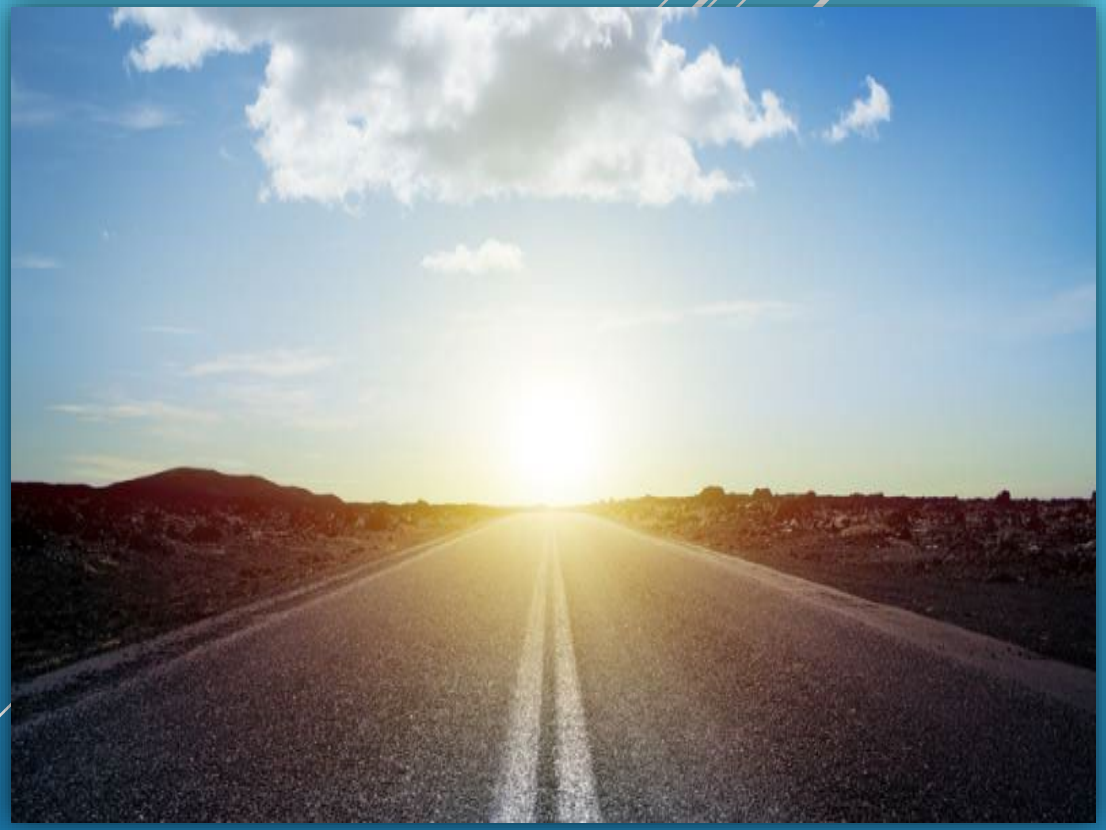
CONTINUOUS PM2.5

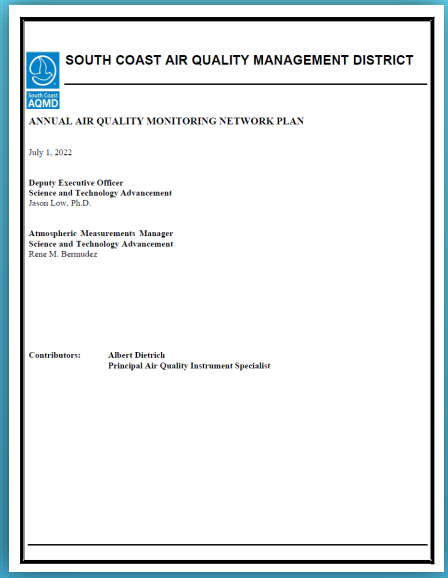
Road to Transition



Rene Bermudez
Atmospheric Measurements Manager
South Coast AQMD

OVERVIEW

- Monitoring Network Background
- Monitor Performance
- Monitor Comparisons
- Continuous FEM Waivers
- NAAQS Comparisons
- FRM vs FEM Differences
- Final Thoughts



SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

ANNUAL AIR QUALITY MONITORING NETWORK PLAN

July 1, 2022

Deputy Executive Officer
Science and Technology Advancement
Jason Low, Ph.D.

Atmospheric Measurements Manager
Science and Technology Advancement
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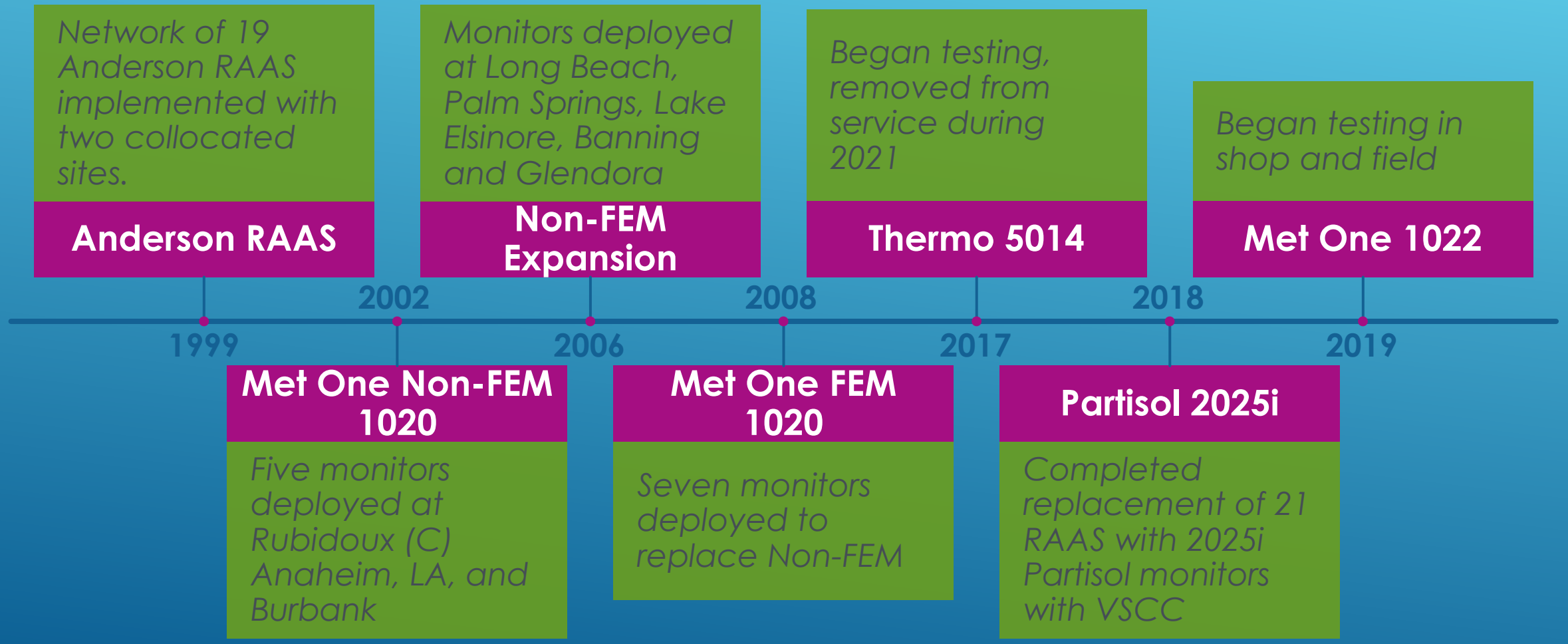
Contributors: Albert Dietrich
Principal Air Quality Instrument Specialist

MONITORING NETWORK BACKGROUND FRM VS FEM

- Total of 27 PM2.5 monitoring sites
- Eight collocated FRM/FEM with more than 3 years data
- Four SPM FEM with less than 3 years data or no daily FRM

MONITORING NETWORK BACKGROUND

PM2.5 Implementation



MONITOR PERFORMANCE

FRM

- RAAS Sequential –worked great!(19 years)
  - The beast we knew!
- Partisol 2025i – Better performance than RAAS

FEM

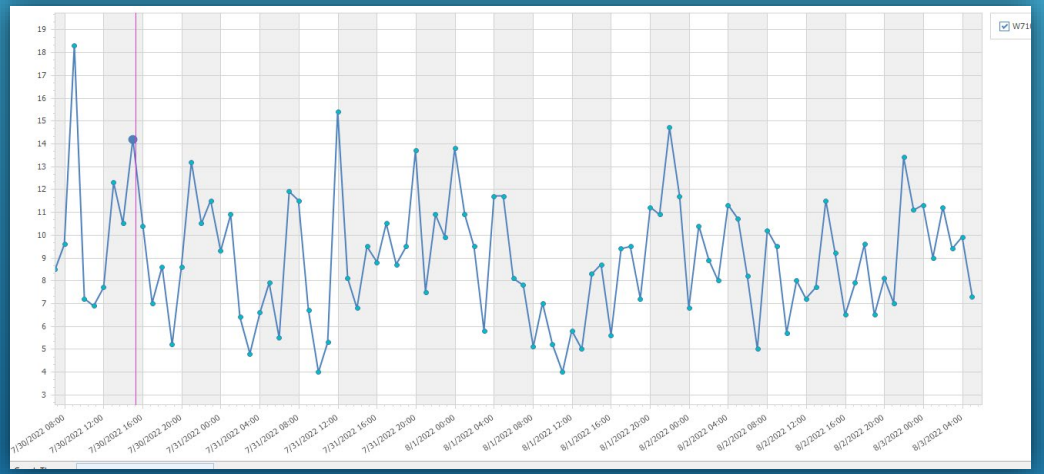
- 1020 – Non-FEM monitors worked well for AQI purposes
- 1020 FEM
  - Second Generation have high completeness
  - Appear to be more stable, less noisy
  - History of failing FRM vs FEM comparison
- 5014 – Utilized for approximately four years. Instruments have been unreliable, and maintenance intensive, Thermo Scientific unable to repair Issues, Hourly data was noisy.

RAAS	2017	95.9%
Partisol	2021	97.2%
FEM	2021	95.6%
Non-FEM	2021	96.8%

MONITOR PERFORMANCE

Met One FEM

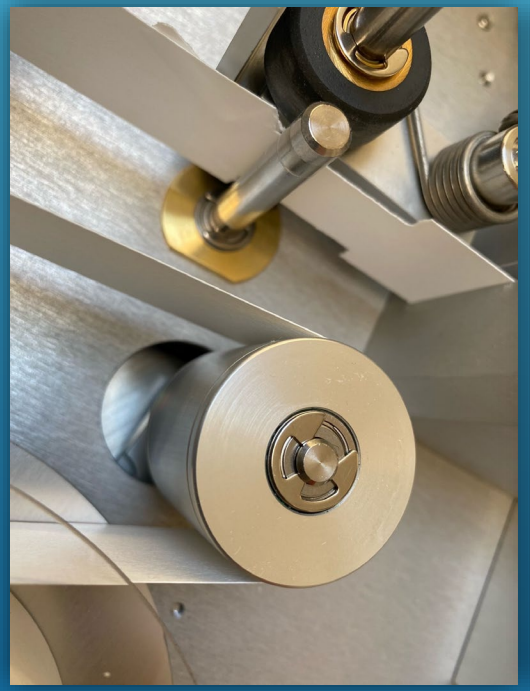
- Working with Met One on Third Generation 1020 FEM (eight)
  - All eight passed zero test in shop, failed in field
  - Installation procedures may have contributed to initial failures in field
  - Required disassembly and cleaning to pass zero test. Out of four deployed one may need to be sent back to factory
  - Would not pass zero test using ambient air, only station air

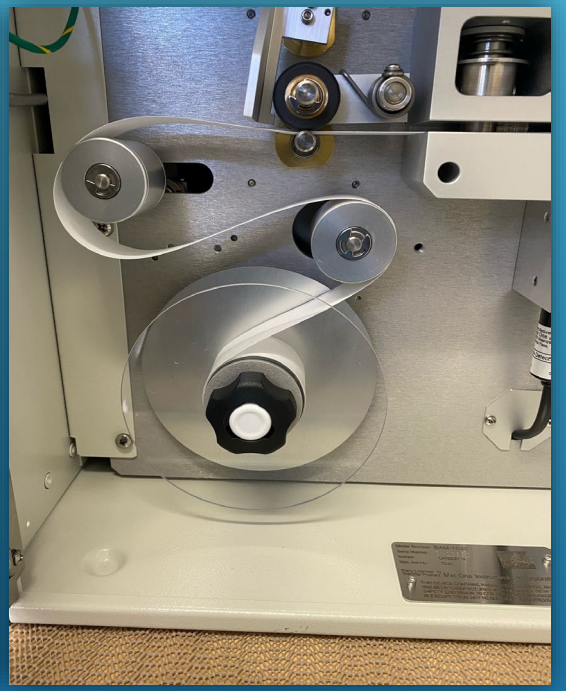


MONITOR PERFORMANCE

Working with Met One on Third Generation 1020 FEM (eight)

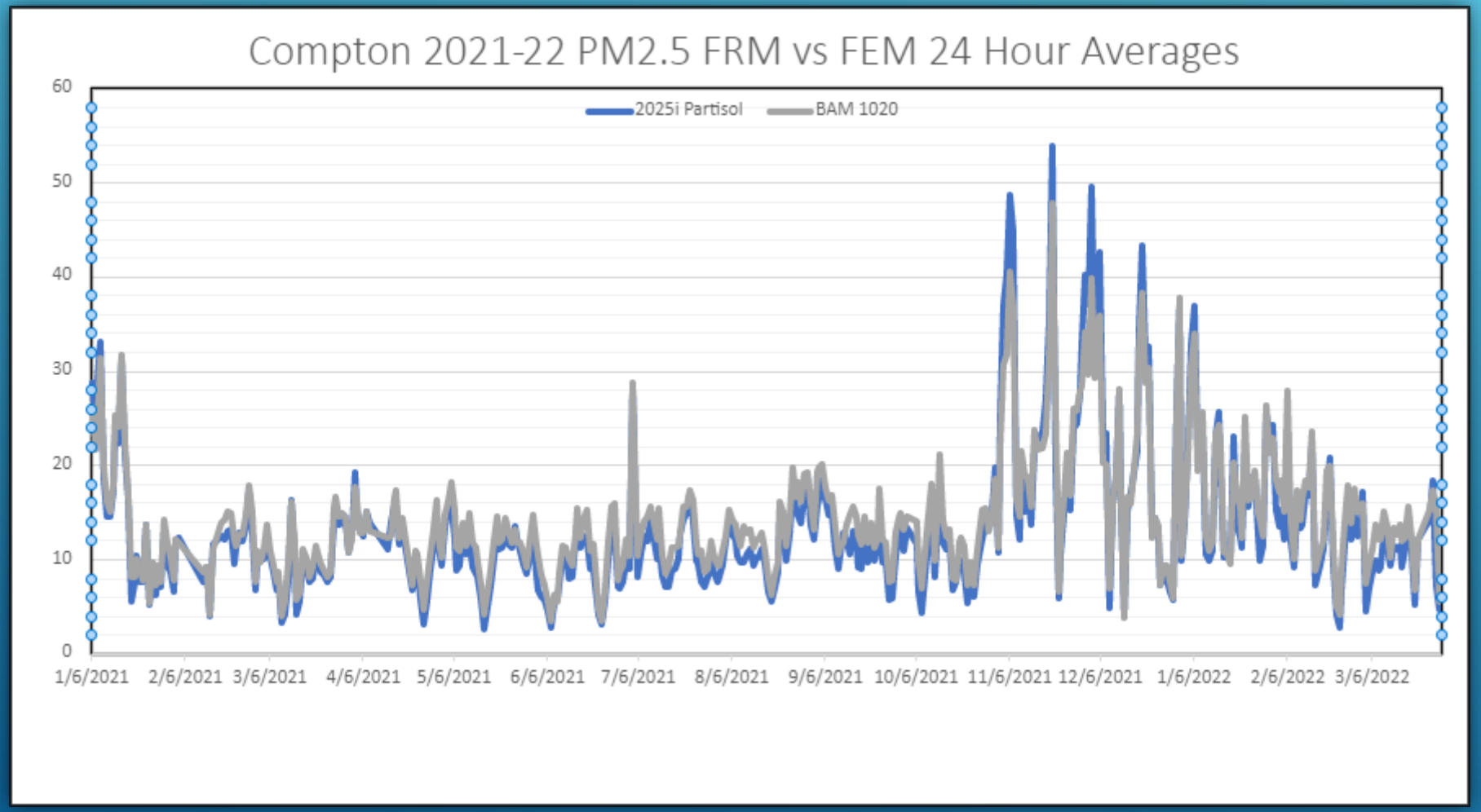
- Dirty nozzles due to improperly assembled take up reel assembly leading to tape misalignment
- Zero test affected by a high background value when received from factory
- New pinch rollers build up tape debris quickly and must be cleaned frequently
- Deformed washer on nozzle assembly
- Communication issues required work-arounds to function properly





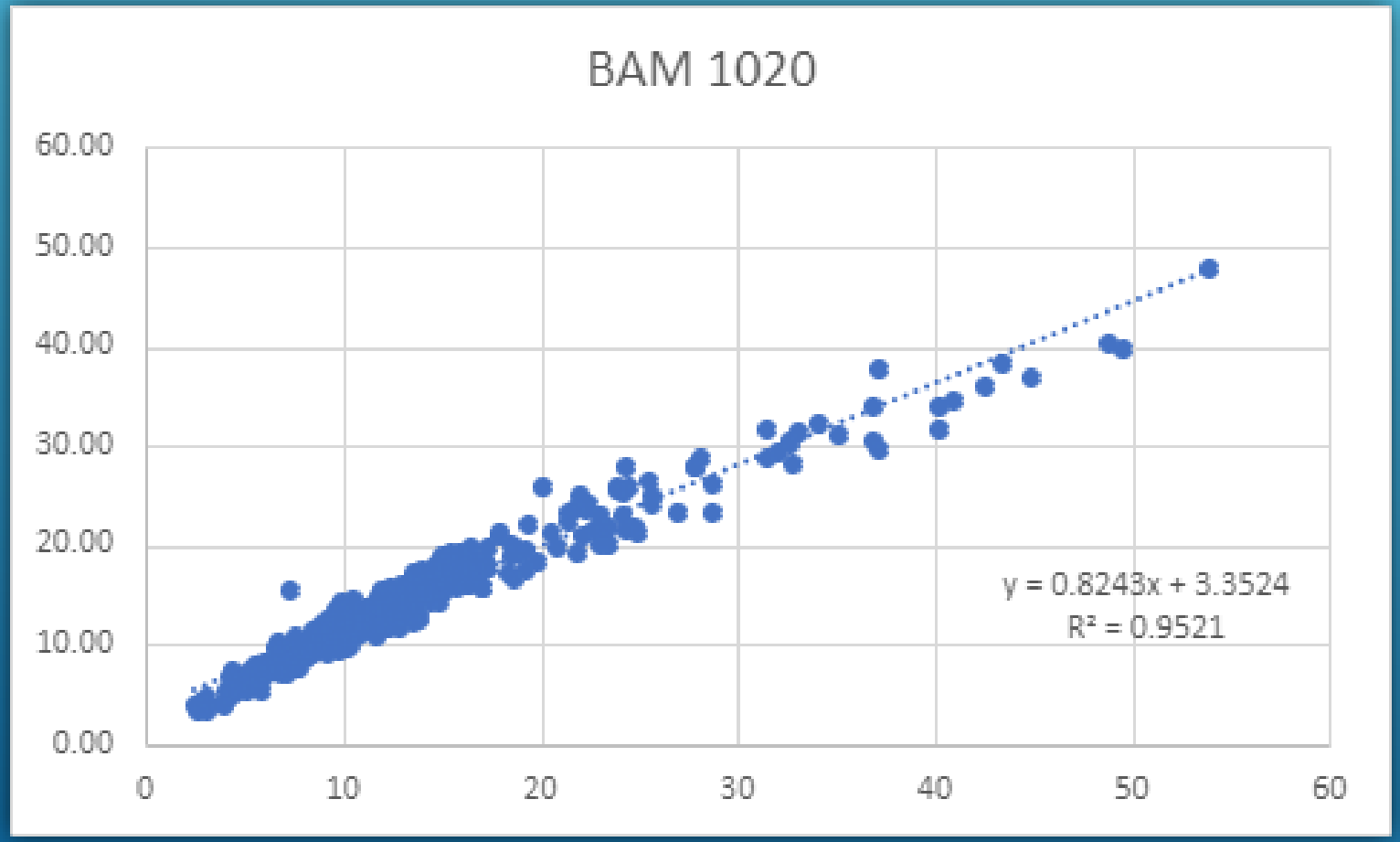
MONITOR COMPARISONS

Compton, CA 2022 Annual FRM DV Site, One year of 1020 Second Generation Data Available.



DAILY MONITOR COMPARISON

Compton, CA Annual 2022 FRM DV Site, One year of 1020 Second Generation Data Available



- Slope Criteria 1.0 +/- 0.1 - FAIL
- Intercept Criteria +/- 2.0 - FAIL
- R2 Criteria > 0.81 - PASS

PM 2.5 CONTINUOUS MONITOR COMPARABILITY ASSESSMENT

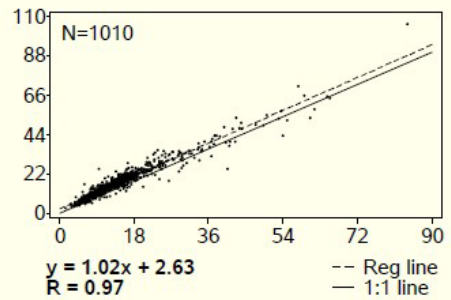
- Ontario Near Road 60, 2022 FRM DV Site (Thermo 5014/Met One 1020)
- Slope Criteria 1.0 +/- 0.1 - PASS
- Intercept Criteria +/- 2.0 - FAIL
- R Criteria > 0.90 - PASS

$PM_{2.5}$ Continuous Monitor Comparability Assessment

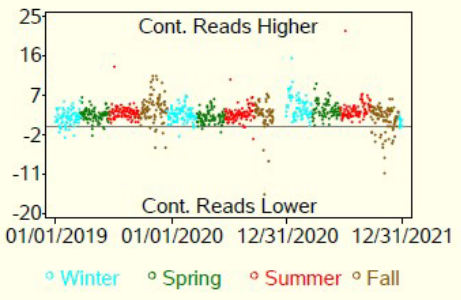
Site 06-071-0027: Ontario, CA

FRM: R & P Model 2025 PM-2.5 Sequential Air Sampler w/VSCC - Gravimetric (145), PM2.5 - Local Conditions (88101), POC=1
Cont: Thermo Scientific 5014i or FH62C14-DHS w/VSCC - Beta Attenuation (183), PM2.5 - Local Conditions (88101), POC=3

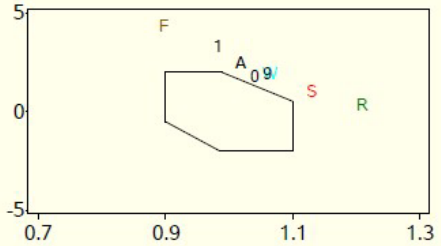
Cont. (y) vs. FRM (x) ($\mu g/m^3$)



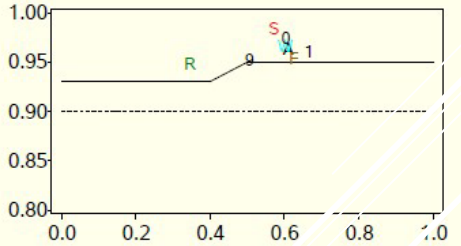
Cont. minus FRM ($\mu g/m^3$)



Additive (y) vs. Multiplicative (x) Bias



R (y) vs. FRM CCV (x)



Mean Concentration ($\mu g/m^3$)

Dataset	N	FRM	Cont	Ratio (Cont/FRM)
AllData	**1010**	**14.2**	**17.1**	**1.20**
Winter	256	13.0	15.9	1.22
Spring	249	10.9	13.7	1.26
Summer	267	15.1	18.3	1.21
Fall	238	17.8	20.5	1.15
2019	345	12.7	15.6	1.22
2020	316	15.2	17.7	1.17
2021	349	14.7	17.9	1.22

Appendix A Statistics

Dataset	N (all observations)	Bias	N (only >= 3 ug/m^3)	Bias
AllData	**1010**	**24.2**	**1006**	**24.0**
Winter	256	25.9	254	25.4
Spring	249	26.1	248	26.0
Summer	267	22.2	267	22.2
Fall	238	22.8	237	22.4
2019	345	25.7	342	25.1
2020	316	19.7	315	19.7
2021	349	26.8	349	26.8

Data Source: EPA AQS Data Mart

Generated: April 29, 2022

FEM WAIVERS – COMPARABILITY ASSESSMENT

- Out of seven monitors, 2018-2020 PM2.5 FEM sites, six passed the Continuous Monitor Comparability Assessment

Site	Slope	Intercept	R	Pass/Fail
Anaheim	1.02	-0.21	.97	PASS
N.R. 710	1.02	1.83	.94	PASS
Mira Loma	0.92	1.80	.94	PASS
N.R. 60	1.06	1.96	.97	PASS
Rubidoux	0.96	0.67	.96	PASS
S. Long Beach	1.06	1.43	.98	PASS

- Out of the same seven monitors, the 2019-2021 showed only three of the same monitors passed
- The three highest DV sites did not pass consecutive years
  - Route 710 Near Road
  - Mira Loma
  - Ontario 60 Near Road

Site	Slope	Intercept	R	Pass/Fail
Anaheim	0.98	-0.17	.97	PASS
N.R. 710	0.97	2.15	.93	FAIL
Mira Loma	0.92	2.20	.95	FAIL
N.R. 60	1.02	2.63	.97	FAIL
Rubidoux	0.92	0.69	.97	PASS
S. Long Beach	1.05	1.64	.98	PASS

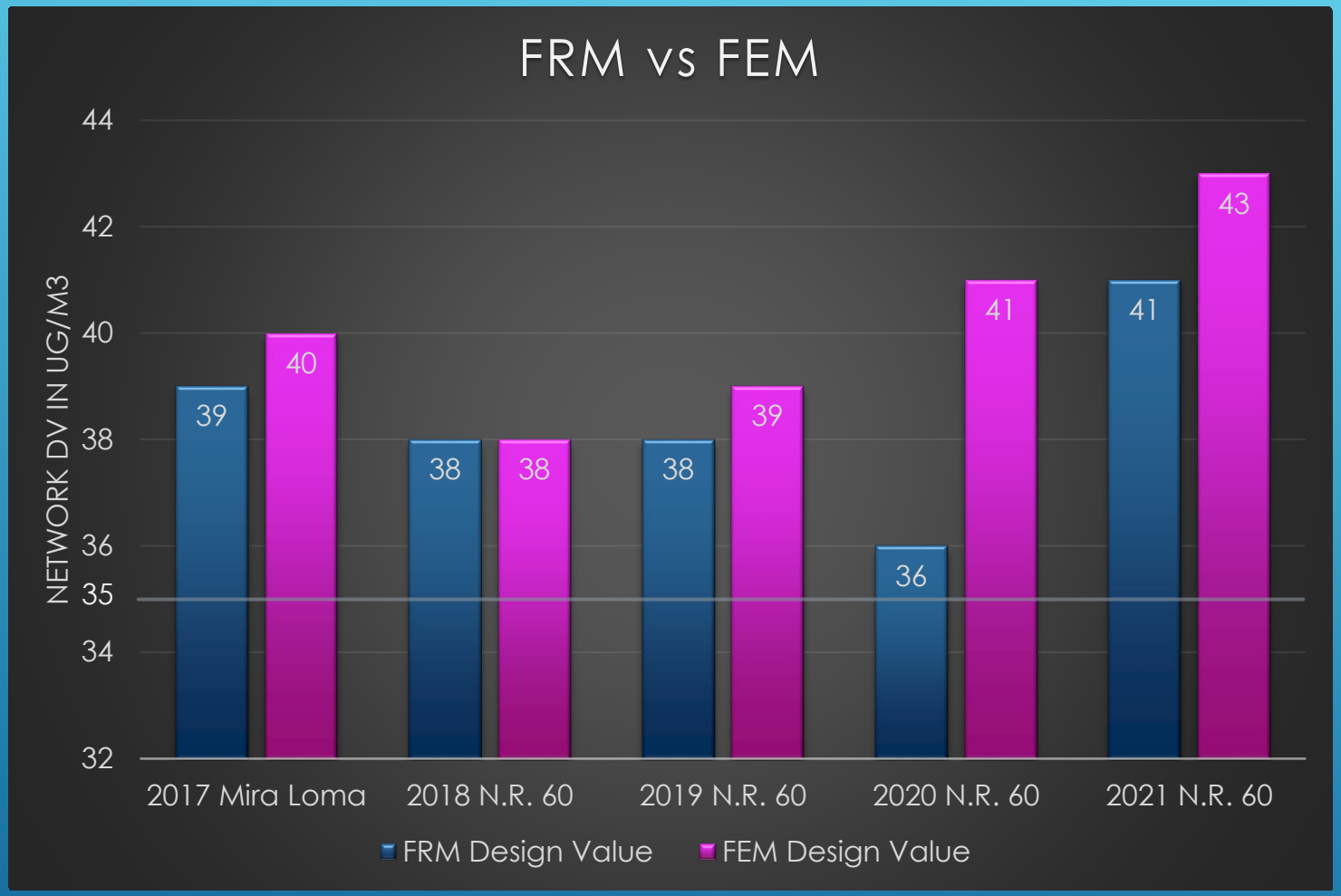
COMPARISON OF PM2.5 DESIGN VALUES CALCULATED USING FRM AND FEM SAMPLES

- Data from collocated FRM/FEM locations from 2015-2021
- Design Values were compared to NAAQS daily and annual standards as the primary monitor

- PM2.5 design values (DV) are calculated by the following method:

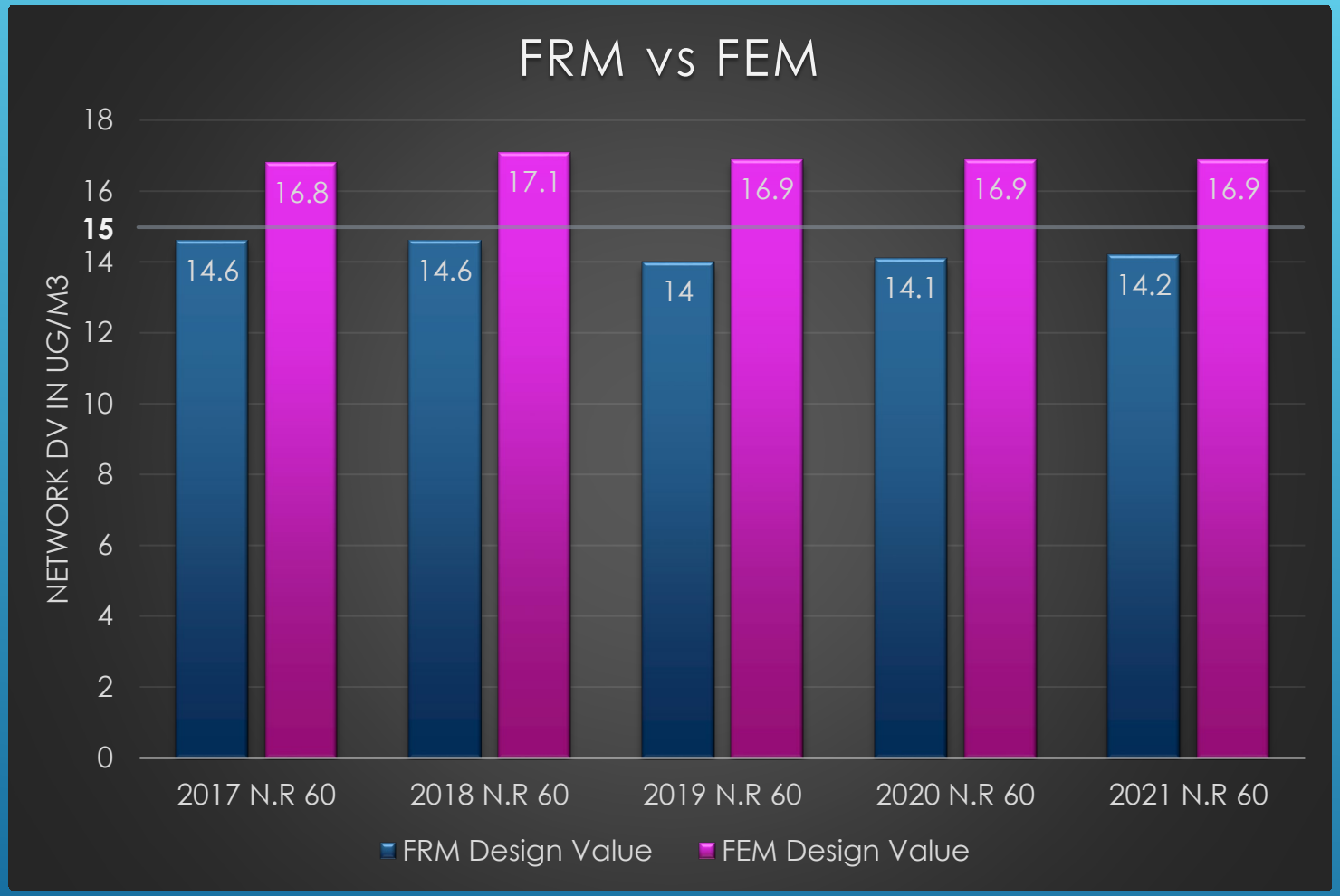
	FRM Design Value	FEM Design Value
Standard EPA Method	Missing FRM Data is replaced with FEM Data	FEM Data Only

PM2.5 DAILY DESIGN VALUE COMPARISONS



- If FEM is the primary monitor, the design value can increase up to 5 µg/m^3 at a site
- Equals up to 14% of Daily NAAQS standard

PM2.5 ANNUAL DESIGN VALUE COMPARISONS



- If FEM is the primary monitor, the Design Value can increase by 2.3-2.9 µg/m^3 at a site
- Equals up to 24% of Primary 12ug/m3 and 19% of 15 ug/m3 Secondary Annual NAAQS

ACCOUNTING FOR FRM AND FEM DIFFERENCES

- Meteorological Factors Such as Temperature and Humidity May Contribute to Differences
- PM2.5 Chemical Composition, Primary vs Secondary Particles
- Monitor Siting

- Possible Procedural Issues
  - Refine acceptance testing and maintenance procedures
  - Work with manufacturers to improve monitor performance
  - Replacing older 1020 FEM and Non FEM
  - Continue to work with EPA to share information on common issues with monitors

FINAL THOUGHTS

- In certain instances, 24 hour design values can be as much as 1- 5 ug/m3 higher utilizing FEM as the primary monitor
- In certain instances, annual design values can be as much as 2.3 – 2.9 ug/m3 higher utilizing FEM as the primary monitor
  - This can be the difference between attaining the 15 ug/ug secondary standard
- Moving to a FEM network, discontinue FRMs?
  - How will we know results of Comparability Assessment if we discontinue FRM?
  - We have found the Comparability Assessment can fail the following year
  - Maintaining FRM and FEM networks are twice as much work while EPA funding is decreasing
- NAAQS Refinement
  - Consider utilizing FRMs to develop a location specific adjustment
  - Develop PM2.5 FEM specific NAAQS

QUESTIONS?

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