

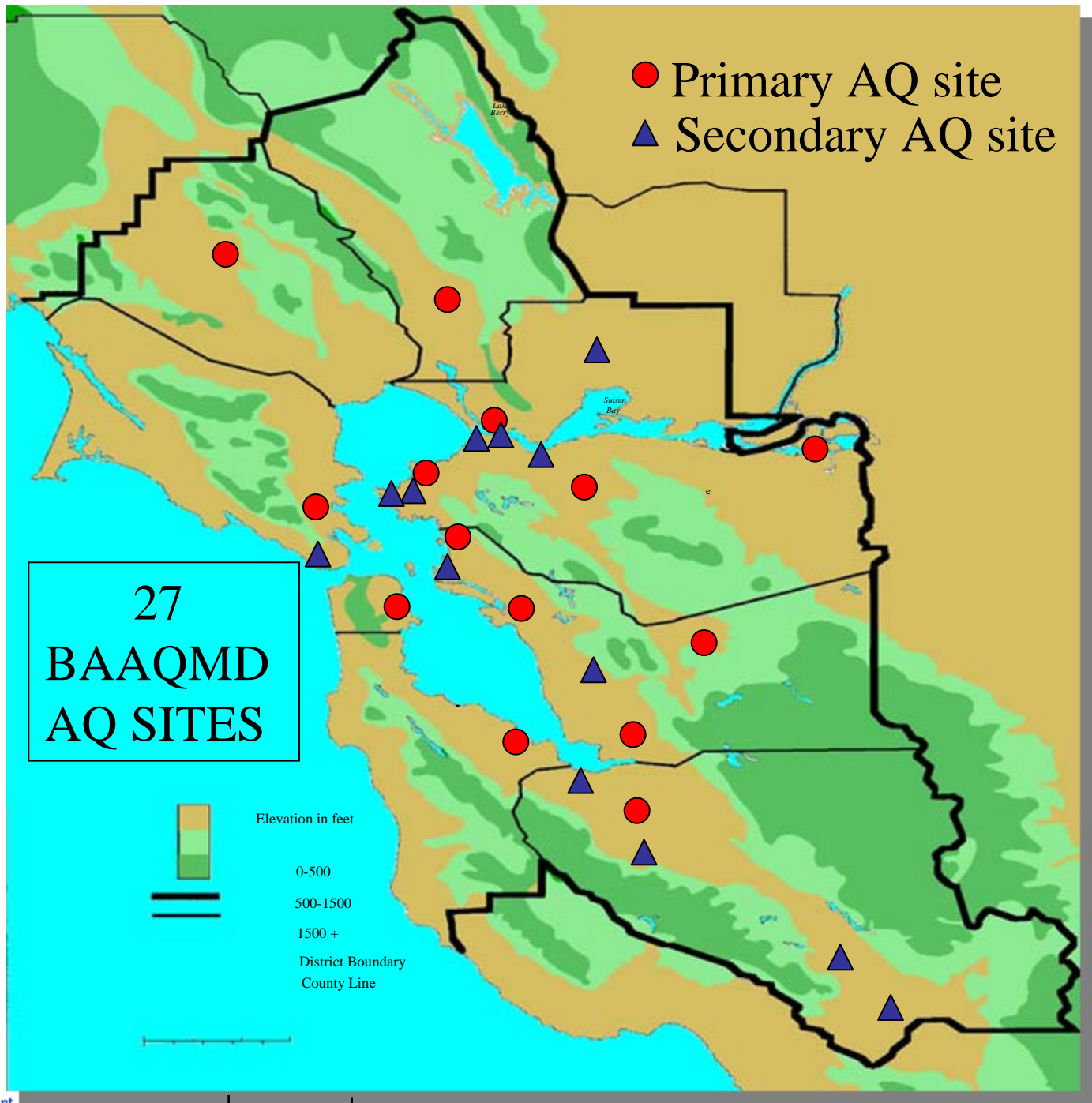
Data Validation & Analysis Performed by BAAQMD

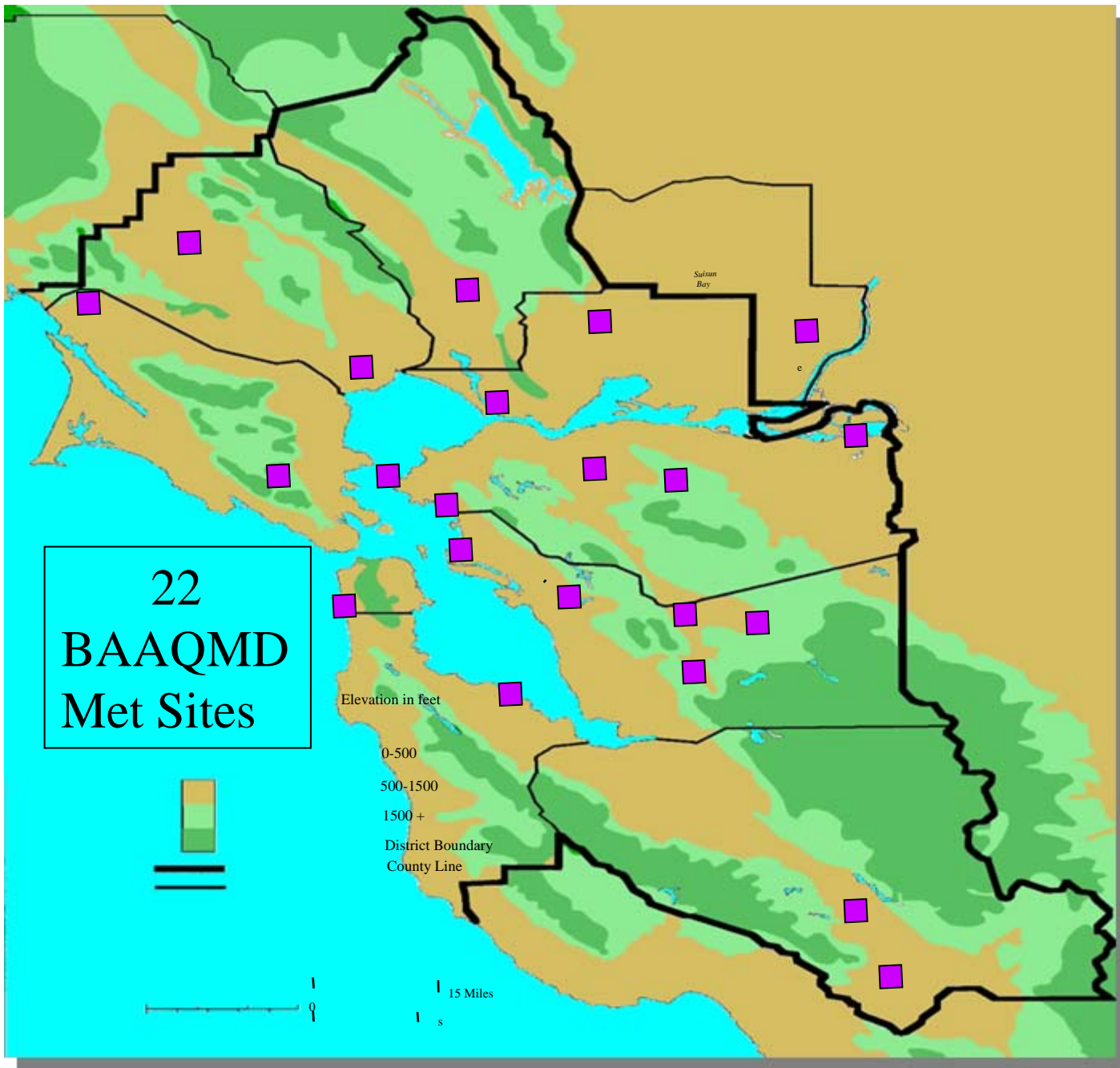
Prepared by: Dick Duker
Bay Area Air Quality Management District
San Francisco, CA

Presented at:
2009 National Ambient Air Monitoring Conference
Nashville, TN
November 2-5, 2009

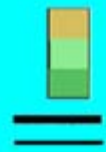
Definition of Level I and Level II

- Level I validation consists of reviewing and editing data for accuracy, completeness and internal consistency.
- After Level I is completed, Level II can be begun.
- Level II review is comparing data for consistency against other independent data sets (e.g., between instruments, between stations, with meteorological data).





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BAAQMD
Met Sites



Elevation in feet

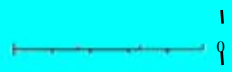
0-500

500-1500

1500 +

District Boundary

County Line

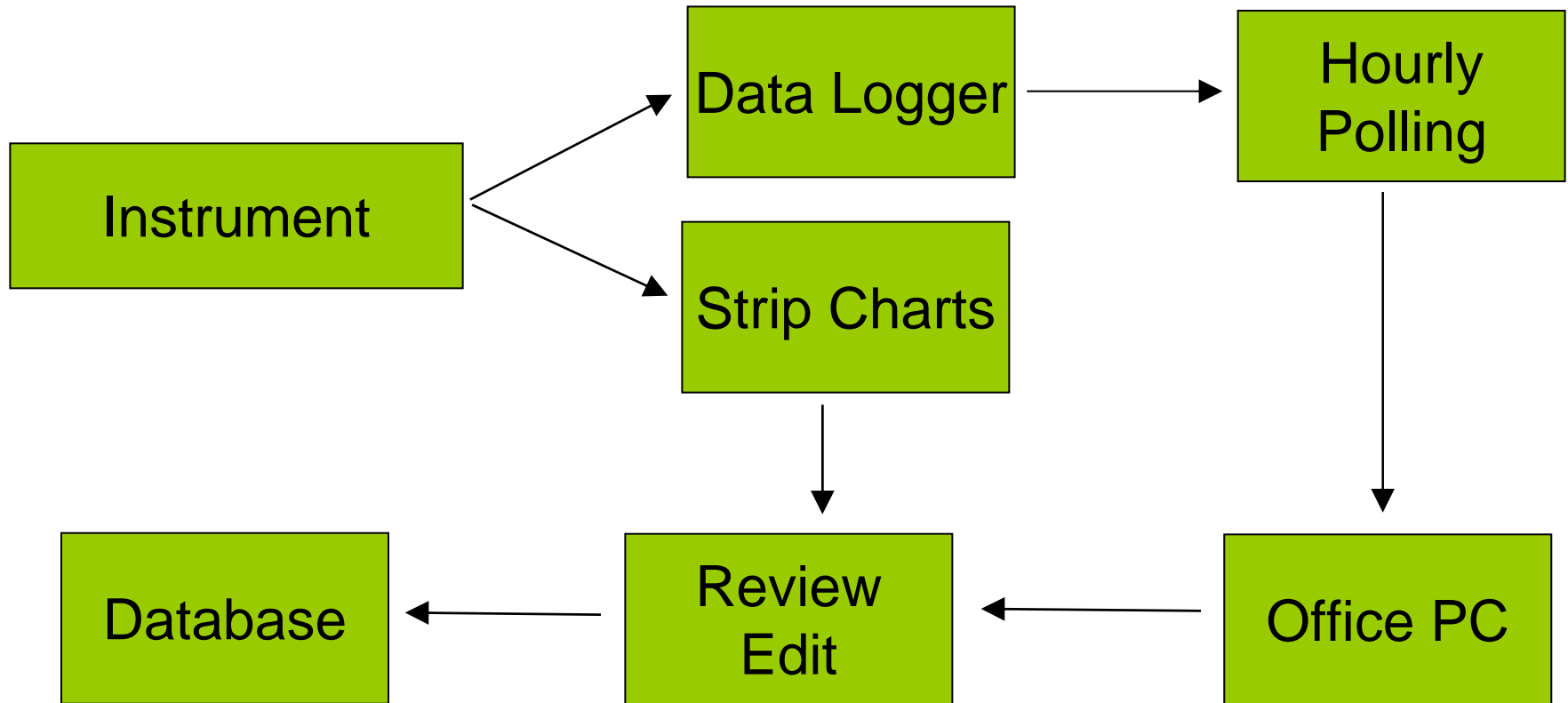


15 Miles

Types of Data to be Validated

- Continuous instruments
- Particulate filters (both PM2.5 & PM10)
- Toxics
- Meteorological

Continuous Instruments



Level I

Continuous Instruments

Station Operators

- Notes problems with the instrument that would invalidate the data.
- Checks that zero, span, and precision values are within 5% of true. If outside of $\pm 5\%$ then notes data to be invalidated.
- Checks that zero, span, and precision values on strip charts match data on summary sheets.

Example of ESC Summary Report

DAILY SUMMARY						
	10/23/09	00:00	DAY= 296	7032SJS		
CHANNEL:	03	04	05	06	07	08
NAME:	O3	CO	NO	NO2	TEMP	NMHC
UNITS:	PPB	PPTM	PPB	PPB	DEGC	PPHM
VOLTS FS:	10.00	10.00	10.00	10.00	1.000	10.00
SLOPE:	500.0	100.0	1000.	500.0	50.00	200.0
INTERCEPT:	.0000	.0000	.0000	.0000	.0000	.0000

10/23 00:00	-1.	8.7	51.	20.	27.	34.
10/23 01:00	-1.	4.5B>	26.	18.	27.	22.
10/23 02:00	-1.C>	4.5B>	15.C>	20.C>	27.C	19.
10/23 03:00	0.C<	.0B<	0.C<	0.C<	0.C	0.C
10/23 04:00	-1.C>	7.6C>	56.C>	17.C	26.C	34.
10/23 05:00	-1.	8.3B>	89.	18.	26.	41.
10/23 06:00	-1.	15.4	138.	20.	25.	55.
10/23 07:00	-1.C>	18.6C>	170.C>	27.C>	25.C	58.C>
10/23 08:00	2.C>	8.5C>	68.C>	31.C	26.	24.
10/23 09:00	9.	4.8B>	30.	28.	25.	18.
10/23 10:00	14.	4.7	15.	26.	26.	14.
10/23 11:00	14.	5.1	20.	32.	28.	16.
10/23 12:00	25.	3.2	7.	19.	29.	9.
10/23 13:00	31.	2.3B>	4.	13.	29.	5.
10/23 14:00	34.	2.4	2.	10.	26.	3.
10/23 15:00	35.	2.6	2.	11.	27.	4.
10/23 16:00	25.	3.2	2.	17.	29.	6.
10/23 17:00	7.	4.3B>	5.	31.	29.	11.
10/23 18:00	1.	5.6	12.	36.	29.	15.
10/23 19:00	-1.	8.0	29.	34.	29.	23.
10/23 20:00	-1.	7.6	29.	31.	29.	24.
10/23 21:00	-1.	6.2B>	32.	30.	29.	24.
10/23 22:00	0.	6.1	19.	27.	29.	18.
10/23 23:00	11.	2.3	1.	10.	29.	4.

CHANNEL:						
	09	10	12	13	15	16
NAME:	CH4	BAM	SO2	AETH	910A	PM10
UNITS:	PPHM	UG/M3	PPB	UNG/M	CC/M	"H2O
VOLTS FS:	10.00	10.00	10.00	5.000	5.000	5.000
SLOPE:	1000.	1000.	100.0	20.00	100.0	100.0
INTERCEPT:	.0000	-5.000	.0000	.0000	.0000	.0000

10/23 00:00	273.	8.	.4	4.3	.0-<	2.2
10/23 01:00	259.	7.	.2	2.9	.0-<	.1
10/23 02:00	244.C>	8.	.1C>	2.7	.0-<	.1
10/23 03:00	0.C<	9.	.0C<	3.3	.0-<	.1
10/23 04:00	277.C>	8.	3.9C<	4.5	.0-<	.1
10/23 05:00	289.	10.	1.6	7.3	.0-<	.1
10/23 06:00	298.	11.	1.5	10.4	.0-<	.1
10/23 07:00	283.C>	18.	2.0C>	13.4	.0-<	.1
10/23 08:00	233.C>	18.	1.2C>	7.5	.0-<	.1
10/23 09:00	217.	17.	.7	5.8	.0-<	.1
10/23 10:00	208.	11.	.7	5.0-<	.0-<	.1
10/23 11:00	208.	22.	.9	7.2	.0-<	.1
10/23 12:00	210.	15.	.5	3.7	.0-<	1.7
10/23 13:00	203.	5.	.4	2.0	.0-<	.1
10/23 14:00	197.	6.	.3	1.9	.0-<	.1
10/23 15:00	197.	15.	.3	2.7	.0-<	.1
10/23 16:00	198.	10.	.4	2.1	.0-<	.1
10/23 17:00	204.	12.	1.0	3.6	.0-<	.1
10/23 18:00	206.	26.	.9	4.5	.0-<	.1
10/23 19:00	217.	15.	.7	4.7	.0-<	.1
10/23 20:00	230.	7.	.6	3.7	.0-<	.1
10/23 21:00	229.	16.	.5	3.6	.0-<	.1
10/23 22:00	222.	12.	.4	3.9	.0-<	.1
10/23 23:00	201.	11.	.1	1.0	.0-<	.1

Level I

Continuous Instruments

Station Operators - Continued

- Reviews summary sheets.
 - Notes as invalid data with disabled flag.
 - Notes as invalid data with calibration flag.
 - Notes as invalid data with power failure flag.
 - Notes as invalid data with less than 75% of hour.
 - Notes as invalid data when shelter temperatures are not within 20° - 30°C).

Level I Continuous Data

Air Monitoring Supervisors

- Reviews all strip charts and summary sheets before sending to District Office.

Data Technician

- Makes corrections to data files after reviewing field notes on strip charts and summary sheets.

Level I Continuous Data

Data Analysts

- Daily review by Forecasters.
 - As users, they verify data completeness everyday using Gate1. Repoll as needed.
 - Review accuracy of data on daily basis as a check on their forecasts.



Bay Area Air Quality Management District

[Spare the Air](#)[Air Quality](#)[Meteorology](#)[Contact Us](#)**Data Display System**

October	▼	2009	▼			
S	M	T	W	T	F	S
27	28	29	30	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31
1	2	3	4	5	6	7

Measurement:

Ozone ▼

2009: Daily (Exceedances)

Station	State: 1Hr
Bethel Island	2
Concord	2
Fairfield	2
Fremont	4
Gilroy	1
Hayward	4
Livermore	8
Los Gatos	3
Napa	1
San Martin	4
Vallejo	2
District	33

[New AQ Data Beta Page Preview](#)**Daily**[Monthly](#)[Annual](#)**Air Quality****Ozone:** units: ppb ▼

Hourly Average Values and 24-hour changes

Raw data: Unchecked data that may contain errors

Tuesday, October 20, 2009, Ending Hour (PST)

Daily Max*

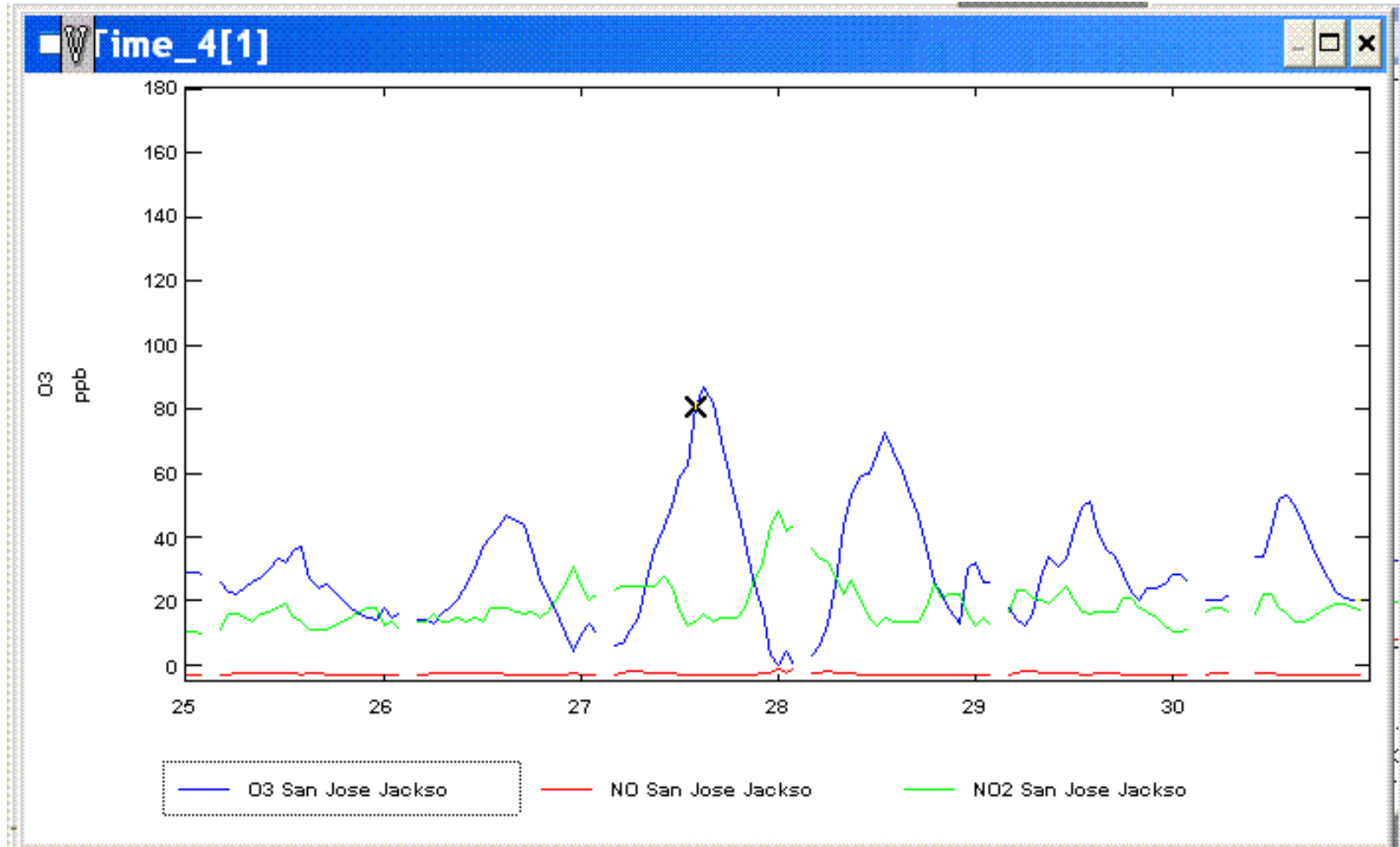
Station:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	1Hr	8Hr	
North Counties:																											
Napa	3	3	3	4	2	2	4	7	10	15	20	22	28	30	26	21	19	17	13	13	11	6	4		30	22	
San Rafael	-21	-19	-12	+0	+0	-1	-7	-10	-12	-6	+2	+6	+4	+5	+7	+3	+9	+11	+7	+10	+7	+2	+1		23	22	
Santa Rosa	0	2	2	0	3	5	7	10	11	14	17	16	21	23	22	21	23	22	21	23	15	11	8				
Vallejo	-19	-12	-16	-29	-24	-18	-10	-3	-9	-11	-7	+2	+4	+4	+2	+6	+17	+18	+18	+21	+14	+8	+7				
Bethel Island	4	9	9	9	4	2	5	10	12	14	18	19	22	22	19	13	14	14	14	11	16	15	12		22	17	
Concord	-1	+5	+3	-1	-6	-11	-15	-6	-6	-8	-7	-6	-1	-4	-7	-10	-1	+11	+12	+10	+12	+14					
Fairfield	1	1	1	2	1	1	4	9	16	16	18	22	26	30			23	14	21	18	19	19	17	17	30	22	
Fremont	-33	-31	-29	-25	-26	-22	-10	-14	-2	-5			+2	+5	+5		+6	+2	+10	+8	+8	+17	+16	+16			
Gilroy																											
Hayward																											
Livermore																											
Los Gatos																											
Napa																											
San Martin																											
Vallejo																											
District																											
Coast & Central Bay:																											
Berkeley	7	13	14	10	2	2	7	9	15	15	19	24	20	22	19	17	19	16	8	1	0	9	14		24	19	
Oakland	-24	-13	-14	-7	-12	-4	+3	-1	+3	-3	-4	+6	+4	+0	-5	-9	+7		+7	+0	-1	+8	+13				
San Francisco	2	14	7	10	1	0	1	10	9	8	16	19	21	24	20	17	12	6	1	9	12	16	23		24	17	
San Francisco	-31	-16	-23	-1	-1	-3	+0	-7	-15	-9	-10	-9	-2	+6	+4	+5	+5	-3	+8	+11	+15	+22					
Berkeley	4	7	13	10	6	6	11	14	16	21	27	30	27	22	22	22	21	19	20	24	25	19	17		30	24	
San Francisco	-28	-27	-20	-10	-7	-13	-8	-4	-1	-5	-5	-1	-4	-2	+1	+4	+14	+16	+17	+21	+23	+18	+15				
Eastern District:																											
Bethel Island	17	19	20	23	20	22	12	17	22	24	27	29	32	35	36	31	27	20	17	13	14	10	10		36	30	
Bethel Island	-11	-12	-6	-1	-1	-3	-14	-12	-5	+2	+3	+2	+3	+10	+7	+2	+0	+3	+2	-1	-3	-6	-9				
Concord	23	21	14	1	1	1	4	11	18	21	25	28	30	32	32	31	24	16	11	8	9	2	3		32	27	
Concord	-10	-11	-19	-31	-29	-27	-24	-19	-10	-8	-3	+1	+10	+10	+8	+9	+15	+14	+10	+0	-5	-11	-11				
Fairfield	2	8	10	1	1	2	5	13	18	18	22	25	27	31	31	28	25	20	19	19	18	19	19		31	26	
Fairfield	-29	-22	-18	-23	-16	-19	-19	-12	-9	-9	-3	+1	+10	+8	+6	+5	+12	+12	+7	+9	+16	+18	+18				
Livermore	2	0	4	20	14	2	2	10	17	22	26	30	27	29	30	27	19	13	6	0	0	7	6		30	26	
Livermore	-30	-32	-28	-14	-20	-24	-19	-15	-12	-8	-6	-8			+4	+1	+9	+4	+3	-4	-1	+4	+0				
South Central Bay:																											
Fremont	4	5	6	12	13	9	10	20	25	22	20	24	25	29	31	26	18	16	16	20	21	22	24		31	25	
Fremont	-26	-16	-1	+9	+1	+1	+7	+6	-4	-9	-5	-0	+3	+3	+0		-2	+1	+12	+18	+20	+21	+20				
Fremont	20	23	27	22	26	24	24	27	21	17	14	22	27	30	28	22	16	11	12	11	14	21	25				

Level II Continuous Instruments

Data Analyst

- Loads data into Voyager, and checks:
 - Corrections have been made.
 - Consistency with season and time of day.
 - Pollutants rise and fall in sync.
 - Outliers and constant values.
 - Blocks of missing data.
- When questions or outliers occur, reviews strip charts and summary sheets for Operator notations, and checks meteorological data.

Voyager File From San Jose



Level I – PM Filters

Field Operator fills in COC form

- Notes problems – instrument malfunction, damaged filters, maintenance, filter leakage.
- Notes exceptional events – nearby construction, roadwork, roofing, forest fires, dust storms.

Level I – PM Filters

Lab Analyst fills in COC form

- Checks accuracy of balance.
- Notes if filters are missing.
- Notes filter damage, contamination, or no dust loading on filter.
- Notes if filter used after 30-day expiration date, or weighed after 30 days from sampling date.

Level I – PM Filters

Data Analyst

- Re-checks data for missed runs.
- Invalidates samples if analyzed >30 days after sampling, or if sample run time is <23 hrs (except on exceedance days), or if sample start time is outside of 23:00 – 01:00.

Level II – PM Filters

Data Analyst

- Compares values at collocated sites (both FRM and BAM), and compares amongst all sites on run days.
- Checks consistency with season – high in winter, low in summer. For outliers, checks meteorology and for forest fires.
- Reviews COCs for samples with null codes, qualifiers or suspiciously high or low values.

Level I - Toxics

Field Operator fills in COC form

- Problems – instrument malfunction, damaged filters, maintenance, filter leakage.
- Exceptional events – nearby construction, roadwork, roofing, forest fires, dust storms.

Level I - Toxics

Lab Analyst fills in COC form

- Staff tests accuracy of GC/MS.
- Lab Manager reviews Galaxie files for completeness, consistency among pollutants.
- Lab Manager compares among sites for the same day (Level II review).

Level I - Toxics

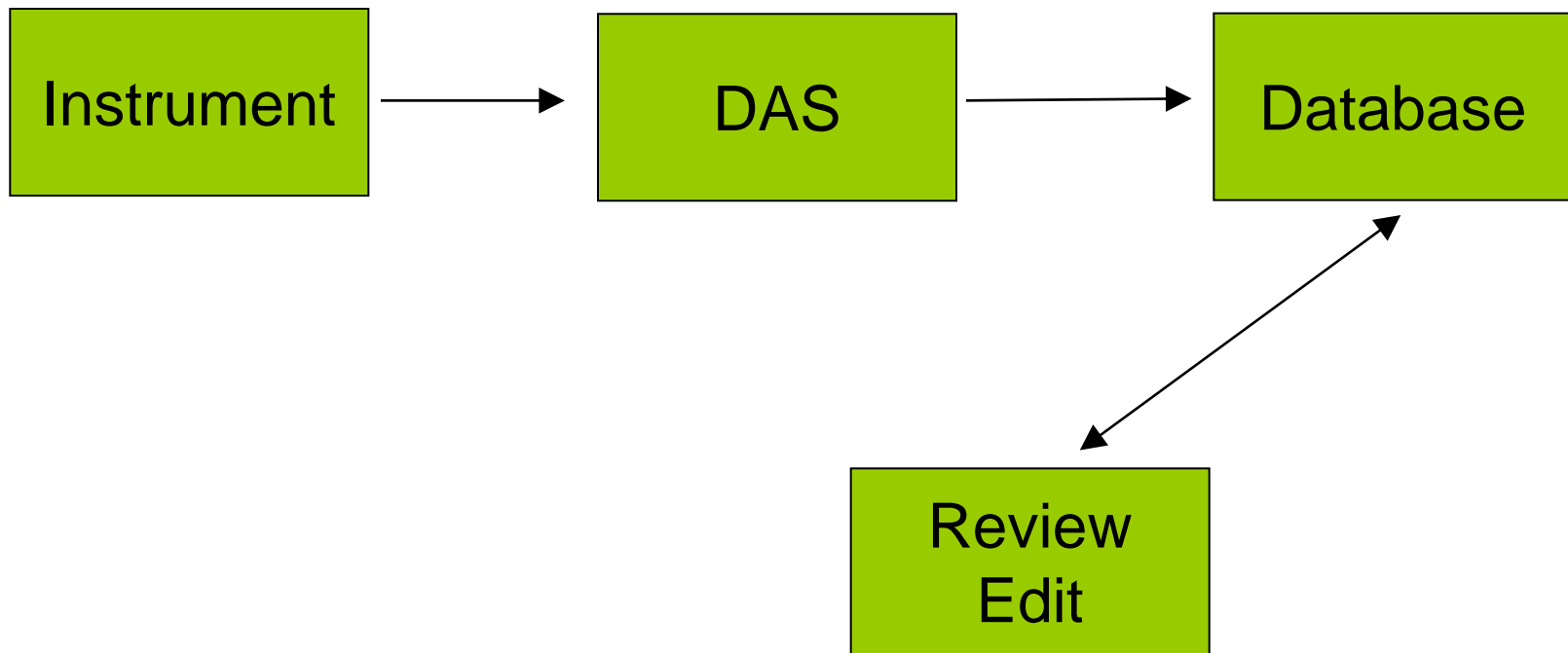
Data Analyst

- Checks COC sheets. Invalidates data if run times outside of 23-25 hrs, or start time outside of 23-01 hrs, or canister pressure is < 2 psi.
- If COC sheet indicates an exceptional event or a qualifier, then looks at individual values for day.

Level II - Toxics

- Compares values between sites.
- Prints out AQS Scan Report and reviews with Lab Manager.
- Runs AMP430 Report quarterly to confirm completeness.

Data Flow with DMS



Advantages of DMS

- All data, data flags, qualifiers, log books, comments will be in one place. No paper strip charts.
- Data are invalidated, not deleted.
- Metadata is available realtime.
- 1-min data averaged to 1-hr data in database.
- Data is reviewed, corrected, and documented in the database.
- Better plots – ie. multiple sites on same plot.

Summary of Data Validation

- Current system meets the requirements of Level I and Level II data validation.
- Current procedures are inefficient and fragmented using multiple data bases and obsolete software.
- New DMS database will give us powerful review and editing tools to use within the database.
- All data and documentation will be contained within a single database.

Contact Information

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