of when there may be potential for concern.

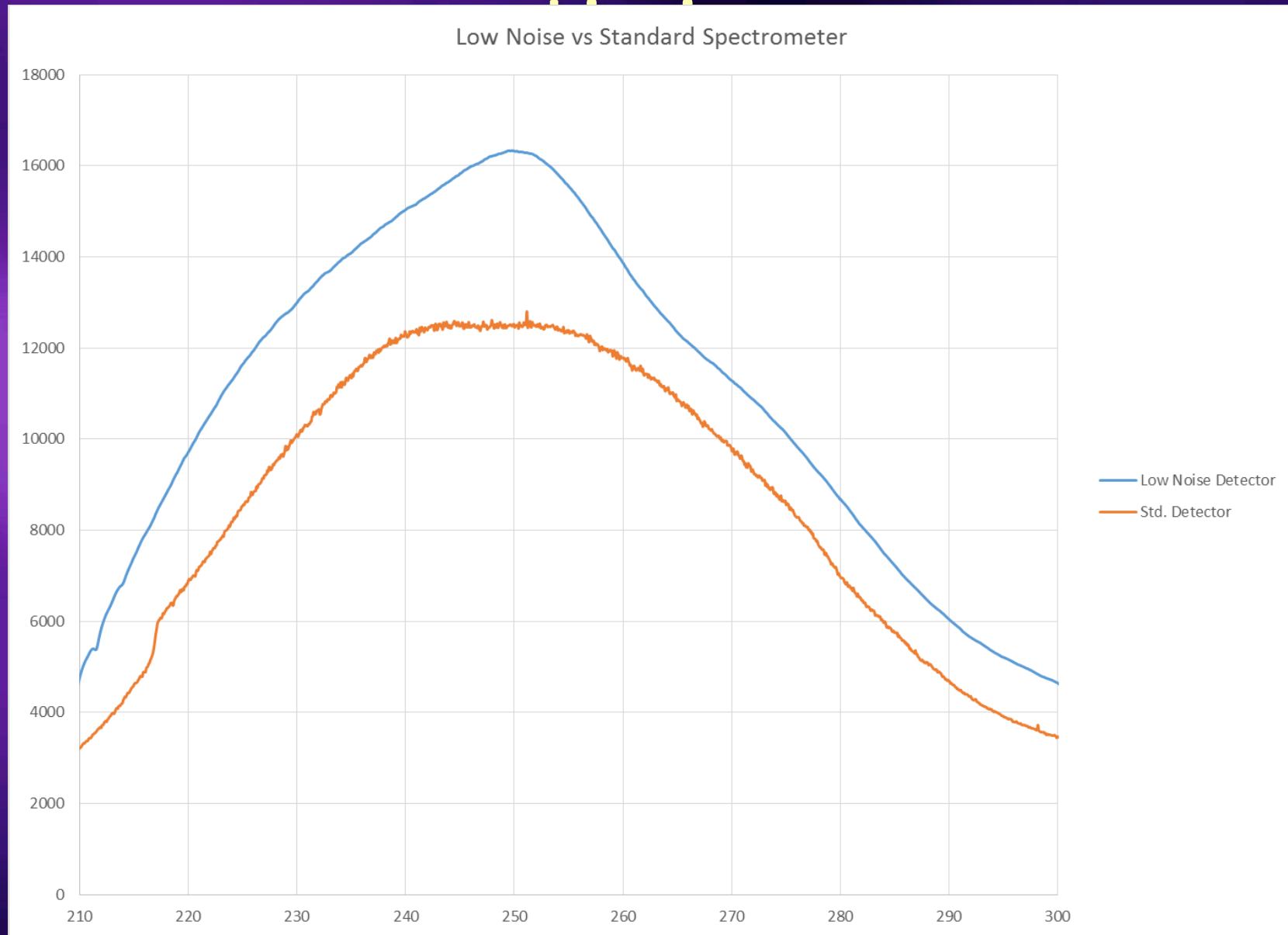
On-Stream Efficiency

- Monitoring equipment that can be serviced and repaired in the field.
- Scenario – A system goes down on a Friday afternoon, but is repaired the next business day.
 - Acceptable?
 - How does this affect on-stream efficiency?
- Weather events?

Moving Forward

- Hardware Upgrades

Lower Noise, Lower Detection



Moving Forward

- Hardware Upgrades
- Software Upgrades
- Improvements
 - Procedures
 - Documentation
 - Say what we do, do what we say.

Regulatory Requirements - Moving Forward

- Environmental Protection Agency (EPA)
- Petroleum Refinery Sector Risk and Technology Review and New Source Performance Standards
 - June 2014
 - Status

Regulatory Requirements - Moving Forward

- Bay Area Air Quality Management District (BAAQMD)
- Air District Regulation 12, Rule 15: Petroleum Refining Emissions Tracking
 - Draft August 2014
 - Status

BAAQMD – Air Monitoring Rule

- Purpose

- “to provide a framework on how these air monitoring systems should be developed and deployed and what metrics the Air District will use to evaluate the ability of those systems to meet the goals outlined...”

BAAQMD – Air Monitoring Rule

- Goals – Fence Line Monitoring
 - to provide continuous information on a short enough time scale
 - to provide data of sufficient accuracy to identify when concentrations of compounds associated with refinery operations are elevated
 - to provide context to the data so that the community can determine if there is cause for concern
 - to aid in identifying corrective actions that will lower emissions

BAAQMD – Air Monitoring Rule

- “It is expected that the fence-line monitoring will be permanently installed and continually operated.”
- “Multiple technologies need to be employed to ensure adequate compound identification at appropriate levels of detection and accuracy.”
 - Fence Line Monitoring
 - Fixed Community Monitoring

BAAQMD – Air Monitoring Rule

- “The Expert Panel agreed with the DRI report that open path monitors best addressed the goal of monitoring potential impacts from refineries and also believed that shorter time scale resolution was very desirable.”
- “Open path equipment should provide appropriately accurate data on an hourly basis, at a minimum, and the Expert Panel believed that 5 minute data resolution was reasonable.”

Meeting the Challenge

- Past and Present
 - Proof of Concept
 - Long-term field deployment/fixed installation
 - Third Party Audit
- Future - the tools are in place
 - Guidance Document
 - EPA - Method TO-16
 - EPA – Environmental Technology Verification (ETV) Program (Battelle Laboratories)
 - Generic Verification Protocol for Optical Open-Path Monitors - 2002

Pose the Question

- If open path monitors are treated as traditional air monitoring stations...
- If in accordance with EPA requirements and recommendations...
 - Siting
 - Calibrate
 - QA/QC
 - Audit
 - Data Analysis and Reporting – Linearity, Detection Limits, Precision, Accuracy, Interferences, etc.

Pose the Question

-then why would this be labeled as anything other than valid?
- A valid monitoring system that...
 - Covers the fence line between industry and community (near real-time)
 - Warns stakeholders of events (near real-time)
 - Reports routine data to the public (near real-time)

Summary

- Where have we been?
- Where are we now?
- Where are we going?

Questions?

Questions?