

SITE OPERATIONS 101

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AQIS I (Station Operations)

South Coast Air Quality Management District



THE STATION OPERATOR

“What is your son doing for work these days?”

My dad: “He’s a driver.”

We drive

A lot



“HOW DO YOU FEEL ABOUT DRIVING?”

Navigation interface showing route options from Los Angeles International Airport to Santa Clarita. The interface includes a search bar, a list of route options with their respective times and distances, and a 'Send directions to your phone' button.

South Coast Air Quality Management District
Los Angeles International Airport
Add destination

Leave now **OPTIONS**

Send directions to your phone

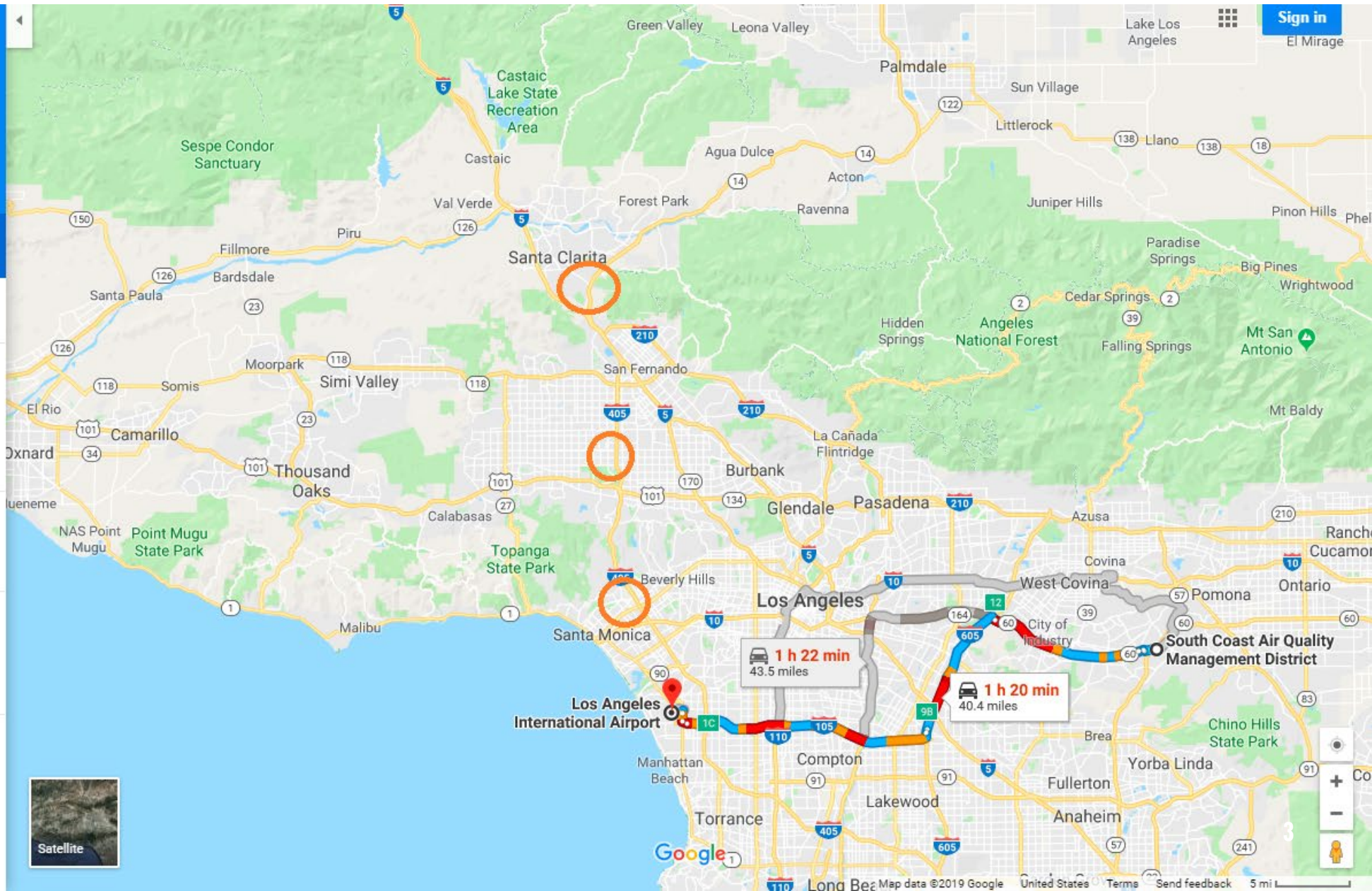
via CA-60 W and I-105 W **1 h 20 min**
Fastest route, despite heavier traffic than usual
40.4 miles

DETAILS

via CA-60 W, I-710 S and I-105 W **1 h 22 min**
Much heavier traffic than usual
43.5 miles

8:45 AM–11:33 AM **2 h 48 min**

> > > 482 > 480 > Silver Streak
> > > LAX FlyAway-US2LAX



MY SAMPLE TRIANGLE

SCAQMD > LAX: 40 miles

LAX > Santa Clarita: 37 miles

Santa Clarita > SCAQMD: 60 miles

Total: 137 miles on a sample collection day

So yeah, my dad isn't exactly wrong about what I do one day of week

BUT driving isn't the only thing we do!



THE STATION OPERATOR

What do you think a station operator does?



THE OPERATOR

- The South Coast Air Quality Management District divides the jobs of our Air Quality Instrument Specialists into three distinct categories
 - Operations
 - Repair
 - Calibrations
- Most other AQMD's have operators conduct basic operations as well as repairs
- Station Operators at the SCAQMD have multiple stations

AN OVERVIEW OF DUTIES

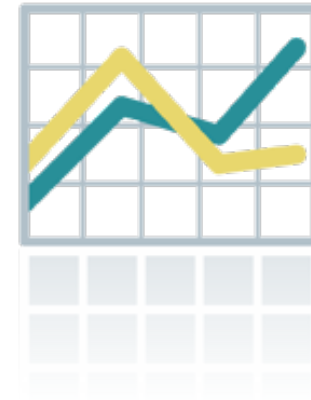
1. Monitor/Maintain gaseous instruments at stations <- Field
2. Collect samples from the field & submit to lab <- Field
3. Document irregularities with sampling/data <- Field
4. *Level 1 QC for data that eventually goes into AQS <- Office

*New for the SCAQMD!

ROUTINE OFFICE PROCEDURES: DAILY CHECKS

At the office:

- Review previous 24-hr data (minute and hourly), looking for:
 - Missing data (power failures, communications failures, etc.)
 - Flags /errors (equipment malfunctions)
 - High / low values (real or not)
 - Extreme values (e.g. over range values, negative values)
 - Unusual changes in values
 - Autocal results



DAILY PC ACROSS THE SOUTH COAST

- What's going on here?
- This is generally where the operator starts his/her day
- If you were an operator, what do you do?

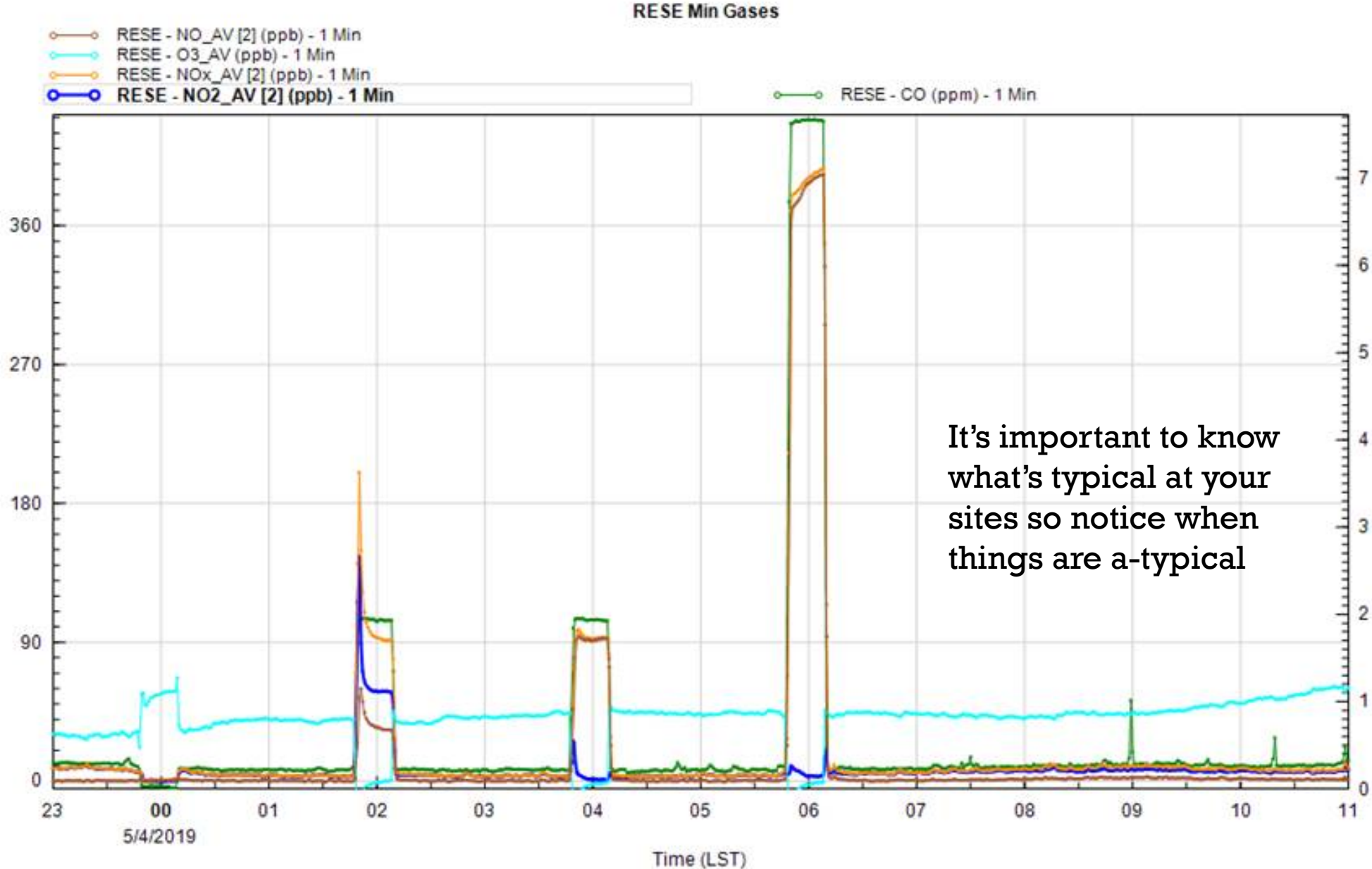
	O3	NO	NO2	NOx	NOy	CO	CO TL	SO2
Warning:	(5%)	(10%)	(10%)	(10%)	(7%)	(7%)	(7%)	(7%)
Invalid:	(7%)	(15%)	(15%)	(15%)	(10%)	(10%)	(10%)	(10%)
60NR		-4.96	-5.55	-3.00				
AHNR		-5.37	-1.19	-4.67		1.19		
ANAH	1.12	-3.98	0.29	-3.57		3.14		
AZUS	-4.24	1.43	5.34	2.78		1.92		
BNAP	-8.36	-6.24	-5.32	-3.84				
CELA	-3.03	1.82	-0.33	2.00	-0.72	1.82	-2.64	-5.56
CMPT	0.56	-15.47	-12.62	-15.62		3.55		
CRES	2.18							
ELSI	-0.56	-7.85	1.18	-6.23		-3.96		
FONT	-3.80	-9.96	-7.29	-8.22		3.85		-0.49
GLEN	-2.69	-0.15	-2.10	-0.24		4.06		
HDSN	0.80	-12.46	-7.84	-12.26		-0.95		-7.60
HNTP		-5.67	-0.24	-4.38				
INDI	-1.17							
LAHB	-1.76	-11.73	-7.91	-11.48		2.70		
LAXH	-1.06	****	****	****		****		0.60
LBSH		-6.22	-6.51	-7.48				
MLVB	-1.06	-4.24	-2.37	-2.43		-1.50		
MSVJ	-4.81					3.93		
ONNR		-24.33	-22.05	-23.87		-4.55		
PASA	-3.49	-3.80	0.31	-3.10		4.22		
PERI	2.29							
PICO	-2.22	-5.53	-3.24	-4.33		-0.72		
PLSP	-3.41	0.63	0.27	1.54		-0.47		
POMA	-3.25	-4.54	5.32	-2.23		0.35		
RDDL	-0.61							
RESE	-0.55	-6.48	-6.51	-8.04		0.69		
RIVR	-2.13	-9.97	7.19	-6.98	-1.64	-0.75	1.73	-1.58
SCLR	-0.42	-4.04	-1.56	-3.33		3.57		
SLMZ								
SNBO	-1.68	-4.21	2.26	-4.20		-2.03		
TMCA	-5.13							
TRMZ								
UPLA	-2.24	-1.02	4.73	1.34		1.17		
W710		-8.44	-7.49	-8.32				
WMAP		-1.24	2.91	-0.82				
WSLA	0.37	-8.97	-3.91	-7.42		0.68		

INSTRUMENT HEALTH

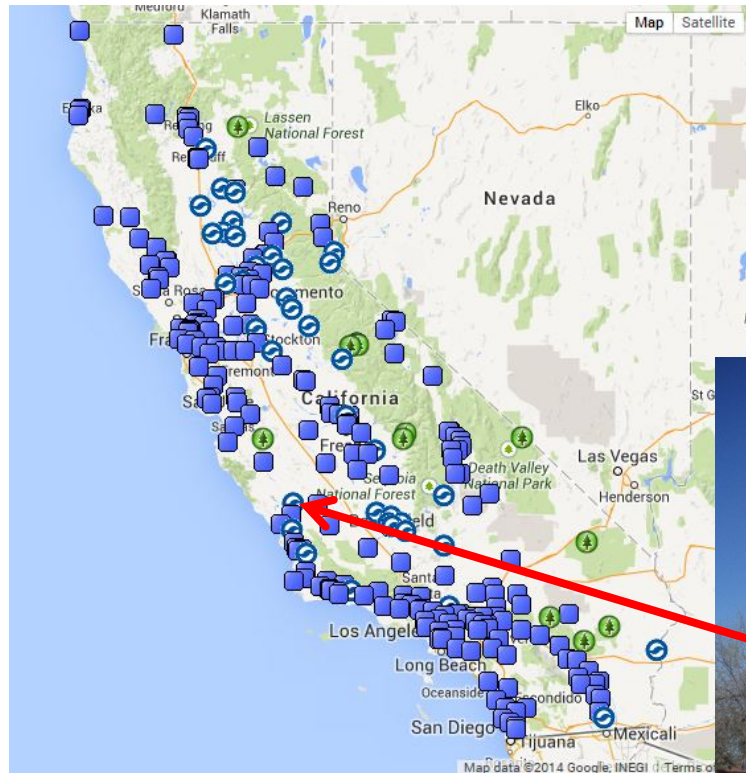
We use these snapshots to keep an eye on instrument health and data validity

	CO	NO	NO2	NOx	O3
Warning:	(7%)	(10%)	(10%)	(10%)	(5%)
Invalid:	(10%)	(15%)	(15%)	(15%)	(7%)
01	1.96	-8.35	-5.80	-7.87	1.16
02	1.24	-9.03	-4.45	-8.21	0.30
03	1.20	-9.96	-6.08	-9.21	1.37
04	1.36	-10.51	-7.16	-9.74	0.88
05	1.81	-9.13	-5.15	-8.70	0.15
06	0.93	-9.84	-5.95	-9.78	0.01
07	1.24	-10.79	-8.43	-10.02	0.40
08	1.32	-9.98	-7.22	-9.72	-0.67
09	1.14	-9.71	-5.52	-9.11	-1.26
10	1.95	-10.77	-7.15	-10.16	0.10
11	2.60	-10.57	-5.43	-9.77	1.28
12	1.97	-9.12	-5.14	-8.18	0.10
13	1.40	-9.95	-2.73	-9.04	0.65
14	0.74	-10.15	-8.33	-9.51	-0.60
15	1.29	-9.44	-6.66	-9.25	0.83
16	0.80	-10.10	-6.33	-9.72	0.70
17	1.16	-10.90	-6.65	-10.44	0.00
18	0.58	-11.37	-8.03	-10.39	-0.01
19	1.02	-10.97	-7.07	-10.04	-0.18
20	1.41	-10.59	-6.03	-9.82	0.24
21	1.46	-11.11	-6.51	-10.88	-0.47
22	0.68	-10.44	-7.49	-10.30	-0.12
23	1.37	-11.06	-6.53	-10.19	0.68
24	0.67	-11.23	-6.43	-10.34	-0.61
25	-65.82	-70.25	-72.75	-69.74	-0.28
26	-26.09	-35.13	-9.69	-34.65	0.05
27	-30.03	-37.70	-9.41	-37.18	-0.17
28	-31.34	-38.81	-5.63	-38.48	-0.71
29	-32.82	-39.64	-7.09	-39.20	-0.42
30	-34.34	-40.56	-9.74	-40.53	-0.89

MORE TOOLS TO MONITOR HEALTH OF INSTRUMENTS

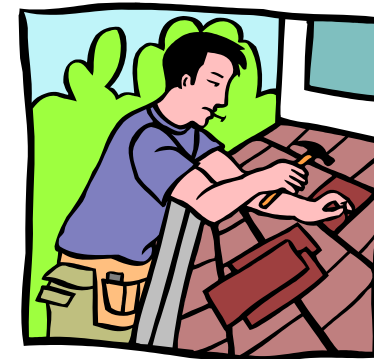


AT THE STATION



ROUTINE PROCEDURES: SITE CHECK

- Upon arriving at monitoring site:
 - Note outside conditions
 - Weather conditions, trees, shelter condition, potential sources, pests, anything abnormal
 - E.g.: construction activity, fires nearby could interfere with measurements or even contaminate instruments and sample lines.





Is there anything here that could be affecting the data?

Some things cannot be seen from the numbers alone

OFF-SITE THINGS TO NOTICE

This is going on less than 0.5 miles upwind from one of my stations







Could anybody
guess why it is
important to
have boots on
the ground for
this
instrument?

ROUTINE PROCEDURES: SITE CHECK

Check for obvious issues:

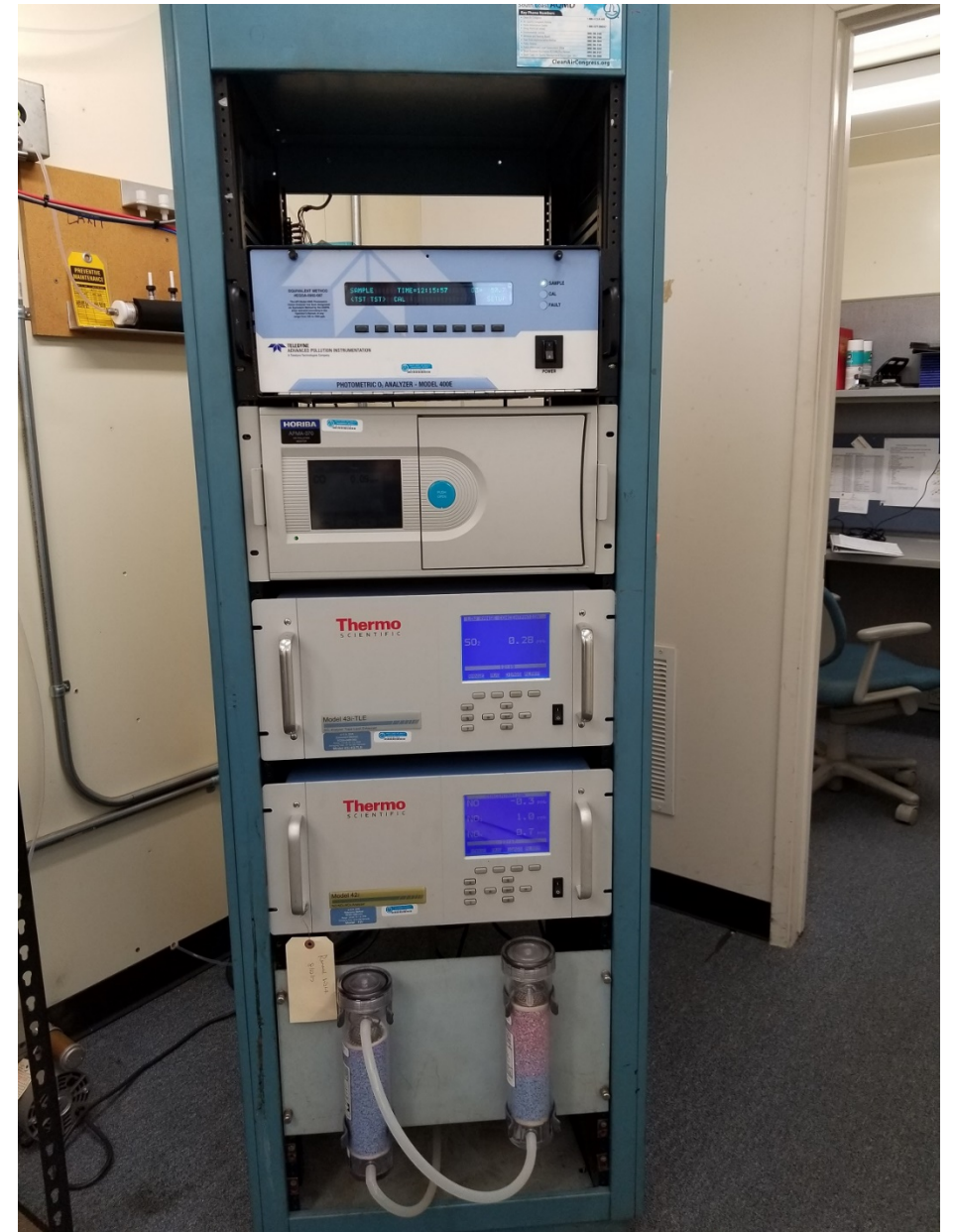
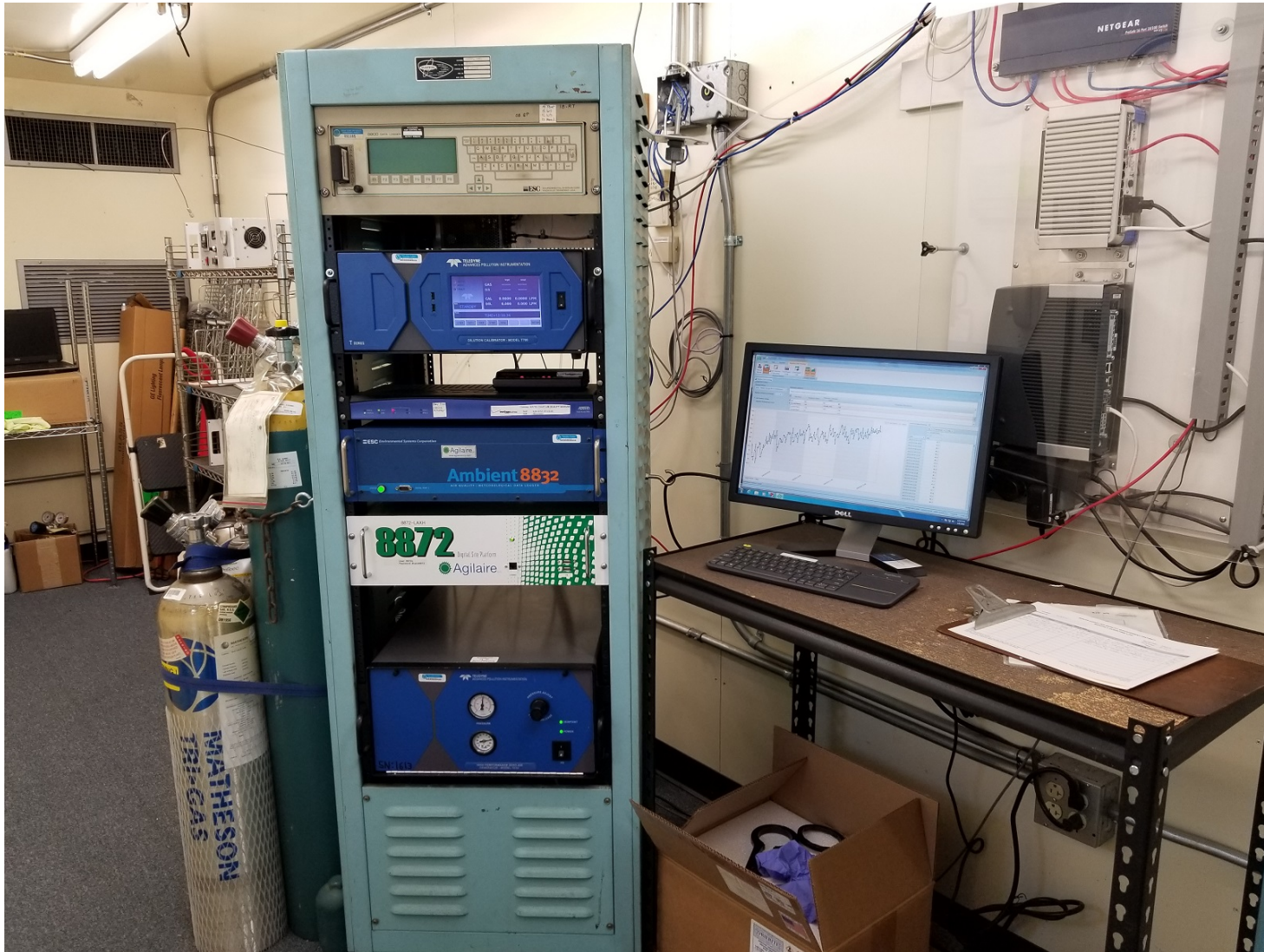
- Instruments and computers in fault conditions/crashed
- Gas lines disconnected, probes damaged
- Damaged meteorological equipment
 - Do instantaneous values in logger match what your eyes see?
- Incorrect clocks and/or timers, ensure actual time is correct

Document!

GAS INSTRUMENTS: PREVENTIVE MAINTENANCE

- Preventive maintenance:
 - Prevents downtime and costly repairs
 - Increases data capture
 - An ongoing element of quality control
 - Incorporate into the daily routine

THE INSTRUMENT RACK



South Coast Air Quality Management District

Monthly Maintenance Report
Thermo 42i NO/NO2/NOX Analyzer

See SOP for Maintenance Sheet Instructions

Location: <u>WSLA</u>	Month & Year: <u>Nov 2018</u>
Station # <u>70091</u>	Technician: <u>R. Lam</u>
Instrument Serial # <u>CM08360045</u>	AQMD Property # <u>0016734</u>

DATE:	<u>11/6</u>	<u>11/13</u>	<u>11/20</u>	<u>11/28</u>	
TIME:	<u>1001</u>	<u>1201</u>	<u>1142</u>	<u>1145</u>	
Change Filter	<u>Y</u>	<u>Y</u>	<u>Y</u>	<u>Y</u>	
PMT Supply (-700 - -1100 V)	<u>-917.6</u>	<u>-916.9</u>	<u>-917.0</u>	<u>-916.1</u>	
Internal Temp (8 - 47°C)	<u>32.8</u>	<u>33.4</u>	<u>31.2</u>	<u>33.4</u>	
Chamber Temp (47 - 51°C)	<u>50.4</u>	<u>50.5</u>	<u>50.1</u>	<u>50.1</u>	
Pressure (50-300mmHg)	<u>274.3</u>	<u>277.9</u>	<u>274.6</u>	<u>275.8</u>	
Sample Flow (0-1.0 Lpm)	<u>0.582</u>	<u>0.589</u>	<u>0.582</u>	<u>0.581</u>	
Ozonator Flow (OK)	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	
Alarm	<u>0</u>	<u>1</u>	<u>0</u>	<u>0</u>	
NO BKG (Zero)	<u>11.1</u>	<u>10.9</u>	<u>11.1</u>	<u>12.6</u>	
NOX BKG (Zero)	<u>11.4</u>	<u>11.1</u>	<u>11.3</u>	<u>14.0</u>	
NO COEF (Span)	<u>1.150</u>	<u>1.150</u>	<u>1.150</u>	<u>1.310</u>	
NO2 COEF (Span)	<u>1.000</u>	<u>1.000</u>	<u>1.000</u>	<u>1.000</u>	
NOX COEF (Span)	<u>1.000</u>	<u>1.000</u>	<u>1.000</u>	<u>1.000</u>	

Monthly: Perform Analog Output Test (± 1% Full Scale)

DATE:	TELEMETRY		CHESSEL	
<u>Digital</u>	ZERO	SPAN	ZERO	SPAN
	NO			
	NOX			

Comments:

11/13/18 : Alarm : Pressure High
11/20 AS-15 NO, cal, adjusted pressure alarm from high of 275 to 285 mmHg

Calibration Date: 7/15/18

Reviewed BY _____

MAINTENANCE SHEETS

*At the South Coast AQMD these tasks are generally carried out by the AQIS II (repair/calibration unit)

COMPONENT	ACTION	WHY	WHEN
Pumps	Rebuild or replace	Wear on diaphragms, vanes, seals, and bearings causes low/unstable vacuum	When test values indicate deviation from acceptable range and /or on a PM schedule. (Check instrument manuals or SOP's for recommended schedule.)
Lamps	Adjust lamp position, drive voltage, and/or detector gain. Or replace.	Output decreases over time	
Optics	Clean and/or replace windows and optical filters	Clouding and pitting causes excessive noise, zero/span drift, low response	
Chemicals & scrubbers	Replace	Due to depletion of reagent or lack of scrubbing effectiveness	
Critical Orifices	Replace orifice and associated O-rings and sintered filters	Critical orifices will occasionally clog up causing reduction in flow, zero/span drift, high or low response	

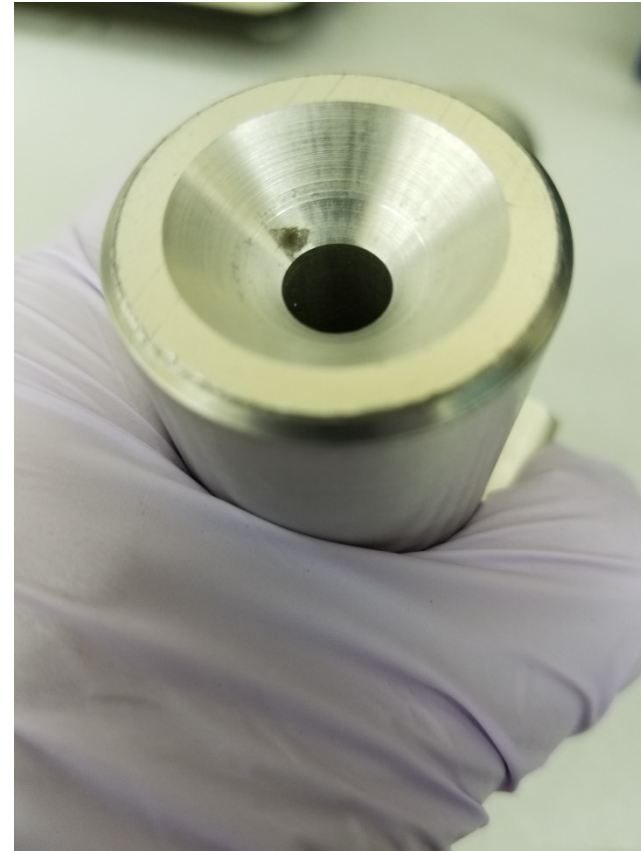
FLOW CHECKS!

- Flow checks once a month on samplers (SSI, TSP, BAM, Partisol 2025i, etc.)
- Leak checks + cleanings on certain instruments bi-monthly (BAM1020)
- These regular flow checks help us maintain a higher data capture rate if we find something is amiss



MAINTAINING SAMPLERS

It's important for an operator to catch these little things because they can have an effect on what actually goes through the cyclone



THE DATA IS ONLY AS GOOD AS THE EQUIPMENT

- Ensure validity of flow checks
- Maintain the integrity of sampling instruments
- Observations from the field to help put irregular data into context

COMMENTS TO GIVE INSIGHT

What if a given sample looks much different than what is typical for a given site?

Lab tech: ???

The people at the lab would have no idea without the operator comments

Science & Technology
 High-Volume Sampler
 Size-Selective Sampler (SS1)

PM₁₀

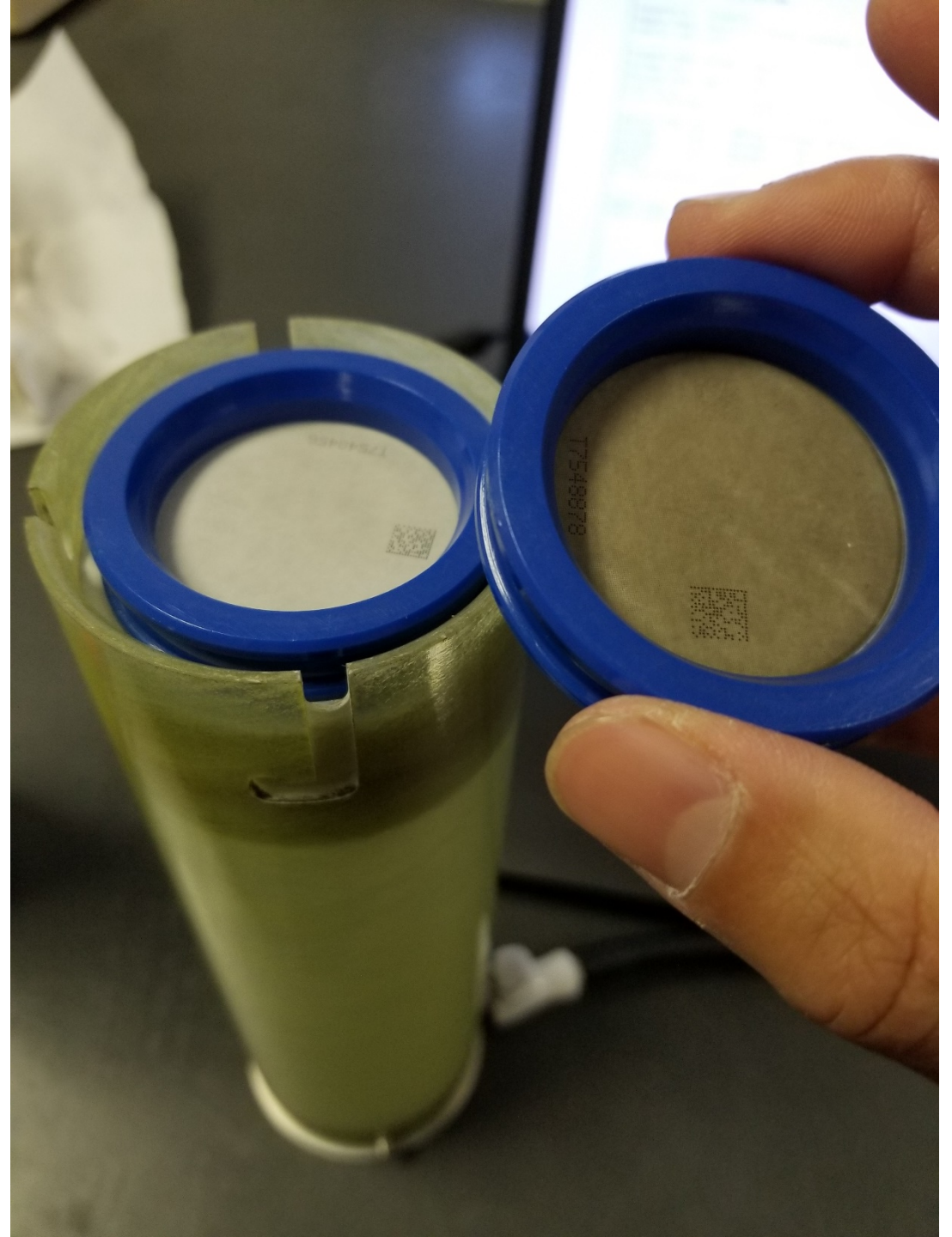
Field Operator Use		Laboratory Use	
Station #	70111	Final Weight (gm)	_____
Location:	LAXH	Tare Weight (gm)	_____
Sampler #	50470	Sample Weight (gm)	_____
Filter #	Q8528387	Total Particulates, ug/M ³	_____
Sample Date:	3/10/19	Sample Receive Date:	_____
Start Time:	00:00	Sample Received By:	_____
Elapse Time:	1438	Sample Weigh Date:	_____
Average Flow:	40.56	Sample Weighed By:	_____
Actual Volume (M ³):	1658.10		
Standard Volume (M ³):	1651.47		
Data QC Check (Explain if Fail)			
Pass <input checked="" type="checkbox"/>		Fail <input type="checkbox"/>	
Removed from Sampler:	3/13/19		
Calibration Date:	10/31/18	Seasonal Setpoint:	41
Station Operator:	R. Lam		
Remarks: Light drizzle during install. Clear & breezy during removal. Large excavation occurring ~0.5 m ² SW of station. Branches found in lower compartment of sampler (non-sampling area) - possibly bird's nest.			

(Indicate Data QC issues & unusual activities including weather, sampling conditions, etc.)

(SSI) Hi-Volume Filter Envelopes 20160728.xl

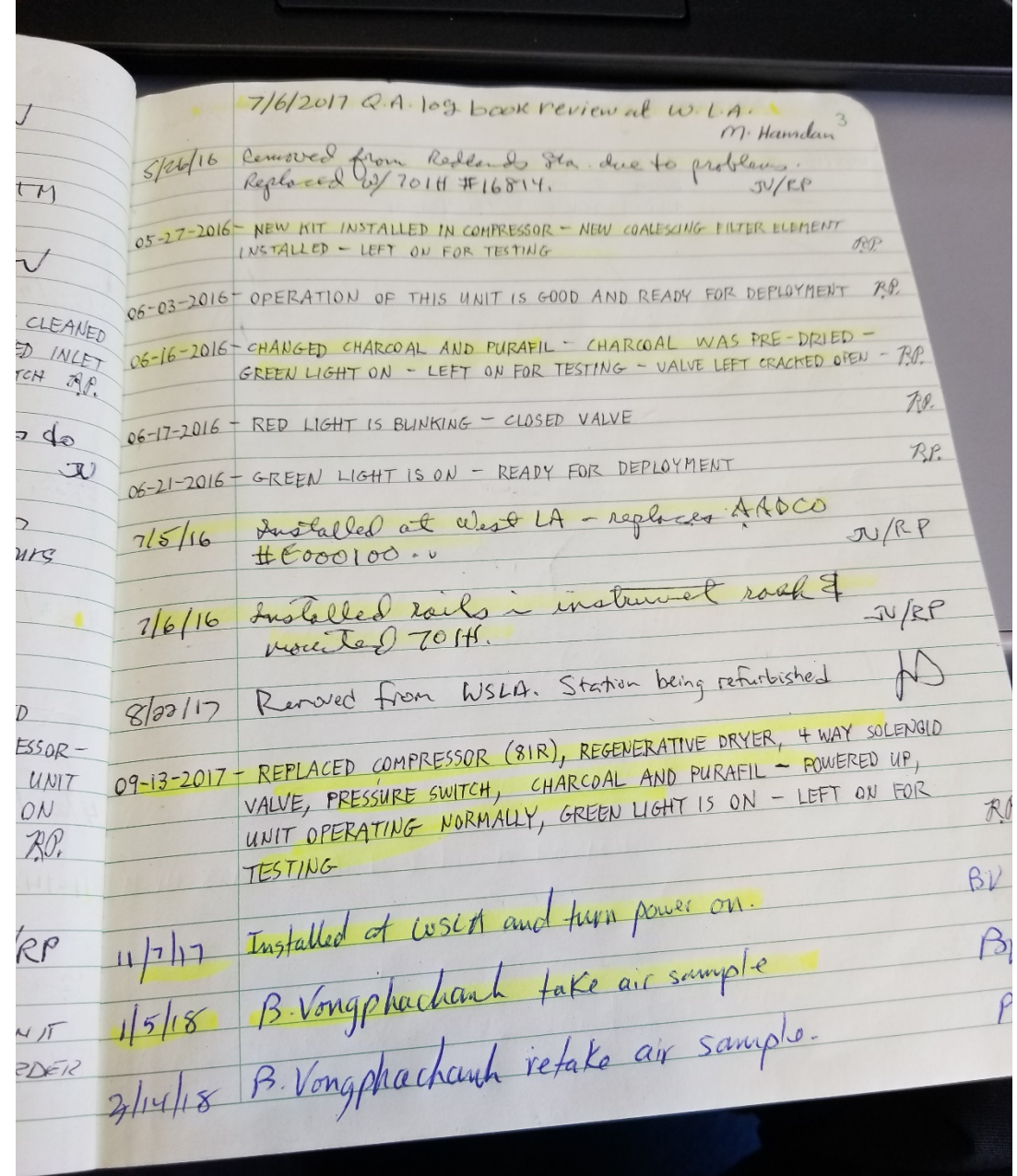
PRETEND YOU ARE THE LAB TECH

1. What would you think if there were no comments on the chain of custody?
2. How would you process these samples if you knew there was a fire going on during one of these sampling days?
3. How would you process these samples if you were told the instrument ran twice as long as the FRM time?
4. The samples are treated differently depending on the observations of the operator
5. Therefore it is important that operators are consistent in their observations and documentation



THE LOGBOOK

- Record notable things in logbook & downtime log (helpful for data review later on)
- Most questions about data happen several months/years after the event has occurred
- Keeps your memory out of your body and recorded onto something that won't get cleared



**SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
MONTHLY DOWNTIME LOG**

Location: LAXH

Month/Year: April 2019

Reviewed by: _____

Technician: R. Cam

Page: 1 of 2

DOWNTIME LOG

VERY important for Level 2 & Level 3 QC to get a feel for what is going on at the station

QC	Pollutant	Event	Date & Time		COMMENTS	Initials
			From	To		
✓	Station	Power Failure	4-2-19 10:32	4-2-19 10:33	42 second power failure recorded on 8832	PC
✓	All Gases	Weekly Maint	4-4-19 0946	4-4-19 1002	Zero Air, change filters, Analog output Test Cleaned manifold catch jar (spiders)	PC
AX	All Gases	Manual Makeup PC	4-5-19 0825	4-5-19 0935	Ran manual make up PCs for O ₃ , NO ₂ , NO _x	PC
✓	701H	Tripped power	4-5-19 4-4-19 ~ 22:00	4-5-19 0825	MFC warning on T700, PCs bad overnight. Arrived @ station to find 701H powered off. Reset 701H power	PC
QC II	T700	High Pressure MFC	4-6-19	4-9-19	MFC Press Warning; NO _x PCs bad from 4-6-19 → 4-9-19	PC
AX	All Gases	Manual Makeup PC	4-9-19 0937	4-9-19 1028	Ran manual PC for NO _x & NO ₂ & relocated 701H outlet	PC
✓	All Gases	Weekly Maint	4-9-19 1028	4-9-19 1054	Zero Air, change filters; Replaced 1 Diaphragm	PC
✓	Station	Strong smell	4-12-19 0934	4-12-19 1030	Strong smell of asphalt/paving - winds coming from SW of station. Excavation ongoing.	PC
✓	All Gases	Weekly Maint	4-18-19 0848	4-18-19 0902	Zero Air; Change Filters	PC
✓	All Gases	Weekly Maint	4-24-19 0846	4-24-19 0859	Zero Air; Change Filters	PC
AT	All Gas	Calibration Repair	4/26/19 7:46	4/26/19 12:17	Replaced Bad Pump + CO AS-FS Cal,	JH
"	↓	↓	↓		Adjusted Output Analog Zero & Span	JH

QC: For Data Validation use only

Date and Time: The time the event began or data became suspect.

Pollutant: All Gas, O₃, CO, NO₂, SO₂, H₂S, NO_y, BAM, TEOM, TSP, SSI, PM_{2.5}, SASS or Meteorological

Comments: Please note thoroughly, specific data related to event and the resolution

Event: Maintenance, Calibration, Repair, Instrument Failure or Lost Sample

Version 3.0

ROUTINE PROCEDURES: GOING OFF LINE

Maintenance/Repairs/Calibrations/Audits

- **Document** periods when instruments are offline
- **You can be off-line for up to 15 minutes per hour without “losing” the hour**
 - If possible, minimize periods of lost data by going offline in the last 15 minutes of the hour and going back online before the 15 minutes past the hour
- Take the respective channel(s) offline at the data logger

STATION RECORDS

Air monitoring station site documentation includes:

- Instrument logs
- Instrument manuals
- Instrument QC check sheets
- Station log book(s)
- Instrument calibration reports
- SOPs
- Technical bulletins
- AQS (AMP390) / ARB Site reports

All should be **on-site** and available to auditors!



Documentation!

A DAY IN THE LIFE OF THE OPERATOR

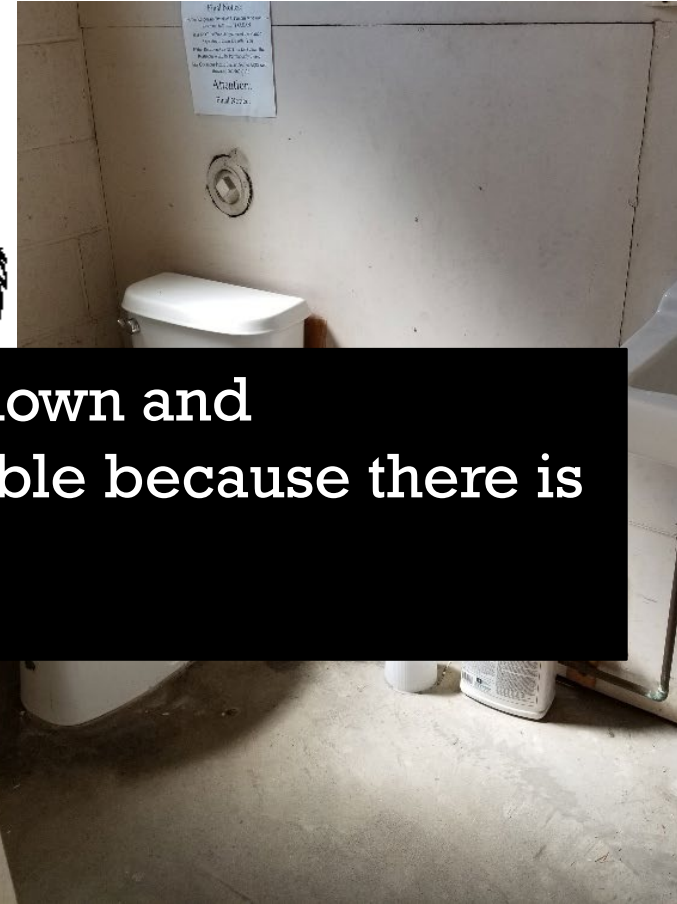
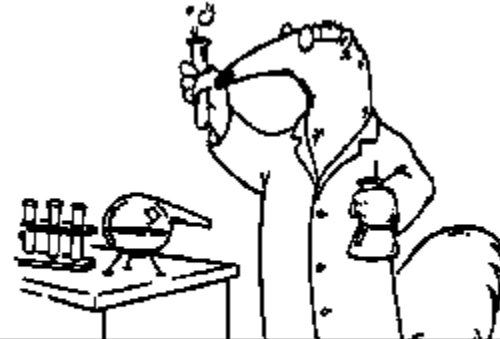
Work in the office:

- Level 1 QC Review
- Monitor data trends/abnormalities
- Check-ups instrument health

Work in the field:

- Gas instrument maintenance
- Sample collection & maintenance
- Site Checks (everything ok? Siting criteria being met? Safety? Special events?)
- Flow Checks (Once/month to ensure validity of data)
- Maintenance (Cleanings, preventive maintenance, repairs, etc.)

STATION OPERATORS WEAR MANY HATS



It is important to expect the unexpected. Systems go down and instruments fail that require fixing. We have to be flexible because there is no fixed schedule



Sometimes we fight fires, and sometimes we clean toilets. Sometimes we vacuum and garden

SUMMARY

- In general, what is the purpose of a station operator?
- What are some important things to notice as a station operator?
- What are the primary duties of the station operator?
- What is in jeopardy if the station operator does not notice the details?
- The data may not reflect reality and the end user would find out after it's too late (if at all)

QUESTIONS / COMMENTS?

Randy Lam

AQIS I

South Coast AQMD

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