PAMS Continuous VOC Monitoring

AutoGC

Overview of Chromatographic Applications

Carol J. Meyer
carol@orsat.com

Orsat, LLC
www.orsat.com

Not-so-continuous VOC Monitoring: AutoGC
~1 Hour Composite Sample

- Sample Collection on Sorbent Trap (composite sample to correlate with hourly criteria measurements)
- Chromatographic separation of target compounds (generally separation occurs during collection of next sample)
- Detection of separated target compounds by one or more detection methods (FID, PID, MS)
- Data analysis to identify and quantitate separated targets compounds (Chromatographic data system supplied with each instrument)

Sample Collection Methods

- Collection on a single trap
  - Cryogenically cooled trap to capture C2-C12 VOCs
  - Dual adsorbent trap for full range collection
  - Single sample injected to multidimensional gas chromatograph
- Separate C2-C6 and C6+ traps
  - C2-C6 single adsorbent trap cryogenically cooled to trap C2 VOCs
  - C6+ single adsorbent trap for C6+ VOCs
  - Each trap injected into separate gas chromatograph

NMHC Monitoring Strategies: Analytical Choices

GC-FID

- Low cost
- Stable < 2% drift over 1 month
- Response relative to carbon content
- Linear detector response
- Not sensitive to O_2, N_2 or H_2O
- Possible interferences

GC-PID

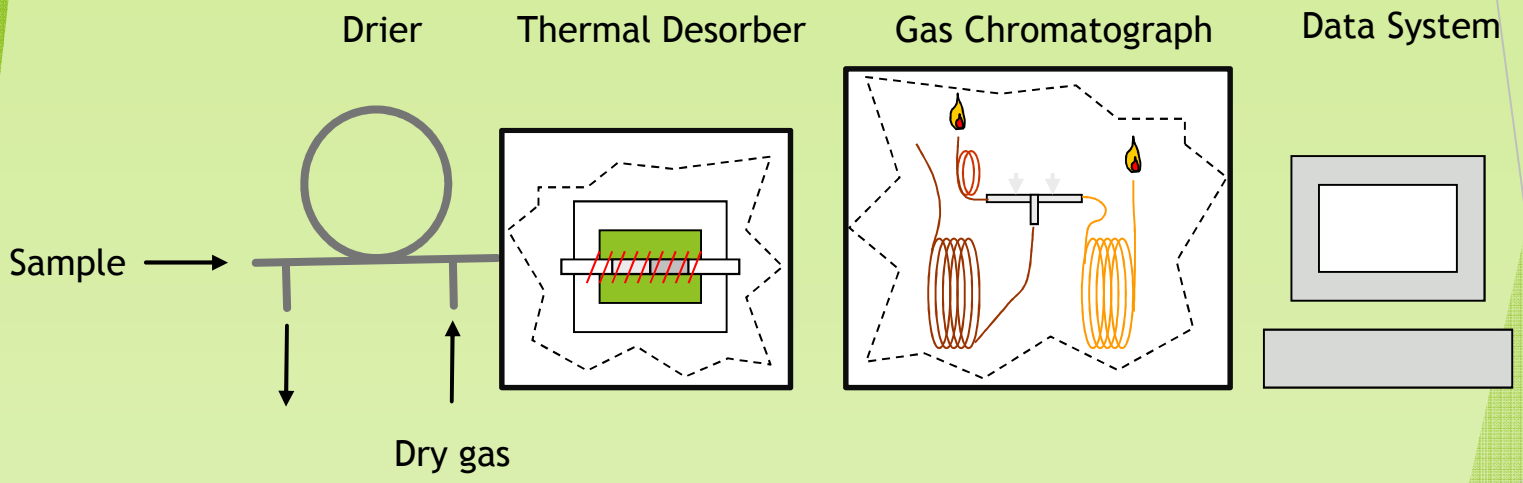
- Low cost
- Uses lamp which can age and require cleaning
- Non-uniform detector response
- Reduced Linear range
- Sensitive to H2O interference
- Not sensitive to interferences

GC-MS

- More complex data
- More complex operation
- Requires more frequent calibration
- Non-uniform detector response
- Sensitive to O2, N2 or H2O interference
- Not sensitive to interferences

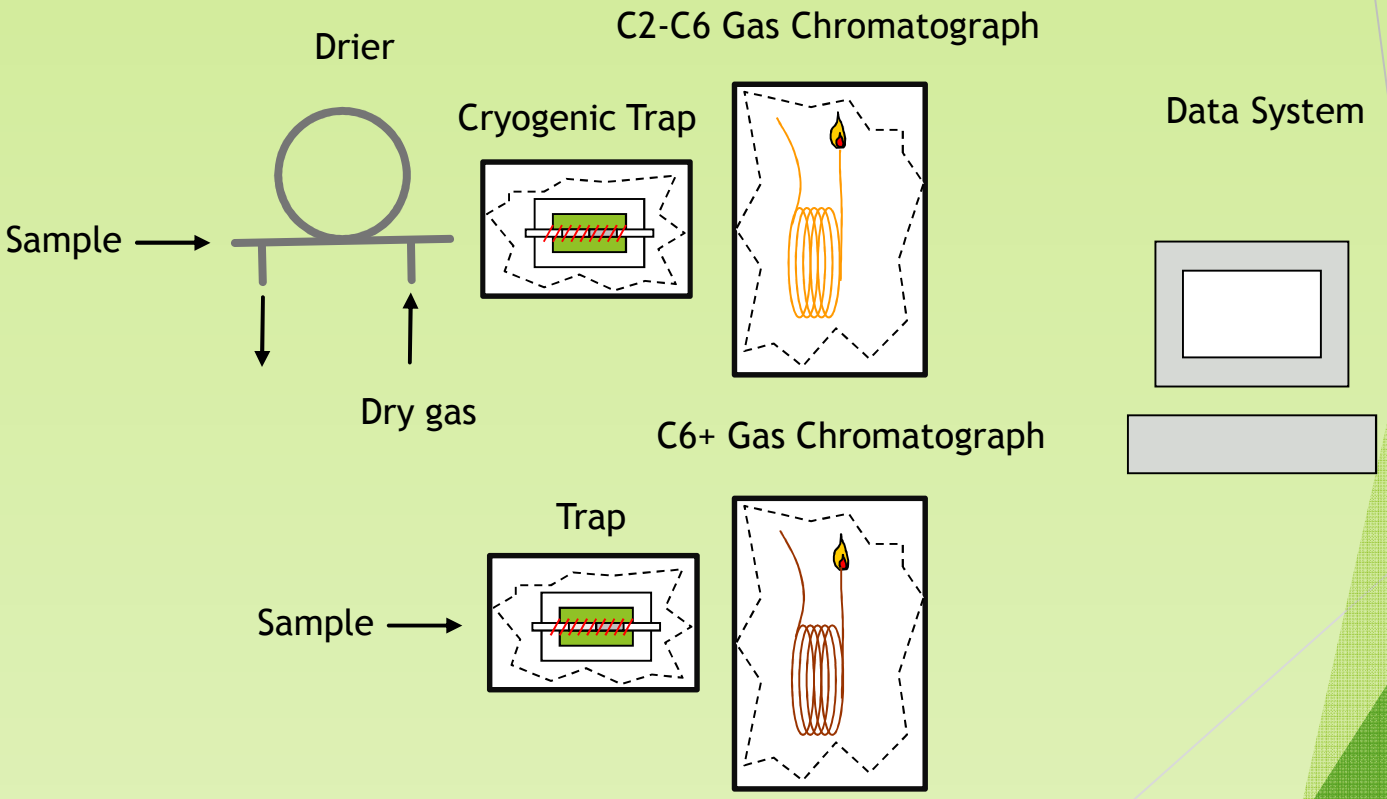
AutoGC Systems: Single Trap Systems

- Dual adsorbent cryogenically cooled trap
- Detection by Dual FID, MS or FID-MS
- Single Data System



AutoGC Systems: Dual Trapping Systems

- Dual Chromatographic Systems – separate samples
- Detection by Dual FID, PID
- Single Data System



Ancillary Equipment Requirements

- Carrier gas – Helium ~10-15 mL/min
- Air supply – Compressor
  - Purification Systems to supply
    - Dry air or N2 < 1ppm moisture for Peltier cooler and nafion drier ~ 350 mL/min
    - Hydrocarbon-free air for FID support gas ~ 800 mL/min
    - Dilution gas for dilution system ~150 – 300 mL/min
- Hydrogen if FID
  - Cylinder gas or Hydrogen generator ~80 mL/min
- Sample manifold and sample pump
- Canisters and dilution system
  - Calibration curves
  - Check standards

Sampling System

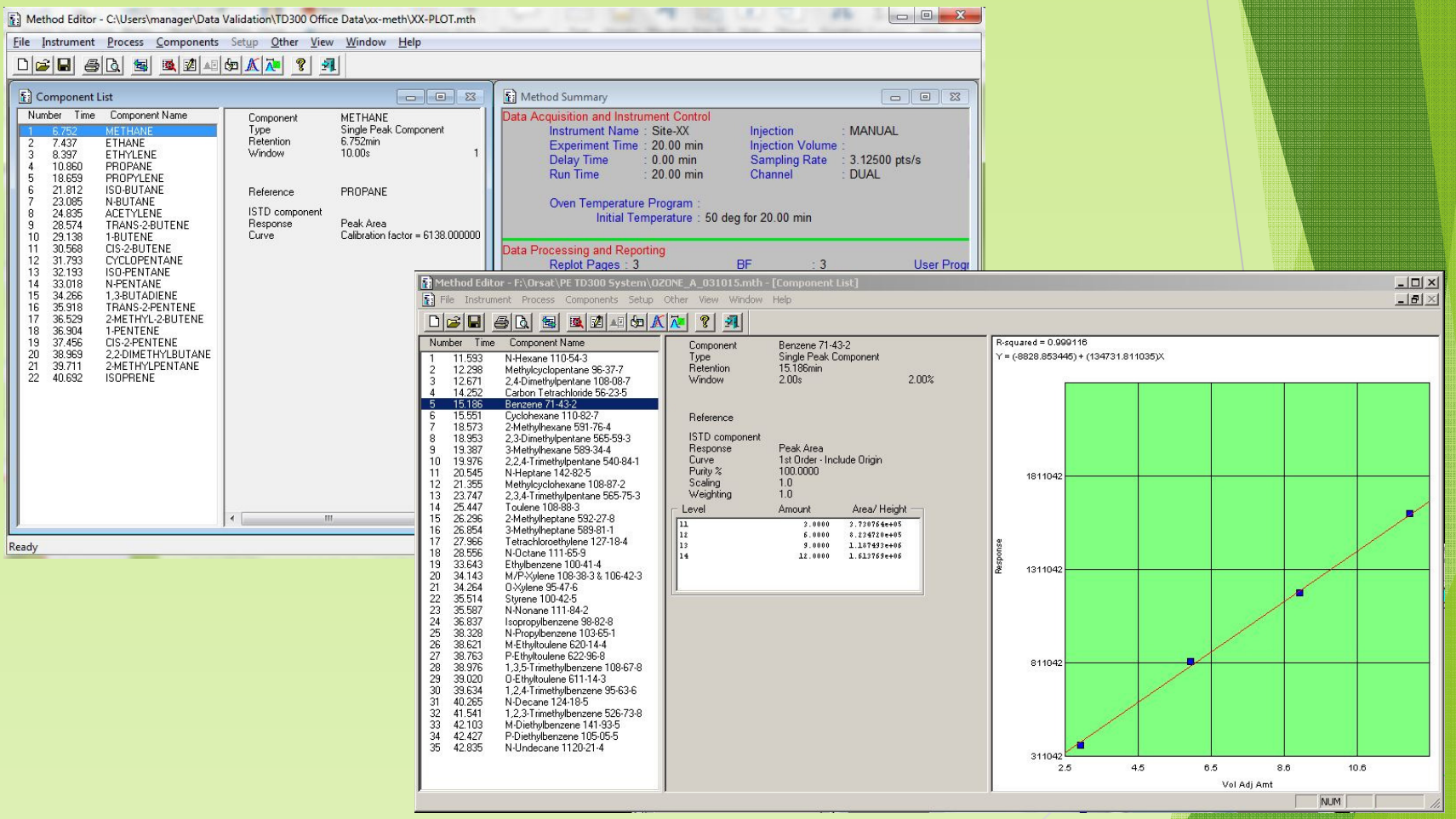
- Standard glass manifold systems
  - Glass with blower to bring sample from outside
  - Heated to eliminate condensation
  - Cleaned regularly with only de-ionized water
- Sample lines from manifold
  - Flow rates < 50 sccm should be 1/8” or smaller
  - Heated stainless steel – chromatographic grade only
  - Silco treated stainless steel
- Problems associated with sample lines
  - Losses of heavy compounds – inadequate humidification
  - Contaminations – inadequately cleaned tubing
  - Carry-over of heavy compounds – inadequate humidification or condensation (may require heating)

Chromatography Data Systems

Requirements:

- Data portability
- Ability to reconstruct the original processing method from result
- Use of Retention time references to accommodate diurnal shifts
- Use of response factors and calibration by reference for unidentified HCs
- Ability to name files for easy identification of site, date, time, hour and sample type
- Ability to schedule and control introduction of routine quality control samples
- Ability to recover from simple power failures and continue hourly sampling
- Remote operation

Method Development
TotalChrom Chromatography Data System



Calibration

Carbon Response Factor

- Single Response factor for each column
- Response factor based on response (peak area) per ppbC
- Requires certified standard for only Propane and Benzene
- Used only on FID systems
- Easy for validators to check for errors

Target Specific Regression

- Linear regression for each target component
- Response based on ppbv
- Requires standard containing all targets
- Required on PID and MS systems which do not have uniform response across targets
- Difficult to achieve and validate

Calibration

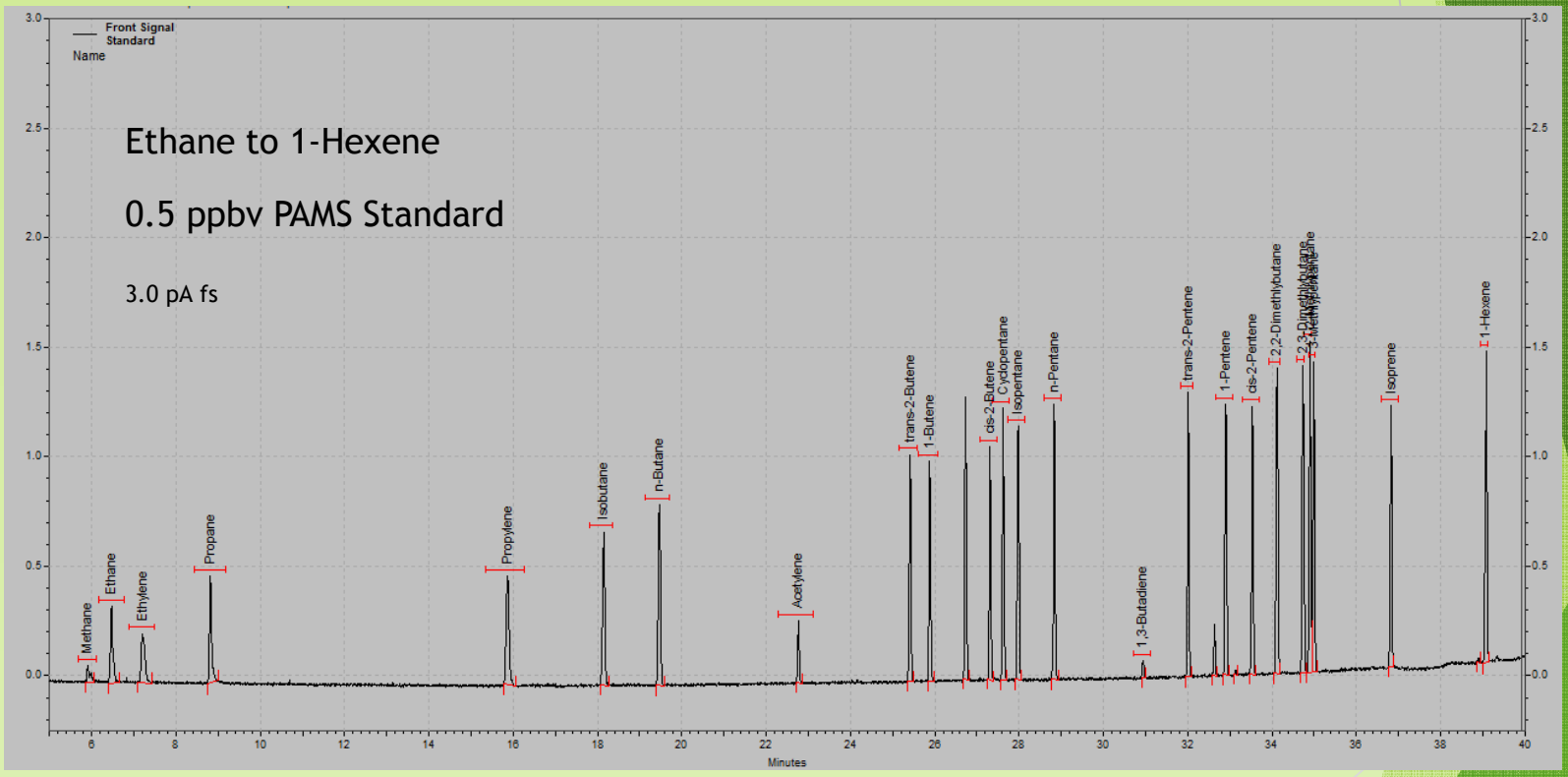
Mass Spectrometry or Photoionization Detector:

- May require calibration across larger dynamic range due to non-linear response (6 points)
- Generally requires target specific calibration
- Will require standards for each target to be calibrated

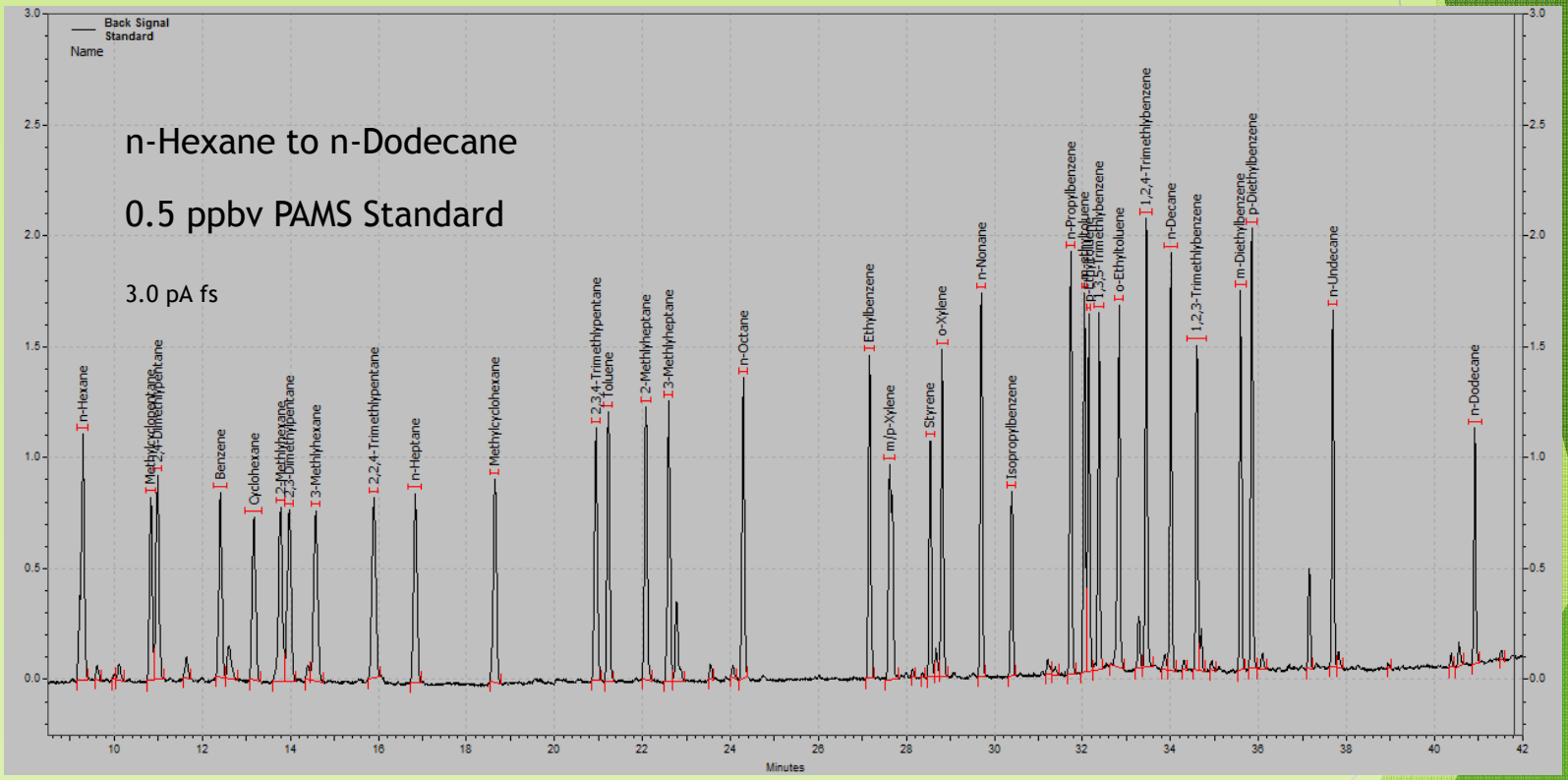
FID Detector

- Has mostly uniform response based on Carbon-Hydrogen bonds
- Extremely linear and may be calibrated with fewer points (1 – 3)
- Only requires standard with propane and benzene for calibration

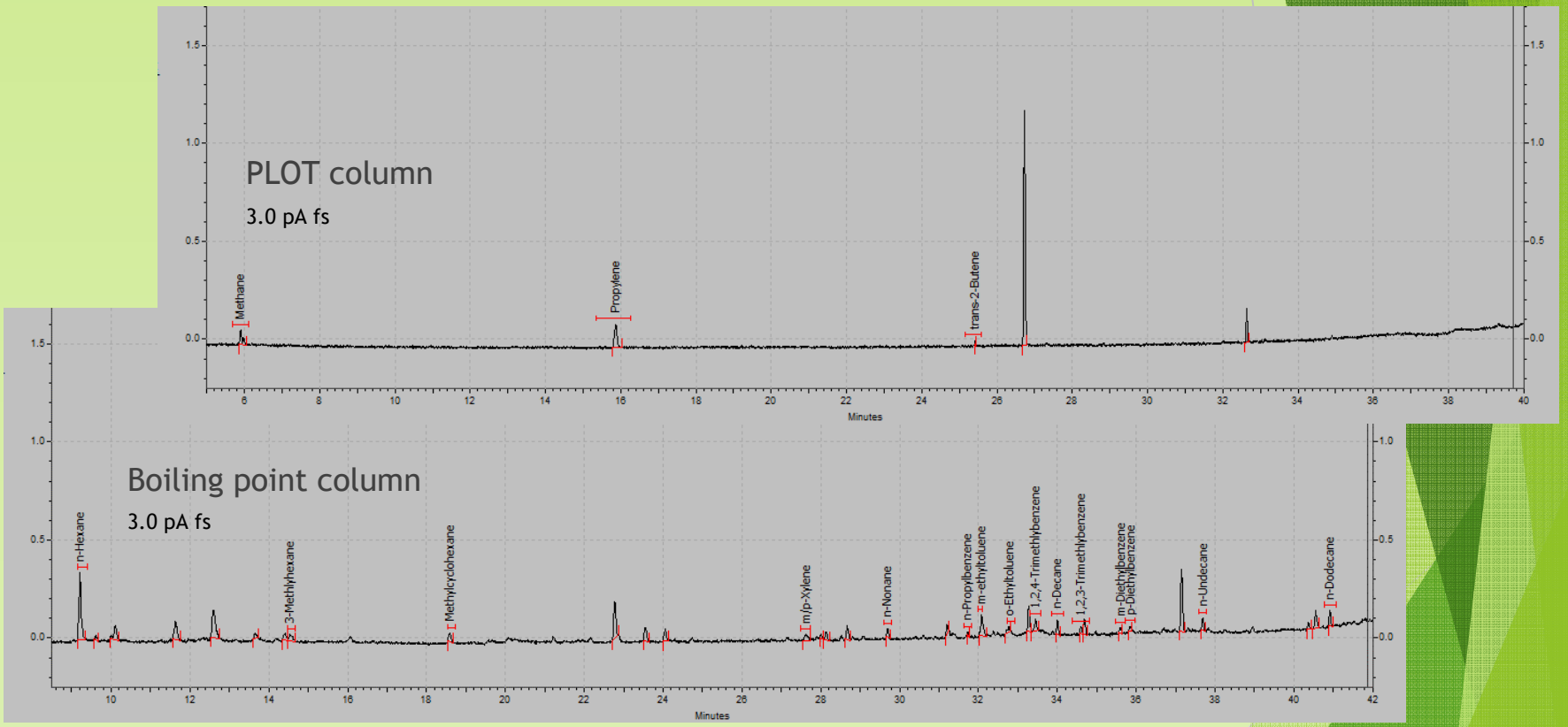
C2-C6 Alumina PLOT Separation



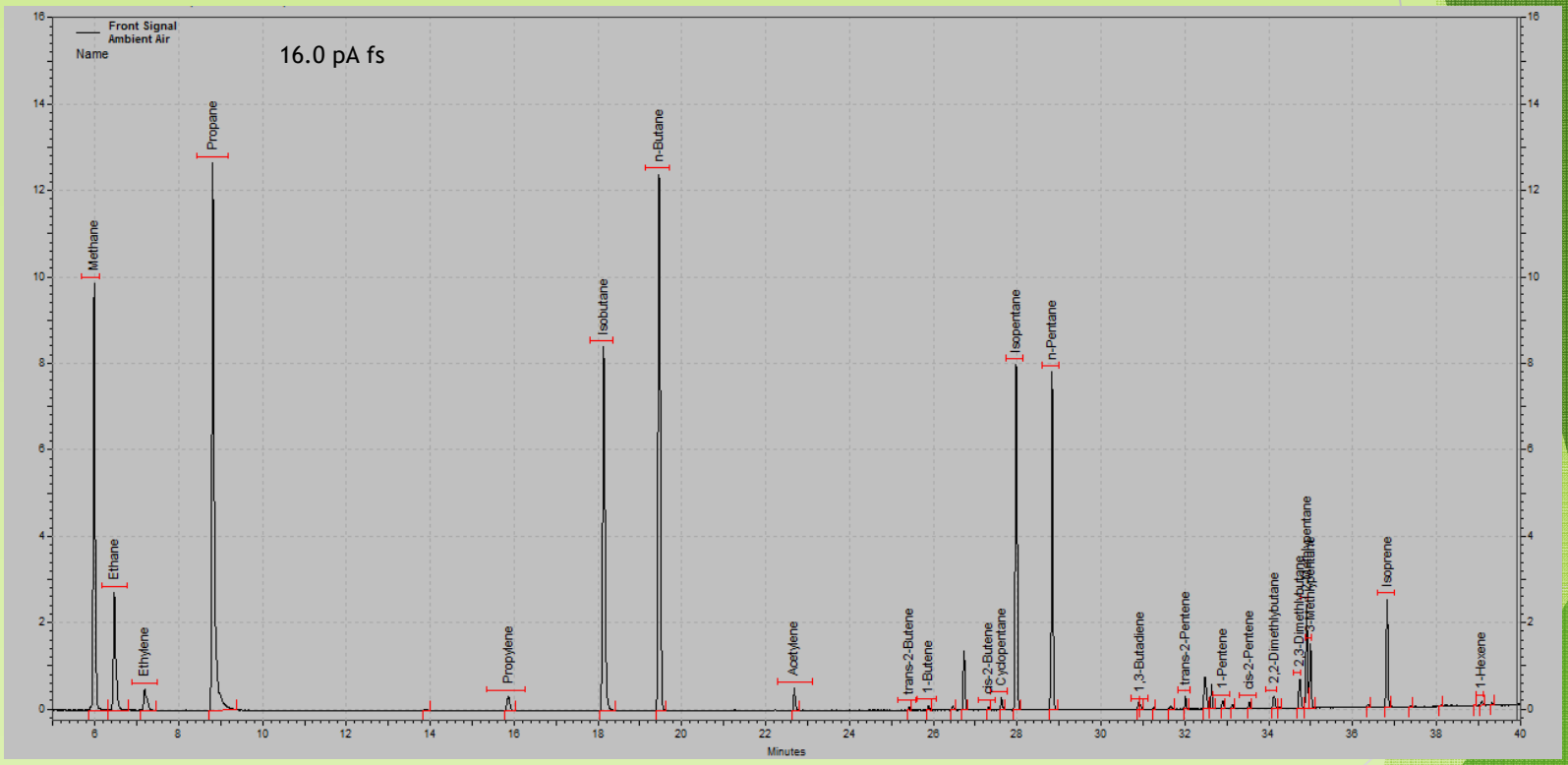
C6+ Dimethylsiloxane (Boiling Point) Separation



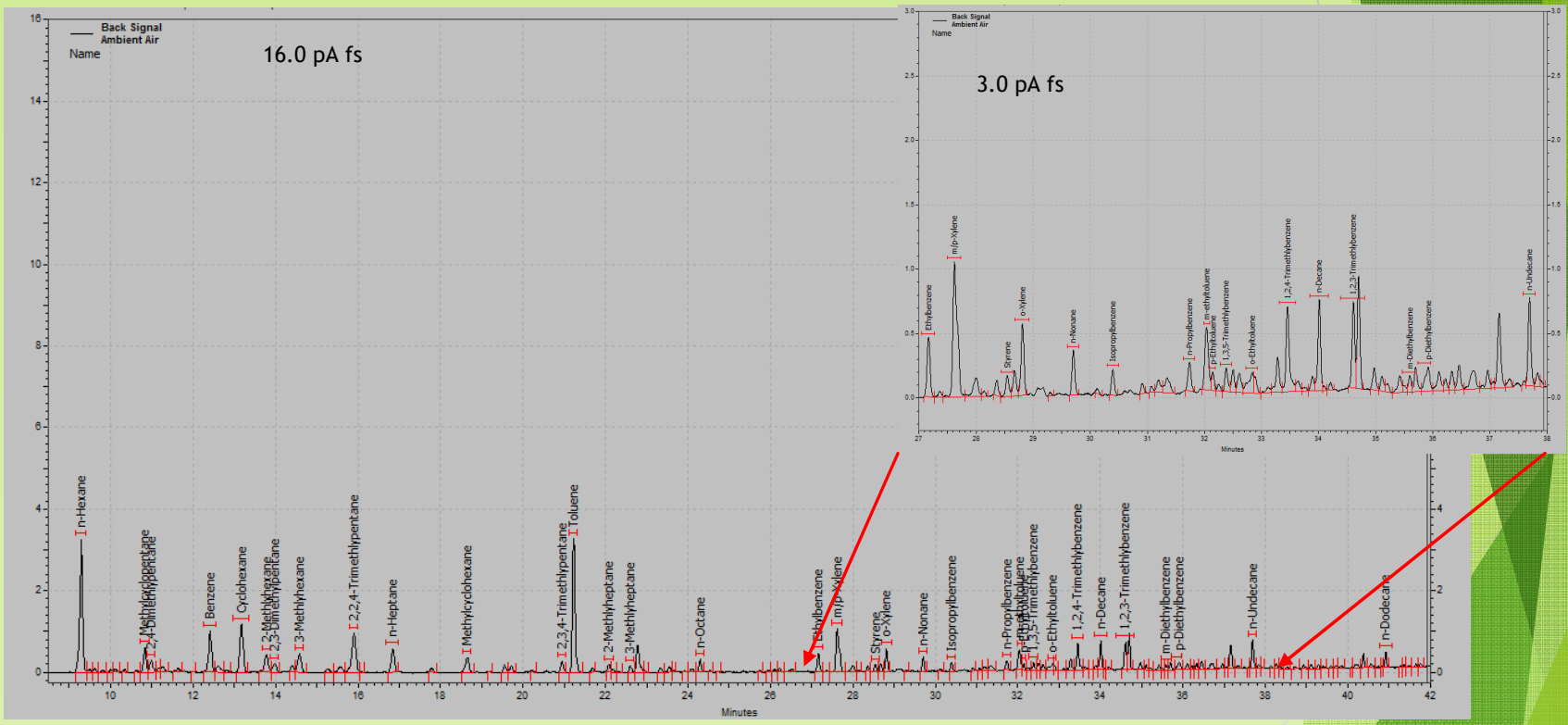
Analytical Blank



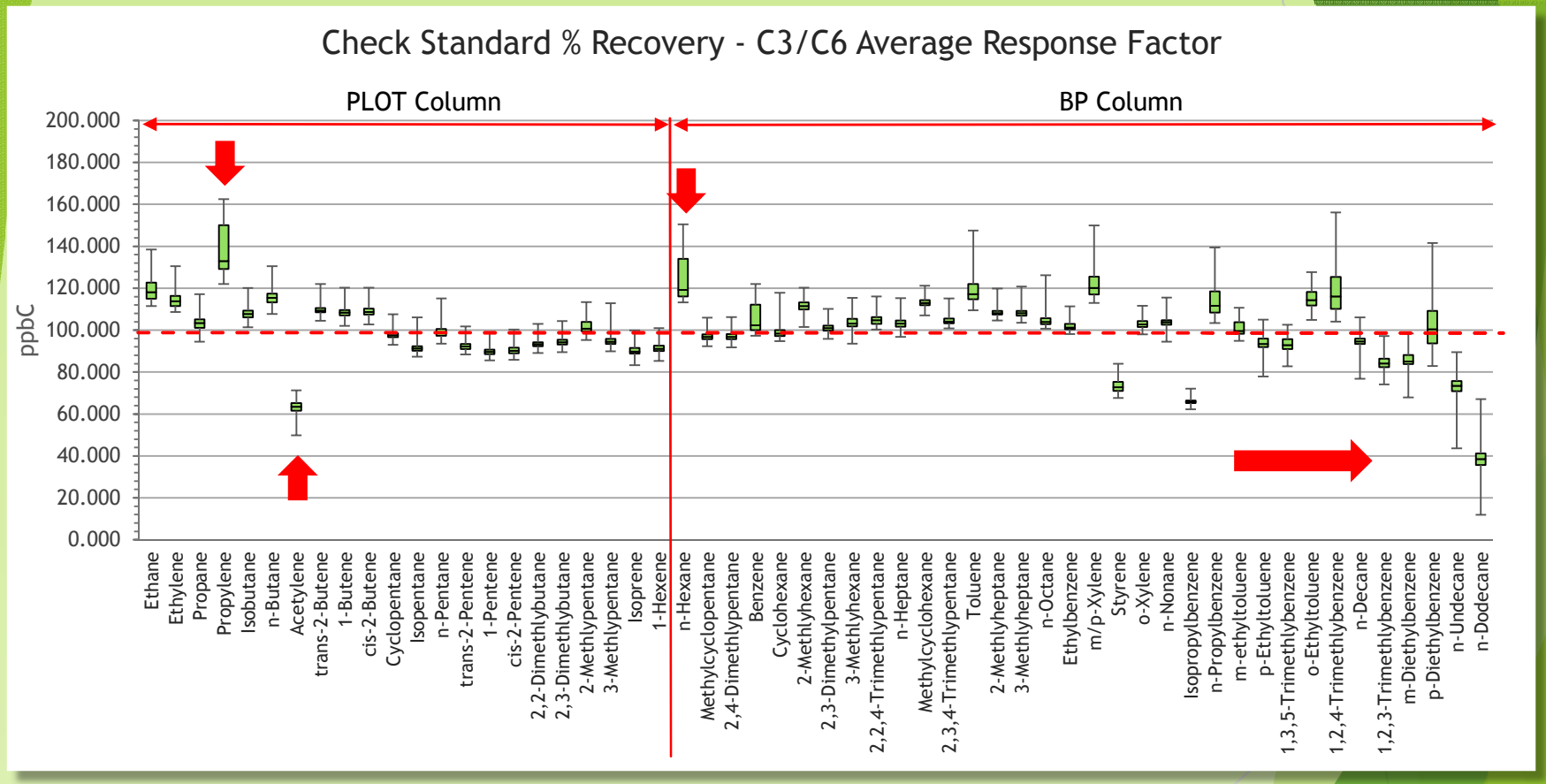
Ambient Air – PLOT Column



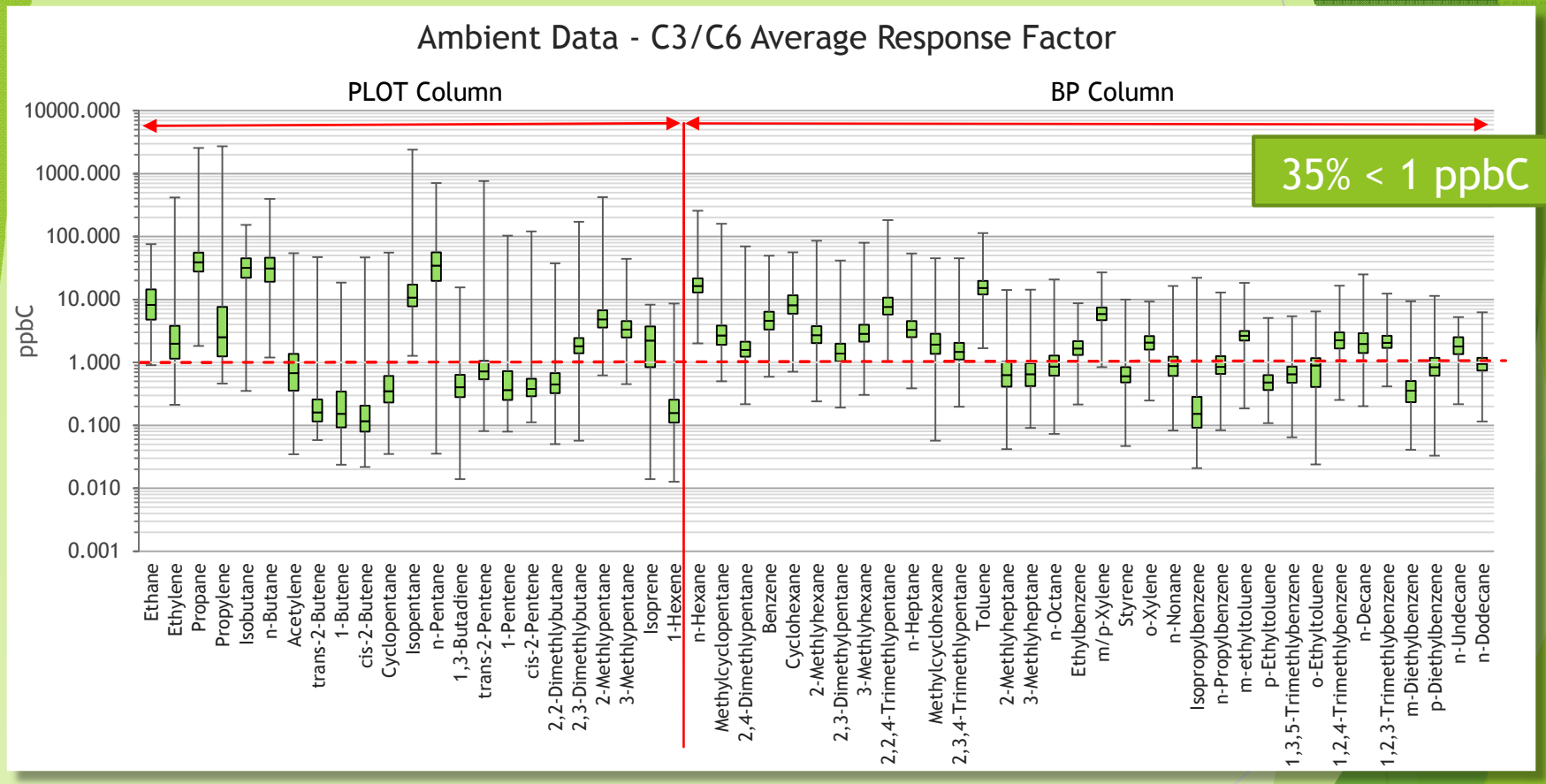
Ambient Air – Boiling Point Column



Recoveries in Daily Check Standard at 0.5 ppbv



Ambient Data – Carbon Response Factor Calibration



Sources of Data Losses and Poor QC Results

Data Losses

- Power failures
- Sample collection time errors
- Shelter AC failures
- Compressor failures
- "Wet" air

Poor QC Results

- Canisters
- Sample lines
- Sample pumps/flow
  - Trap icing
- Losses of light gases
  - Failure of trap cooling
  - Sample or dry purge flow too high
- Contaminants in Blank

Sources of Carry-over and Interferences

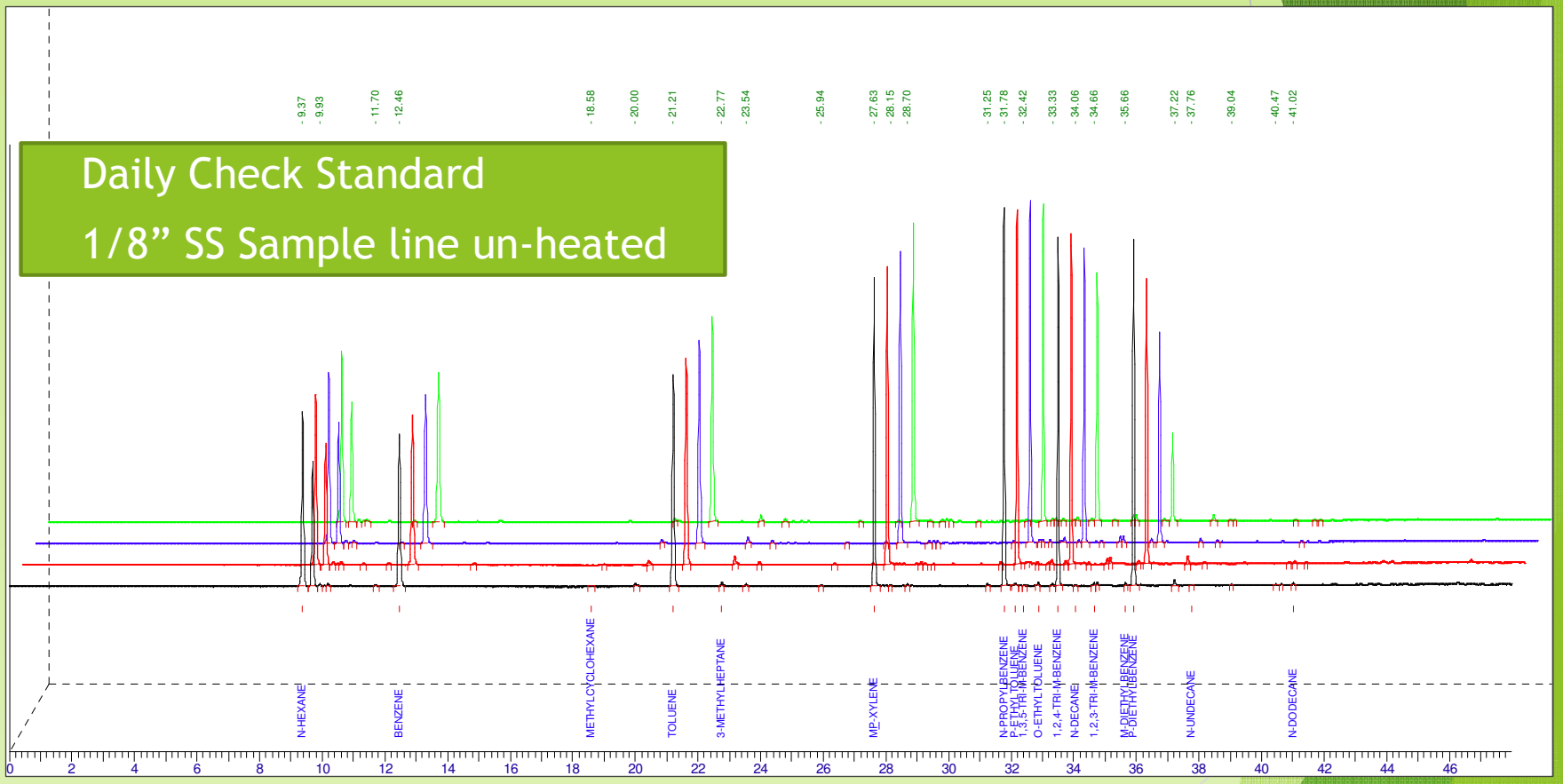
Carry-over

- Extremely high ambient
- Nafion Driers
- Sample lines
  - Heated SS
  - Treated Steel
- Trap failure resulting in trap material in system
- Ferrules

Interferences

- Canisters
- Failing Air system
- Site specific interferences
- Leak testing solutions
- Baseline issues
  - Detector ferrules
  - Air supply
  - Electrical
  - Vibration

Sources of Carry-over and Interferences



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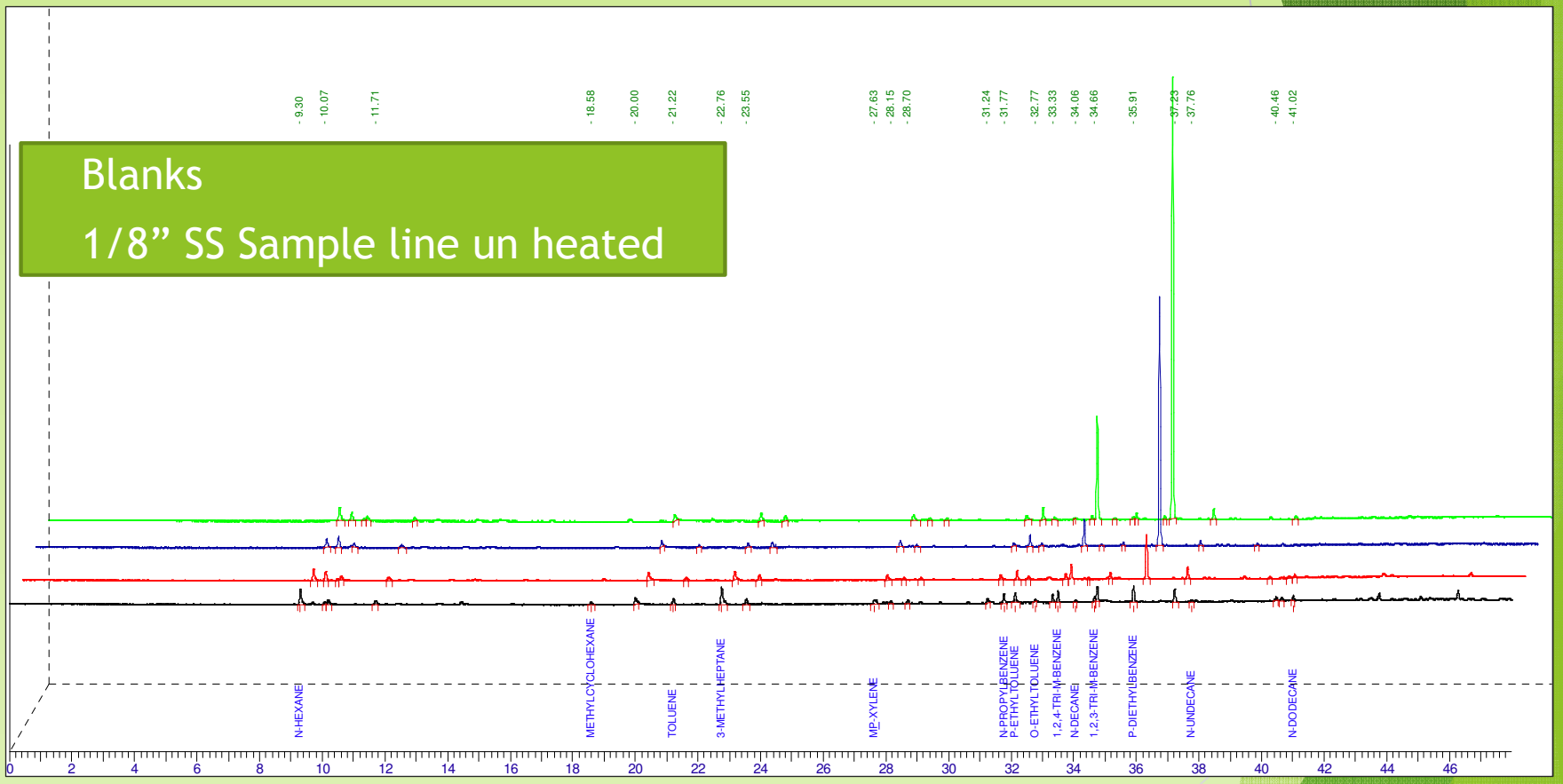

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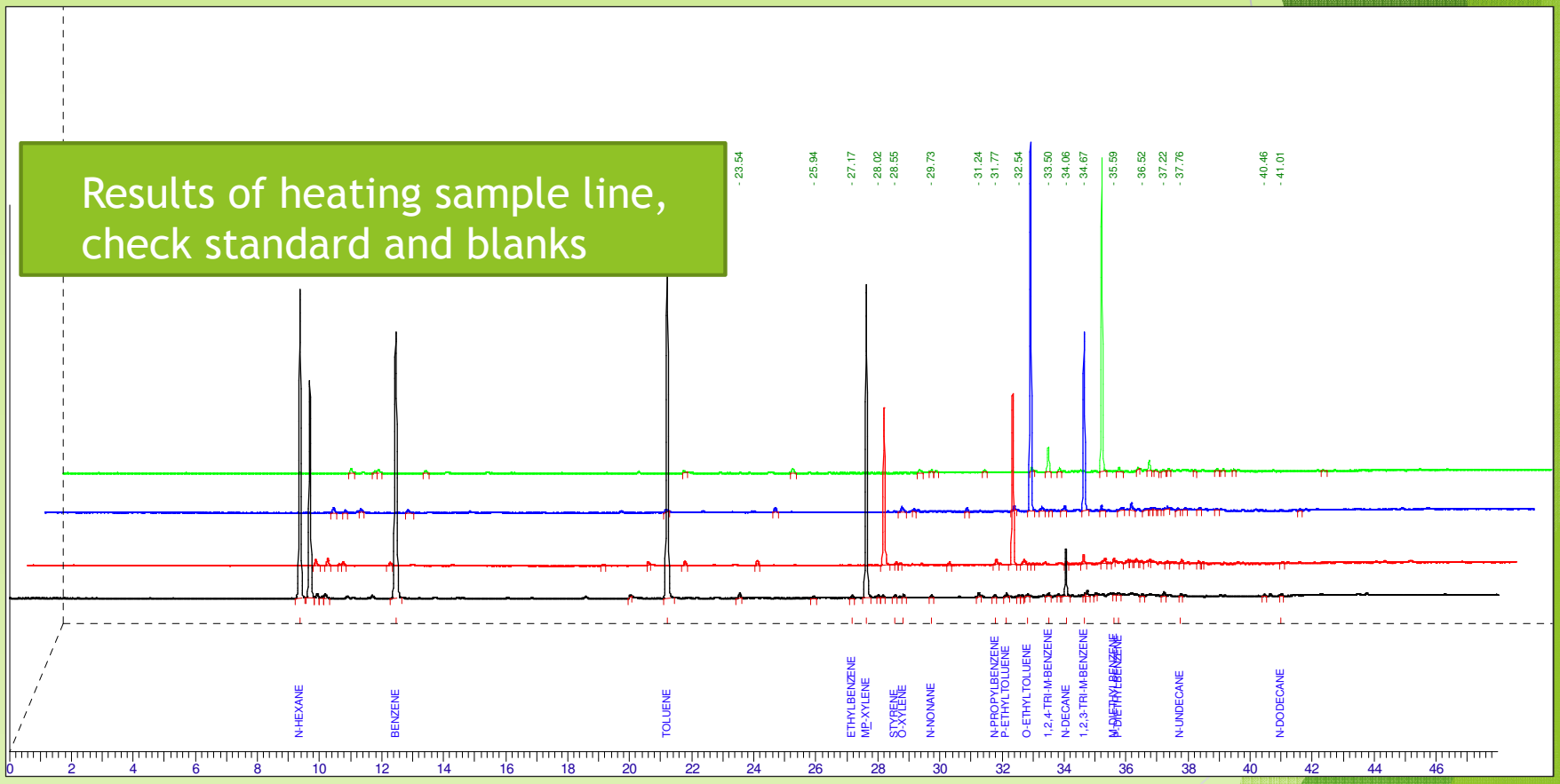
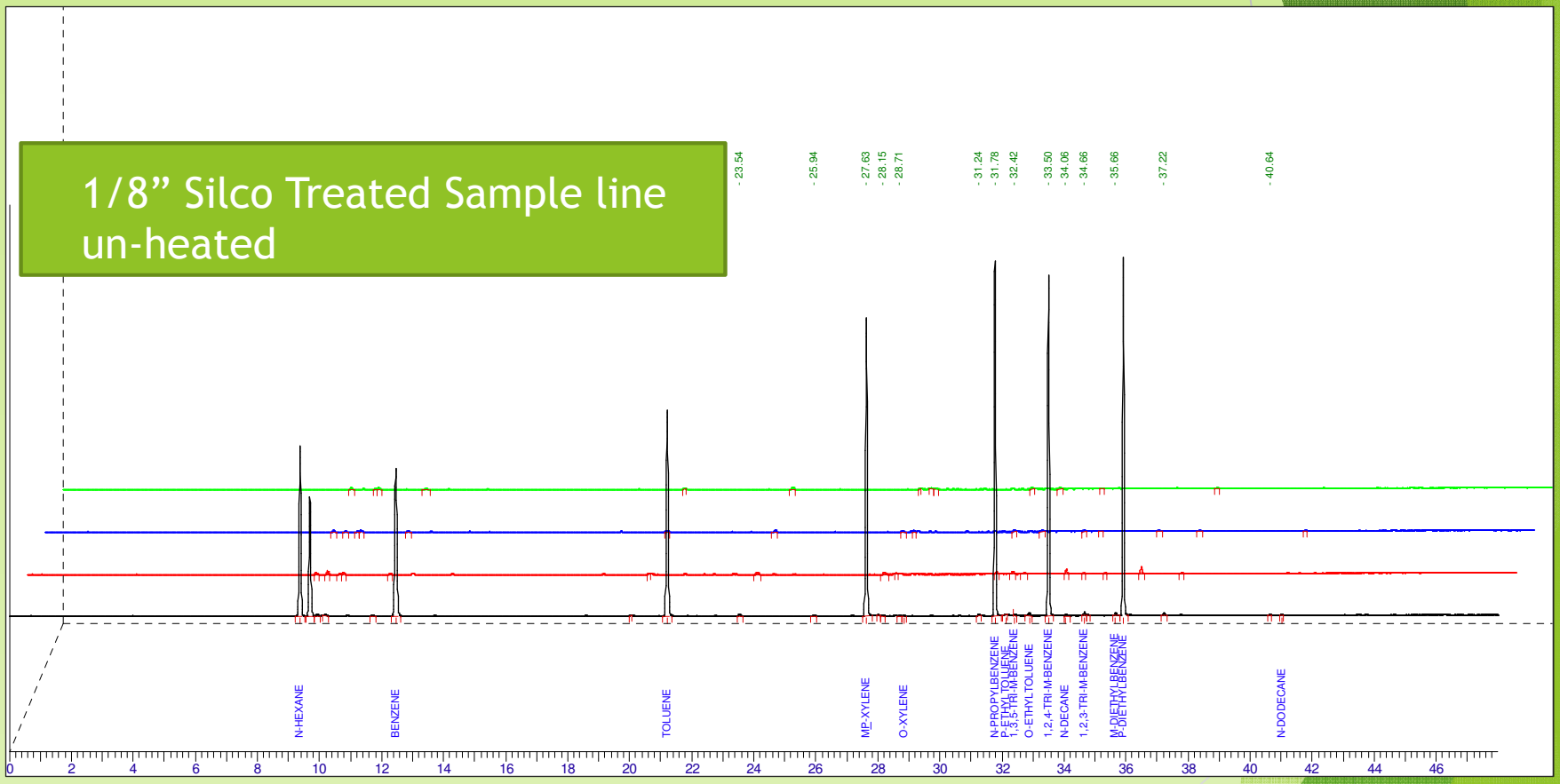


Sources of Carry-over and Interferences



Data Quality Objectives

- Data completeness
- Data representative of ambient concentration
- Minimize contributions from the system

Operations

- Well defined Operating Procedures
- Well documented instrumental parameters
- Fully automated system to reduce errors in operator activities
- Easily identifiable and transportable data files
- Fully automated Quality Checks

Data Validation

- Well defined Data Quality Objectives
- Real-time data transfer and review
- Well defined validation operating procedures
- Good annual audits to review instrument performance across network.

Network Quality Control

Quality Control Check	Composition	Purpose	Frequency	Acceptance Criteria
Retention Time Standard (RTS)	Mixture containing all target compounds ideally between 1-5 ppbC	To help assess retention time shifts and optimize processing methods	Twice a month or weekly	100% of the compounds are identified correctly in the multicomponent RTS
Calibration Verification Standard (CVS)	Mixture of 15 reference compounds including Propane and Benzene used for calibration	To assess the instrument drift and ensure continued instrument calibration	Daily	1) Propane and Benzene % recoveries within 75% - 125% and all other calibrants within 55 - 145%
				2) Data must be bracketed by valid CVS
Method (Analytical) Blank	Humidified, clean air	To assess system contribution to the measurement	Daily	1) All target compounds < 2.0 ppbC
				2) TNMHC < 20 ppbC
				3) Data must be bracketed by valid blanks
Precision Check	Mixture used for CVS	To assess analytical precision	Weekly	Propane and Benzene %RPD < 20% in two consecutive CVS runs
Laboratory Calibration Standard (LCS)	Mixture of 15 reference compounds including Propane and Benzene used for calibration	Second source standard, statically blended 5 ppbv	Twice a month or weekly	Propane and Benzene % recoveries within 70-130%

Data Review – Data Validation

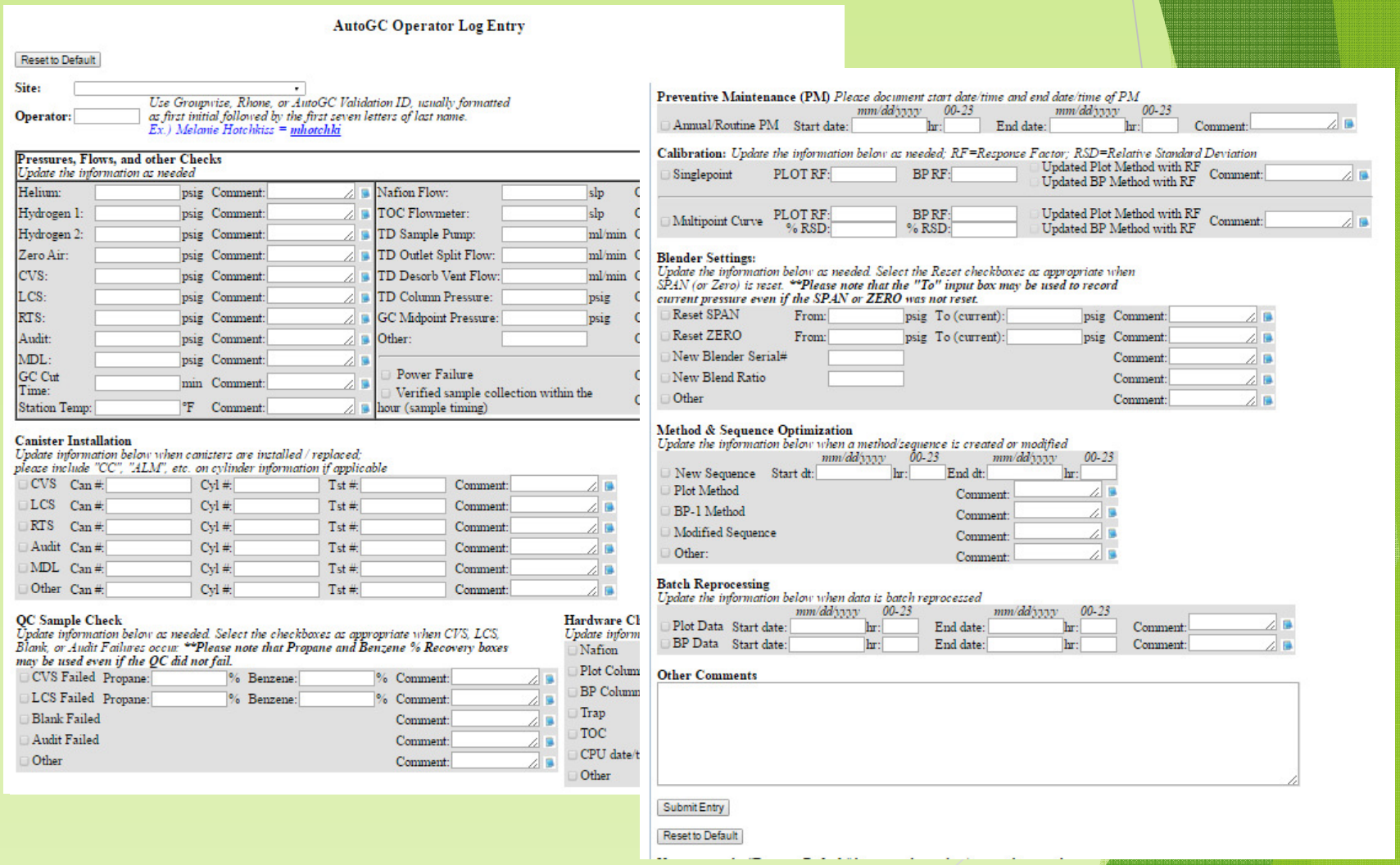
Data Review - Daily

- Site Operations
  - On-time collection
  - Correct identification
  - Equipment parameters
- Quality Controls
  - Passing Blanks
  - Passing check standard recovery

Data Validation - Monthly

- Review of Quality Controls
  - Passing check standard recoveries – flagging
  - Passing blanks – flagging failed targets
  - Retention time checks
- Chromatography review
  - Review of high hours or other issues

Electronic Logbooks



AutoGC Operator Log Entry

Reset to Default

Site:

Operator: *Use Groupwize, Rhone, or AutoGC Validation ID, usually formatted as first initial followed by the first seven letters of last name. Ex.) Melanie Hotchkiss = mhotchki*

Pressures, Flows, and other Checks
Update the information as needed

Helium:	psig	Comment:		Nafion Flow:	slp	C
Hydrogen 1:	psig	Comment:		TOC Flowmeter:	slp	C
Hydrogen 2:	psig	Comment:		TD Sample Pump:	ml/min	C
Zero Air:	psig	Comment:		TD Outlet Split Flow:	ml/min	C
CVS:	psig	Comment:		TD Desorb Vent Flow:	ml/min	C
LCS:	psig	Comment:		TD Column Pressure:	psig	C
RTS:	psig	Comment:		GC Midpoint Pressure:	psig	C
Audit:	psig	Comment:		Other:		C
MDL:	psig	Comment:				
GC Cut Time:	min	Comment:		Power Failure		C
Station Temp:	°F	Comment:		Verified sample collection within the hour (sample timing)		C

Canister Installation
Update information below when canisters are installed / replaced; please include "CC", "ALM", etc. on cylinder information if applicable

CVS	Can #:	Cyl #:	Tst #:	Comment:	
LCS	Can #:	Cyl #:	Tst #:	Comment:	
RTS	Can #:	Cyl #:	Tst #:	Comment:	
Audit	Can #:	Cyl #:	Tst #:	Comment:	
MDL	Can #:	Cyl #:	Tst #:	Comment:	
Other	Can #:	Cyl #:	Tst #:	Comment:	

QC Sample Check
Update information below as needed. Select the checkboxes as appropriate when CVS, LCS, Blank, or Audit Failures occur. ***Please note that Propane and Benzene % Recovery boxes may be used even if the QC did not fail.***

CVS Failed	Propane:	%	Benzene:	%	Comment:
LCS Failed	Propane:	%	Benzene:	%	Comment:
Blank Failed					Comment:
Audit Failed					Comment:
Other					Comment:

Hardware Cl
Update inform
Nafion
Plot Colum
BP Columr
Trap
TOC
CPU date/t
Other

Preventive Maintenance (PM) *Please document start date/time and end date/time of PM*

Annual/Routine PM Start date: *mm/dd/yyyy* hr: *00-23* End date: *mm/dd/yyyy* hr: *00-23* Comment:

Calibration: *Update the information below as needed; RF=Response Factor; RSD=Relative Standard Deviation*

Singlepoint	PLOT RF:		BP RF:		Updated Plot Method with RF Updated BP Method with RF
Multipoint Curve	PLOT RF: % RSD:		BP RF: % RSD:		Updated Plot Method with RF Updated BP Method with RF

Comment:

Blender Settings:
Update the information below as needed. Select the Reset checkboxes as appropriate when SPAN (or Zero) is reset. ***Please note that the "To" input box may be used to record current pressure even if the SPAN or ZERO was not reset.***

Reset SPAN	From:	psig	To (current):	psig	Comment:	
Reset ZERO	From:	psig	To (current):	psig	Comment:	
New Blender Serial#					Comment:	
New Blend Ratio					Comment:	
Other					Comment:	

Method & Sequence Optimization
Update the information below when a method/sequence is created or modified

New Sequence Start dt: *mm/dd/yyyy* hr: *00-23* End dt: *mm/dd/yyyy* hr: *00-23*
Plot Method Comment:
BP-1 Method Comment:
Modified Sequence Comment:
Other: Comment:

Batch Reprocessing
Update the information below when data is batch reprocessed

Plot Data Start date: *mm/dd/yyyy* hr: *00-23* End date: *mm/dd/yyyy* hr: *00-23* Comment:
BP Data Start date: hr: End date: hr: Comment:

Other Comments

Submit Entry

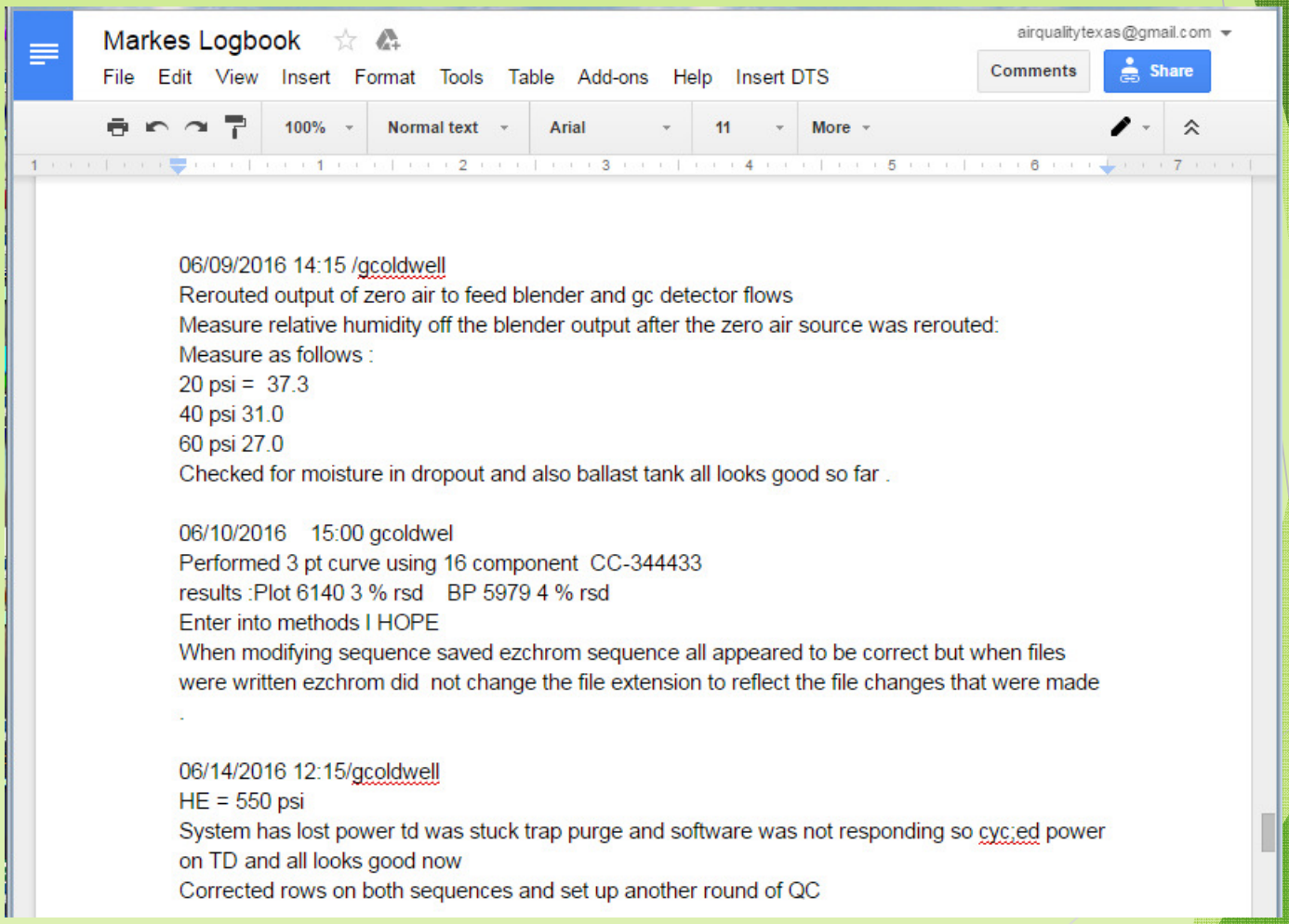
Reset to Default

Electronic Logbooks

AutoGC Operator Log Report

Site	Date	Username	Source	Log Entry	Comment
2D	07/29/2016 07:22	lrice	Remote Visit	**Pressures, Flows, and other Checks** *Verified Sample Timing:* [system is on time with files ending @(:32) and correct row (175)] **QC Sample Check** *CVS:* Propane=100, Benzene=99 [2D*CG29C]	Methods and Blanks look good
2D	07/28/2016 10:40	lrice	Site Visit	**Pressures, Flows, and other Checks** *Helium:* 1100 psig [@60] *Hydrogen 1:* 2300 psig [@65] *Zero Air:* 2300 psig [@85] *CVS:* 25 psig [37806] *LCS:* 16 psig [35919] *RTS:* 30 psig [14440] *GC Cut Time:* 10.00 min *Station Temp:* 73 °F [High 79 Low 70 Humidity: 48% High 48% Low 25%] *Nafion Flow:* .25 slp *TOC Flowmeter:* .49 slp [@80 psi] *TD Sample Pump:* 15 ml/min *TD Column Pressure:* 42.4 psig *GC Midpoint Pressure:* 18.5 psig *Other:* 85 psi [zero air output] *Verified Sample Timing:* [system is on time with files ending @(:32) and correct row (155)] **Canister Installation** *RTS:* 12240, CC-328584 [Removed Can #12247] **Blender Settings** *SPAN Not Reset:* to 5.0 psig *ZERO Not Reset:* to 40.0 psig **Method & Sequence Optimization** *Modified Sequence:* [setup RTS (spike) in sequence]	Methods look good Router signal: 4 lights All green lights on router Magnihelic pressure: .55 RMS noise BP-1: 7.96 Plot: 8.84 A-Fid: .22 mV B-Fid: .22 mV GC inlet pressure: 44.5 psi TOC: green light Variac: 35 volts Manifold tube heater is working Compressor water trap drained Output: 95 psi Tank cutoff: 135 psi Auto drain is working All catalyst feel warm Setup RTS (spike) in sequence
2D	07/27/2016 08:32	lrice	Remote Visit	**Pressures, Flows, and other Checks** *Verified Sample Timing:* [system is on time with files ending @(:32) and correct row (128)] **QC Sample Check** *CVS:* Propane=102, Benzene=102 [2D*CG27C]	Methods and Blanks look good

Electronic Logbooks


Markes Logbook

airqualitytexas@gmail.com

File Edit View Insert Format Tools Table Add-ons Help Insert DTS

Comments Share

100% Normal text Arial 11 More

06/09/2016 14:15 /gcoldwell
Rerouted output of zero air to feed blender and gc detector flows
Measure relative humidity off the blender output after the zero air source was rerouted:
Measure as follows :
20 psi = 37.3
40 psi 31.0
60 psi 27.0
Checked for moisture in dropout and also ballast tank all looks good so far .

06/10/2016 15:00 gcoldwel
Performed 3 pt curve using 16 component CC-344433
results :Plot 6140 3 % rsd BP 5979 4 % rsd
Enter into methods I HOPE
When modifying sequence saved ezchrom sequence all appeared to be correct but when files were written ezchrom did not change the file extension to reflect the file changes that were made
.

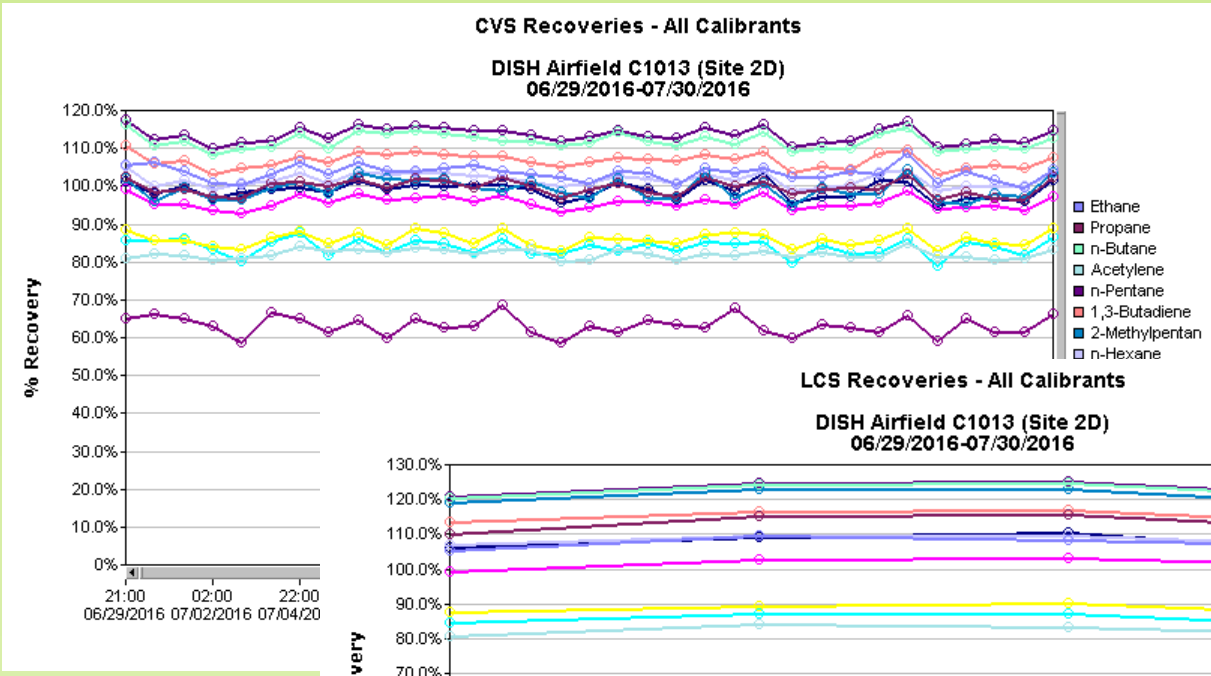
06/14/2016 12:15/gcoldwell
HE = 550 psi
System has lost power td was stuck trap purge and software was not responding so cyc;ed power on TD and all looks good now
Corrected rows on both sequences and set up another round of QC

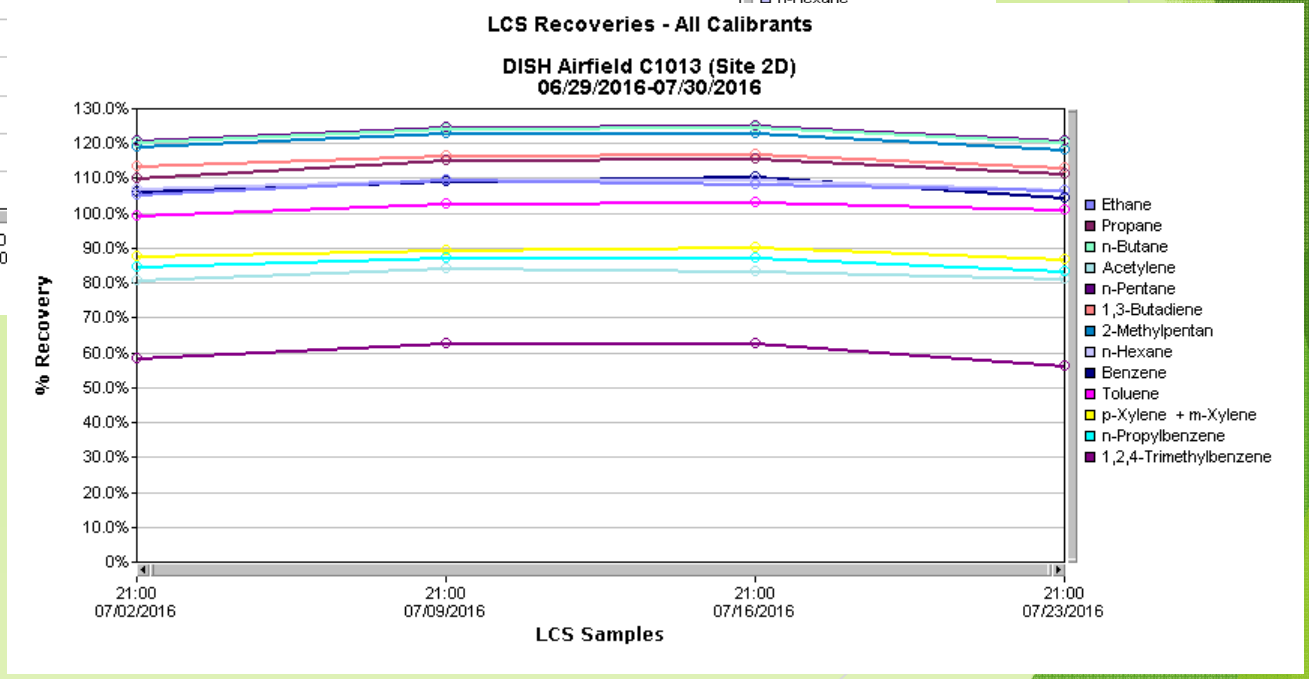
Tools to Monitor Performance

- Automation of routine quality control samples
- Remote Access via broadband connections
  - Applications for remote control (remote desktop)
  - FTP – polling and file transfer automation
- Email alerts
  - Power failures
  - No data (polling)

Tools to Monitor Performance: Control Charts

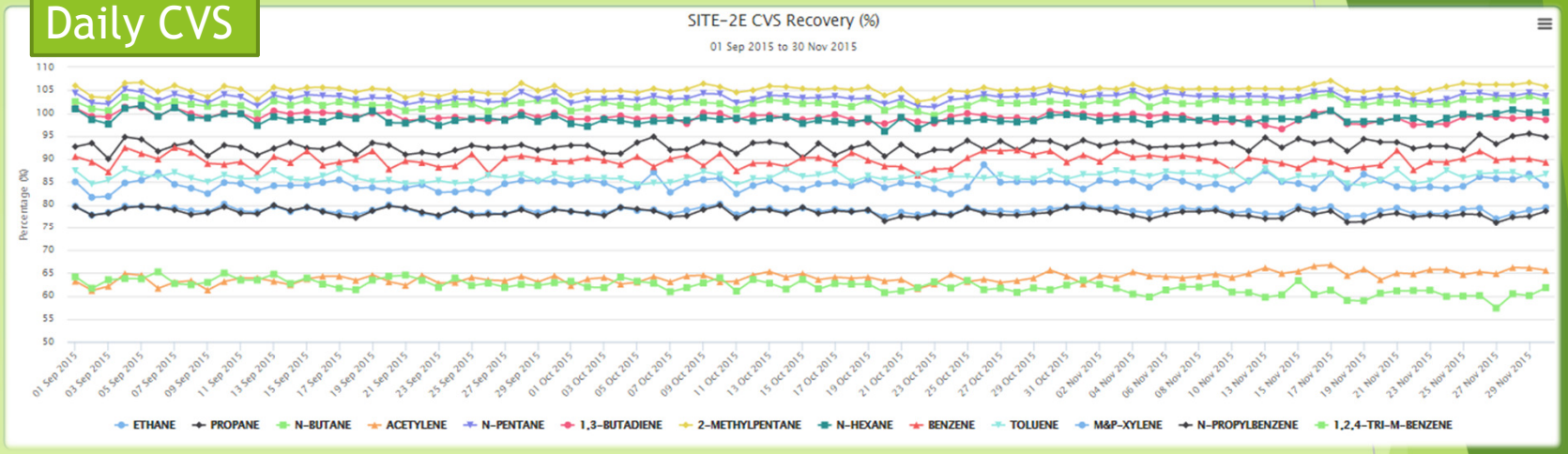
LEADS® Leading Environmental Analysis & Display System



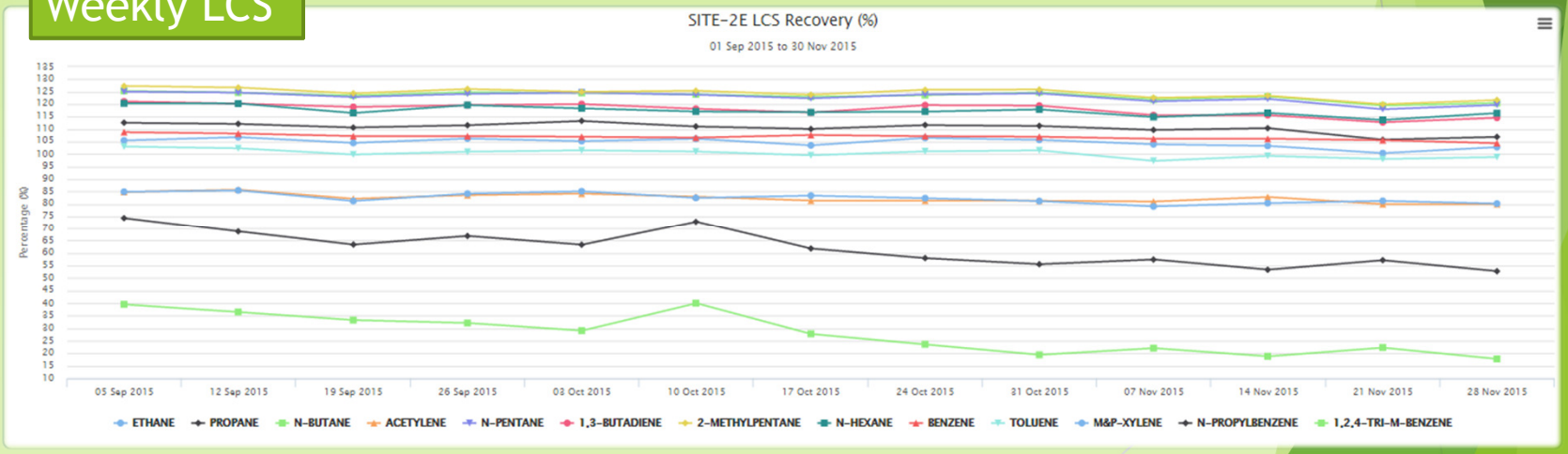


Tools to Monitor Performance: Control Charts

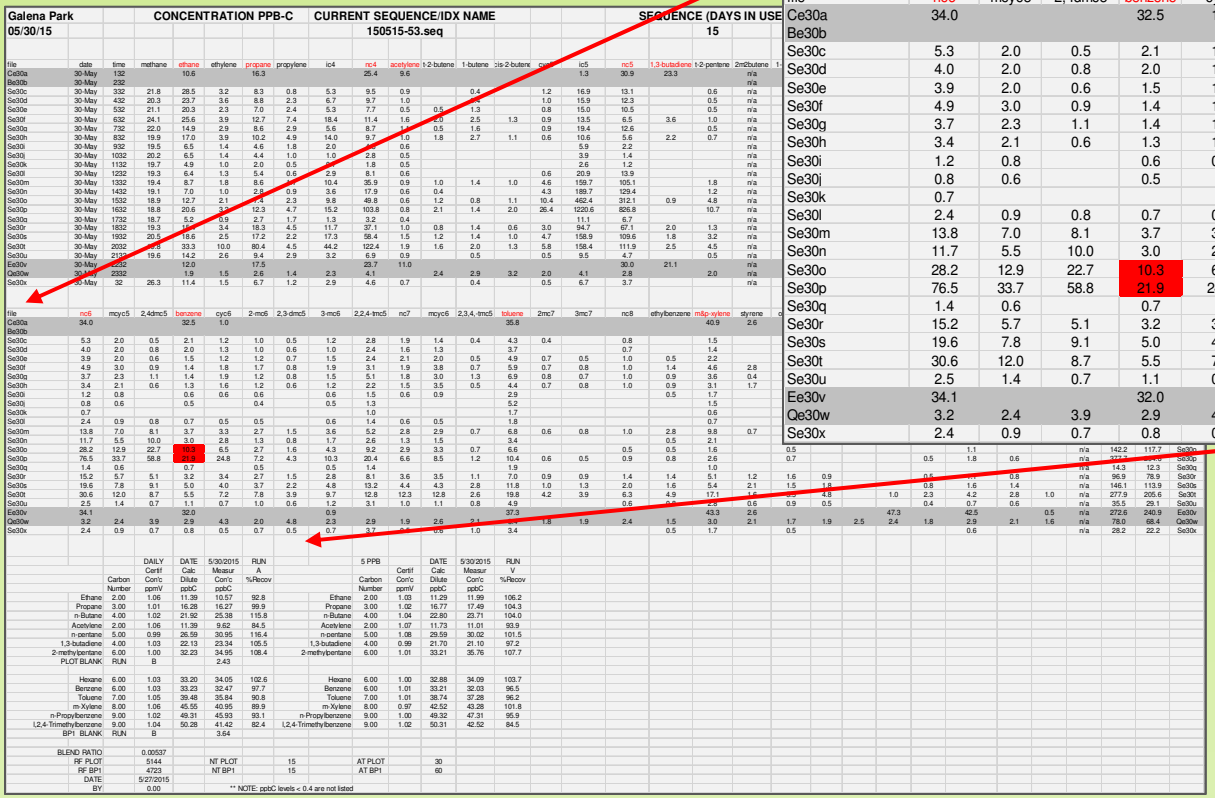
Daily CVS



Weekly LCS



Tools to Monitor Performance
QuickLook Email Report



Galena Park — CONCENTRATION PPB-C — CURRENT SEQUENCE/IDX NAME — SEQUENCE (DAYS IN USE)
05/30/15 — 150515-53.seq — 15

file	date	time	methane	ethane	ethylene	propane	propylene	ic4	nc4	acetylene	t-2-butene	1-butene	cis-2-butene	cpen	ic5	nc5	1,3-butadiene	t-2-pentene	2m2butene
Ce30a	30-May	132		10.6		16.3			25.4	9.6					1.3	30.9	23.3		n/a
Be30b	30-May	232																	n/a
Se30c	30-May	332	21.8	28.5	3.2	8.3	0.8	5.3	9.5	0.9		0.4		1.2	16.9	13.1		0.6	n/a
Se30d	30-May	432	20.3	23.7	3.6	8.8	2.3	6.7	9.7	1.0		0.7		1.0	15.9	12.3		0.5	n/a
Se30e	30-May	532	21.1	20.3	2.3	7.0	2.4	5.3	7.7	0.5	0.5	1.3		0.8	15.0	10.5		0.5	n/a
Se30f	30-May	632	24.1	25.6	3.9	12.7	7.4	18.4	11.4	1.6	2.0	2.5	1.3	0.9	13.5	6.5	3.6	1.0	n/a
Se30g	30-May	732	22.0	14.9	2.9	8.6	2.9	5.6	8.7	1.4	0.5	1.6		0.9	19.4	12.6		0.5	n/a
Se30h	30-May	832	19.9	17.0	3.9	10.2	4.9	14.0	9.7	1.0	1.8	2.7	1.1	0.6	10.6	5.6	2.2	0.7	n/a
Se30i	30-May	932	19.5	6.5	1.4	4.6	1.8	2.0	2.8	0.6					5.9	2.2			n/a
Se30j	30-May	1032	20.2	6.5	1.4	4.4	1.0	1.0	2.8	0.5					3.9	1.4			n/a
Se30k	30-May	1132	19.7	4.9	1.0	2.0	0.5	0.5	1.8	0.5					2.6	1.2			n/a
Se30l	30-May	1232	19.3	6.4	1.3	5.4	0.6	2.9	8.1	0.6				0.6	20.9	13.9			n/a
Se30m	30-May	1332	19.4	8.7	1.8	8.6	2.6	10.4	35.9	0.9	1.0	1.4	1.0	4.6	159.7	105.1		1.8	n/a
Se30n	30-May	1432	19.1	7.0	1.0	2.8	0.9	3.6	17.9	0.6	0.4			4.3	189.7	129.4		1.2	n/a
Se30o	30-May	1532	18.9	12.7	2.1	7.4	2.3	9.8	49.8	0.6	1.2	0.8	1.1	10.4	462.4	312.1	0.9	4.8	n/a
Se30p	30-May	1632	18.8	20.6	3.2	12.3	4.7	15.2	103.8	0.8	2.1	1.4	2.0	26.4	1220.6	826.8		10.7	n/a
Se30q	30-May	1732	18.7	5.2	0.9	2.7	1.7	1.3	3.2	0.4					11.1	6.7			n/a
Se30r	30-May	1832	19.3	12.7	3.4	18.3	4.5	11.7	37.1	1.0	0.8	1.4	0.6	3.0	94.7	67.1	2.0	1.3	n/a
Se30s	30-May	1932	20.5	18.6	2.5	17.2	2.2	17.3	58.4	1.5	1.2	1.4	1.0	4.7	158.9	109.6	1.8	3.2	n/a
Se30t	30-May	2032	19.8	33.3	10.0	80.4	4.5	44.2	122.4	1.9	1.6	2.0	1.3	5.8	158.4	111.9	2.5	4.5	n/a
Se30u	30-May	2132	19.6	14.2	2.6	9.4	2.9	3.2	6.9	0.9		0.5		0.5	9.5	4.7		0.5	n/a
Ee30v	30-May	2232		12.0		17.5			23.7	11.0						30.0	21.1		n/a
Qe30w	30-May	2332		1.9	1.5	2.6	1.4	2.3	4.1		2.4	2.9	3.2	2.0	4.1	2.8		2.0	n/a
Se30x	30-May	32	26.3	11.4	1.5	6.7	1.2	2.9	4.6	0.7		0.4		0.5	6.7	3.7			n/a

file	nc6	mcyc5	2,4dmc5	benzene	cyc6	2-mc6	2,3-dmc5	3-mc6	2,2,4-tmc5	nc7	mcyc6	2,3,4,-tmc5	toluene	2mc7	3mc7	nc8	ethylbenzene	m&p-xylene	styrene
Ce30a	34.0			32.5	1.0								35.8					40.9	2.6
Be30b																			
Se30c	5.3	2.0	0.5	2.1	1.2	1.0	0.5	1.2	2.8	1.9	1.4	0.4	4.3	0.4		0.8		1.5	
Se30d	4.0	2.0	0.8	2.0	1.3	1.0	0.6	1.0	2.4	1.6	1.3		3.7			0.7		1.4	
Se30e	3.9	2.0	0.6	1.5	1.2	1.2	0.7	1.5	2.4	2.1	2.0	0.5	4.9	0.7	0.5	1.0	0.5	2.2	
Se30f	4.9	3.0	0.9	1.4	1.8	1.7	0.8	1.9	3.1	1.9	3.8	0.7	5.9	0.7	0.8	1.0	1.4	4.6	2.8
Se30g	3.7	2.3	1.1	1.4	1.9	1.2	0.8	1.5	5.1	1.8	3.0	1.3	6.9	0.8	0.7	1.0	0.9	3.6	0.4
Se30h	3.4	2.1	0.6	1.3	1.6	1.2	0.6	1.2	2.2	1.5	3.5	0.5	4.4	0.7	0.8	1.0	0.9	3.1	1.7
Se30i	1.2	0.8		0.6	0.6	0.6		0.6	1.5	0.6	0.9		2.9				0.5	1.7	
Se30j	0.8	0.6		0.5		0.4		0.5	1.3				5.2					1.5	
Se30k	0.7								1.0				1.7					0.6	
Se30l	2.4	0.9	0.8	0.7	0.5	0.5		0.6	1.4	0.6	0.5		1.8					0.7	
Se30m	13.8	7.0	8.1	3.7	3.3	2.7	1.5	3.6	5.2	2.8	2.9	0.7	6.8	0.6	0.8	1.0	2.8	9.8	0.7
Se30n	11.7	5.5	10.0	3.0	2.8	1.3	0.8	1.7	2.6	1.3	1.5		3.4				0.5	2.1	
Se30o	28.2	12.9	22.7	10.3	6.5	2.7	1.6	4.3	9.2	2.9	3.3	0.7	6.6			0.5	0.5	1.6	
Se30p	76.5	33.7	58.8	21.9	24.8	7.2	4.3	10.3	20.4	6.6	8.5	1.2	10.4	0.6	0.5	0.9	0.8	2.6	
Se30q	1.4	0.6		0.7		0.5		0.5	1.4				1.9					1.0	
Se30r	15.2	5.7	5.1	3.2	3.4	2.7	1.5	2.8	8.1	3.6	3.5	1.1	7.0	0.9	0.9	1.4	1.4	5.1	1.2
Se30s	19.6	7.8	9.1	5.0	4.0	3.7	2.2	4.8	13.2	4.4	4.3	2.8	11.8	1.0	1.3	2.0	1.6	5.4	2.1
Se30t	30.6	12.0	8.7	5.5	7.2	7.8	3.9	9.7	12.8	12.3	12.8	2.6	19.8	4.2	3.9	6.3	4.9	17.1	1.5
Se30u	2.5	1.4	0.7	1.1	0.7	1.0	0.6	1.2	3.1	1.0	1.1	0.8	4.9			0.6	0.5	2.9	0.6
Ee30v	34.1			32.0				0.9					37.3					43.3	2.6
Qe30w	3.2	2.4	3.9	2.9	4.3	2.0	4.8	2.3	2.9	1.9	2.6	2.4	3.7	1.8	1.9	2.4	1.5	3.0	2.1
Se30x	2.4	0.9	0.7	0.8	0.5	0.7	0.5	0.7	3.7	0.7	0.9	1.0	3.4				0.5	1.7	

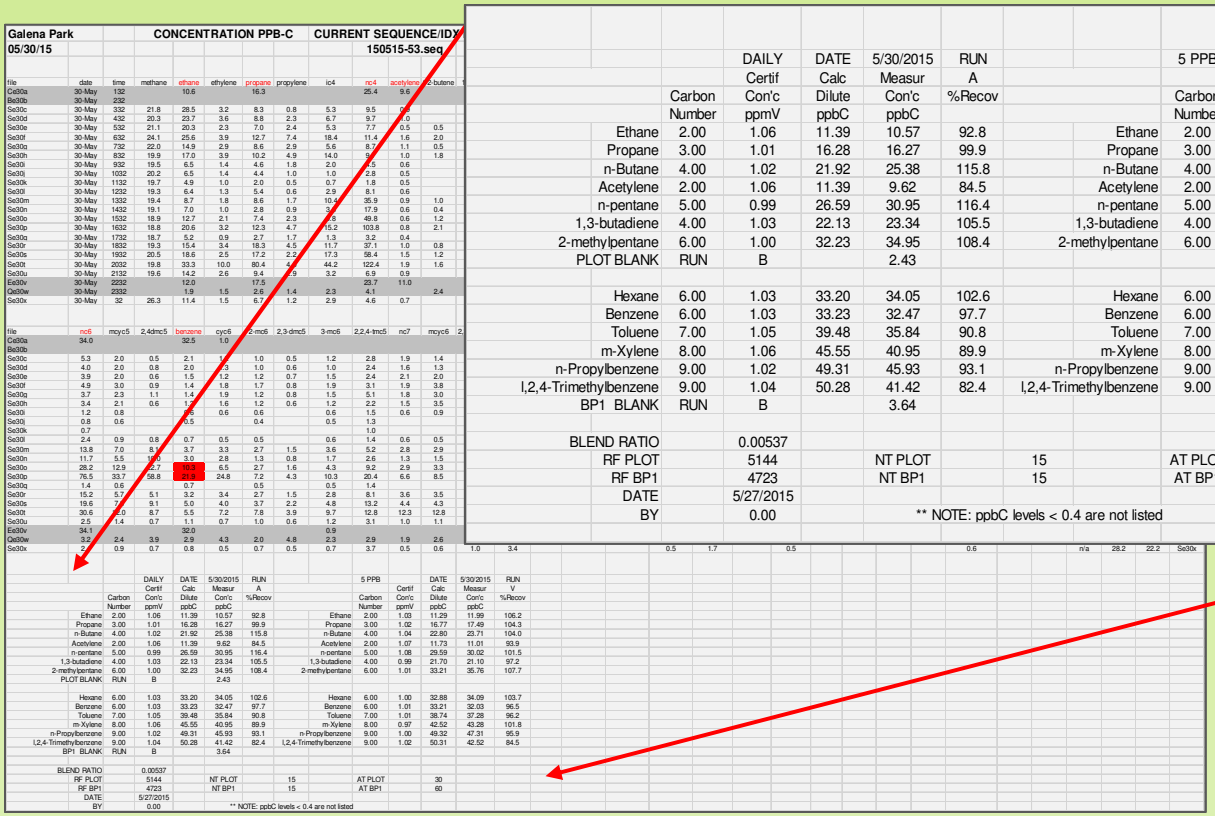
	Carbon Number	DAILY Certif Conc ppmV	DATE Calc Dilute ppbC	5/30/2015 Measur Conc ppbC	RUN A %Recov
Ethane	2.00	1.06	11.39	10.57	92.8
Propane	3.00	1.01	16.28	16.27	99.9
n-Butane	4.00	1.02	21.92	25.38	115.8
Acetylene	2.00	1.06	11.39	9.62	84.5
n-pentane	5.00	0.99	26.59	30.95	116.4
1,3-butadiene	4.00	1.03	22.13	23.34	105.5
2-methylpentane	6.00	1.00	32.23	34.95	108.4
PLOT BLANK	RUN	B		2.43	
Hexane	6.00	1.03	33.20	34.05	102.6
Benzene	6.00	1.03	33.23	32.47	97.7
Toluene	7.00	1.05	39.48	35.84	90.8
m-Xylene	8.00	1.06	45.55	40.95	89.9
n-Propylbenzene	9.00	1.02	49.31	45.93	93.1
1,2,4-Trimethylbenzene	9.00	1.04	50.28	41.42	82.4
BP1 BLANK	RUN	B		3.64	
BLEND RATIO		0.00537			
RF PLOT		5144		NT PLOT	15
RF BP1		4723		NT BP1	15
DATE		5/27/2015			
BY		0.00			

	Carbon Number	5 PPB Certif Conc ppmV	DATE Calc Dilute ppbC	5/30/2015 Measur Conc ppbC	RUN V %Recov
Ethane	2.00	1.03	11.29	11.99	106.2
Propane	3.00	1.02	16.77	17.49	104.3
n-Butane	4.00	1.04	22.80	23.71	104.0
Acetylene	2.00	1.07	11.73	11.01	93.9
n-pentane	5.00	1.08	29.59	30.02	101.5
1,3-butadiene	4.00	0.99	21.70	21.10	97.2
2-methylpentane	6.00	1.01	33.21	35.76	107.7
Hexane	6.00	1.00	32.88	34.09	103.7
Benzene	6.00	1.01	33.21	32.03	96.5
Toluene	7.00	1.01	38.74	37.28	96.2
m-Xylene	8.00	0.97	42.52	43.28	101.8
n-Propylbenzene	9.00	1.00	49.32	47.31	95.9
1,2,4-Trimethylbenzene	9.00	1.02	50.31	42.52	84.5
AT PLOT					30
AT BP1					60

** NOTE: ppbC levels < 0.4 are not listed

file	nc6	mcyc5	2,4dmc5	benzene	cyc6	2-mc6
Ce30a	34.0			32.5	1.0	
Be30b						
Se30c	5.3	2.0	0.5	2.1	1.2	1.0
Se30d	4.0	2.0	0.8	2.0	1.3	1.0
Se30e	3.9	2.0	0.6	1.5	1.2	1.2
Se30f	4.9	3.0	0.9	1.4	1.8	1.7
Se30g	3.7	2.3	1.1	1.4	1.9	1.2
Se30h	3.4	2.1	0.6	1.3	1.6	1.2
Se30i	1.2	0.8		0.6	0.6	0.6
Se30j	0.8	0.6		0.5		0.4
Se30k	0.7					
Se30l	2.4	0.9	0.8	0.7	0.5	0.5
Se30m	13.8	7.0	8.1	3.7	3.3	2.7
Se30n	11.7	5.5	10.0	3.0	2.8	1.3
Se30o	28.2	12.9	22.7	10.3	6.5	2.7
Se30p	76.5	33.7	58.8	21.9	24.8	7.2
Se30q	1.4	0.6		0.7		0.5
Se30r	15.2	5.7	5.1	3.2	3.4	2.7
Se30s	19.6	7.8	9.1	5.0	4.0	3.7
Se30t	30.6	12.0	8.7	5.5	7.2	7.8
Se30u	2.5	1.4	0.7	1.1	0.7	1.0
Ee30v	34.1			32.0		
Qe30w	3.2	2.4	3.9	2.9	4.3	2.0
Se30x	2.4	0.9	0.7	0.8	0.5	0.7

Tools to Monitor Performance
QuickLook Email Report



		DAILY	DATE	5/30/2015	RUN			5 PPB		DATE	5/30/2015	RUN
		Certif	Calc	Measur	A				Certif	Calc	Measur	V
	Carbon	Con'c	Dilute	Con'c	%Recov			Carbon	Con'c	Dilute	Con'c	%Recov
	Number	ppmV	ppbC	ppbC				Number	ppmV	ppbC	ppbC	
Ethane	2.00	1.06	11.39	10.57	92.8		Ethane	2.00	1.03	11.29	11.99	106.2
Propane	3.00	1.01	16.28	16.27	99.9		Propane	3.00	1.02	16.77	17.49	104.3
n-Butane	4.00	1.02	21.92	25.38	115.8		n-Butane	4.00	1.04	22.80	23.71	104.0
Acetylene	2.00	1.06	11.39	9.62	84.5		Acetylene	2.00	1.07	11.73	11.01	93.9
n-pentane	5.00	0.99	26.59	30.95	116.4		n-pentane	5.00	1.08	29.59	30.02	101.5
1,3-butadiene	4.00	1.03	22.13	23.34	105.5		1,3-butadiene	4.00	0.99	21.70	21.10	97.2
2-methylpentane	6.00	1.00	32.23	34.95	108.4		2-methylpentane	6.00	1.01	33.21	35.76	107.7
PLOT BLANK	RUN	B		2.43								
Hexane	6.00	1.03	33.20	34.05	102.6		Hexane	6.00	1.00	32.88	34.09	103.7
Benzene	6.00	1.03	33.23	32.47	97.7		Benzene	6.00	1.01	33.21	32.03	96.5
Toluene	7.00	1.05	39.48	35.84	90.8		Toluene	7.00	1.01	38.74	37.28	96.2
m-Xylene	8.00	1.06	45.55	40.95	89.9		m-Xylene	8.00	0.97	42.52	43.28	101.8
n-Propylbenzene	9.00	1.02	49.31	45.93	93.1		n-Propylbenzene	9.00	1.00	49.32	47.31	95.9
l,2,4-Trimethylbenzene	9.00	1.04	50.28	41.42	82.4		l,2,4-Trimethylbenzene	9.00	1.02	50.31	42.52	84.5
BP1 BLANK	RUN	B		3.64								
BLEND RATIO		0.00537										
RF PLOT		5144		NT PLOT		15		AT PLOT		30		
RF BP1		4723		NT BP1		15		AT BP1		60		
DATE		5/27/2015										
BY		0.00		** NOTE: ppbC levels < 0.4 are not listed								

Carol J. Meyer
carol@orsat.com

Orsat, LLC
www.orsat.com