Variability of Mercury CEMS vs Sorbent Trap Results

WPCA/KCPL
Coal-fired APC Environmental Seminar

June 5, 2018

Presented By
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But first…
“Precondition your mind”…

…Its mercury!

Photo courtesy of D. Haynes

“Variability”

var·i·a·bil·i·ty

lack of consistency or fixed pattern; liability to vary or change

“Consistency”

Considerations for Hg CEMS Variability

1. Variability from a different monitoring approach as a basis (PS -12B sorbent trap)
2. Variability between the population of Hg CEMS

Parameters Considered

1. Relative Accuracy (Table A-2, 40 CFR 63, Subpart UUUUU)
   I. Primary Standard ≤20.0% RA *or*

   II. Alternate Standard $|RM\text{avg} - C\text{avg}| + |\text{CC}| \leq 0.5\ \mu g/scm$, *if* $RM_{avg} < 2.5\ \mu g/scm$

Parameters Considered

2. Hg Concentration Levels
3. Concentration differences ($|RM\text{avg} - C\text{avg}|$)
4. Bias
5. Data Availability

The Basis for Comparison

PS 12B Sorbent Trap Monitoring Systems

VS

EPA Method 30B

The Data Set – PS-12B Hg RATAs

68 RATA Tests

16 facilities

31 EGUs

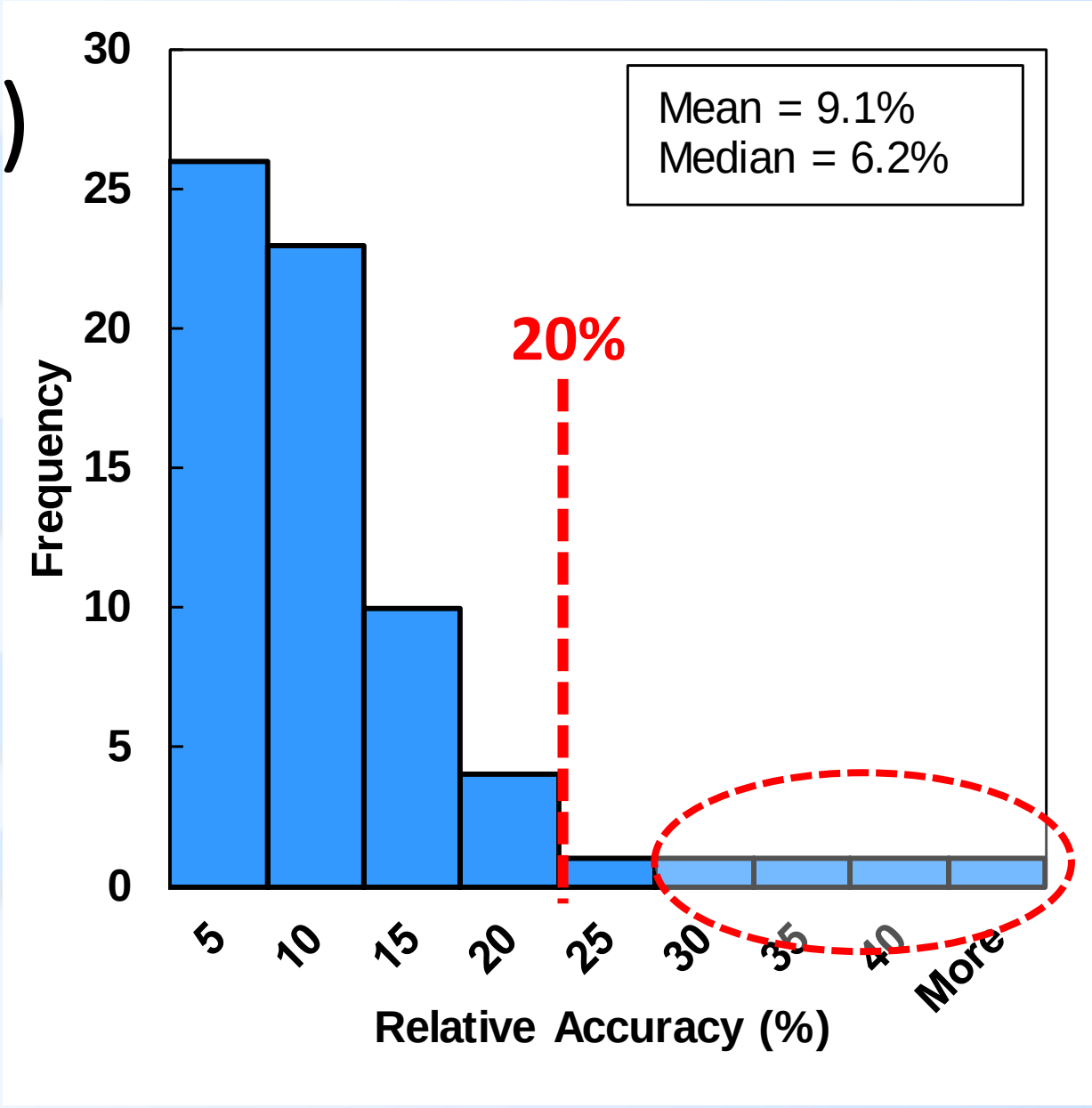
May 2009 – Feb 2017

STMS Relative Accuracy (%)

Average RA – 9.1%
Median RA – 6.2%

Best RATA? – 1.59%
(0.550-0.553 µg/dscm)

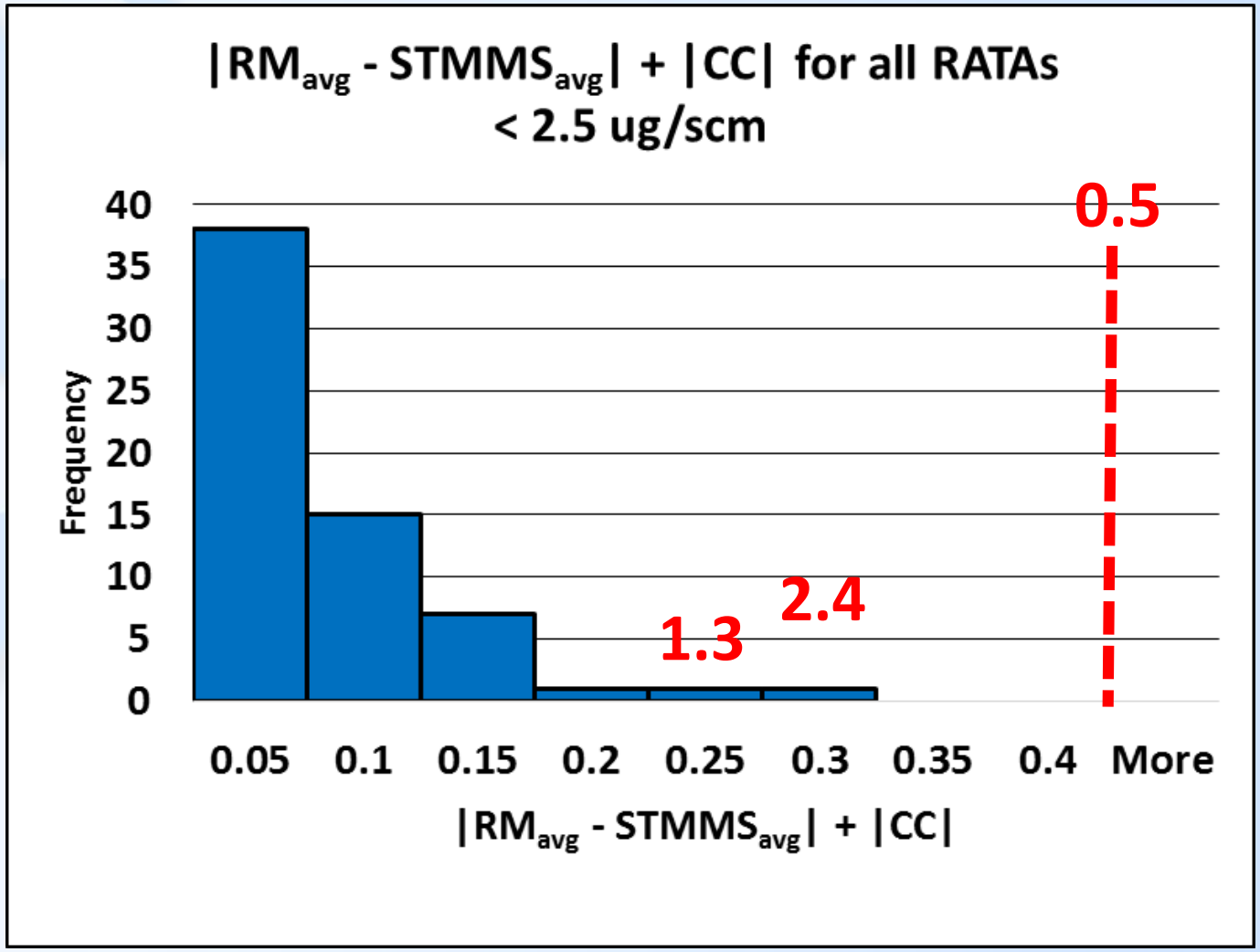
Worst RATA? – 59%
(0.01-0.006 µg/dscm)



STMS Relative Accuracy (Alt)

Average – 0.06%

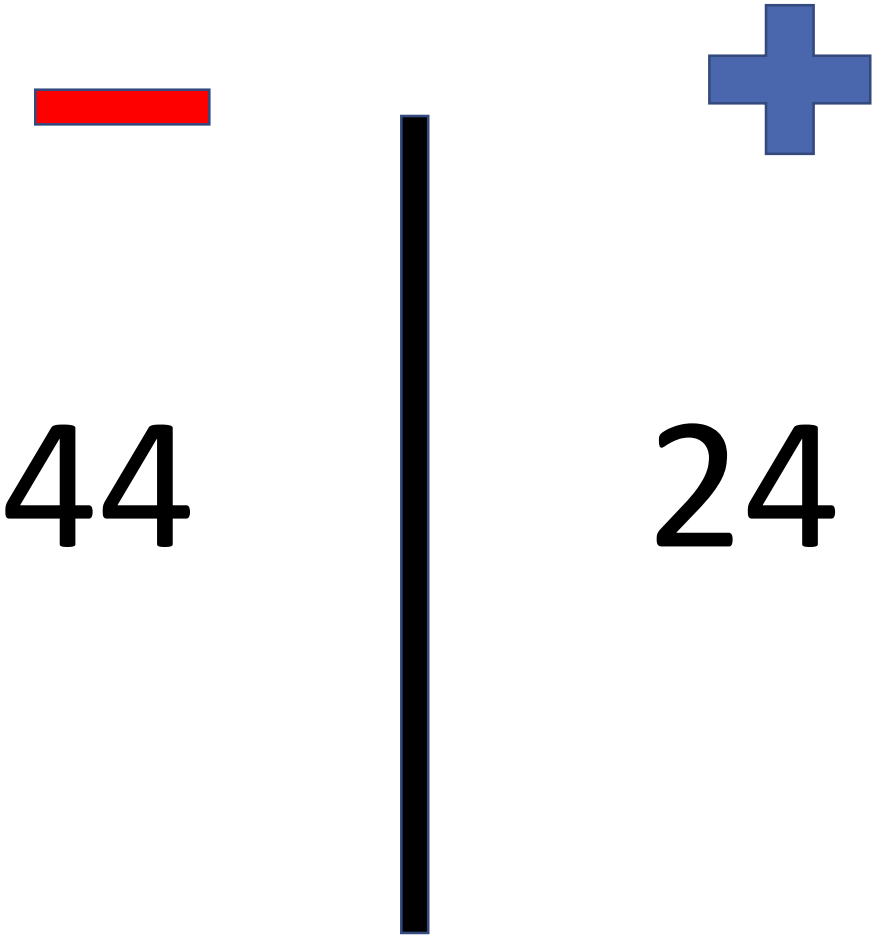
Median RA – 0.04%

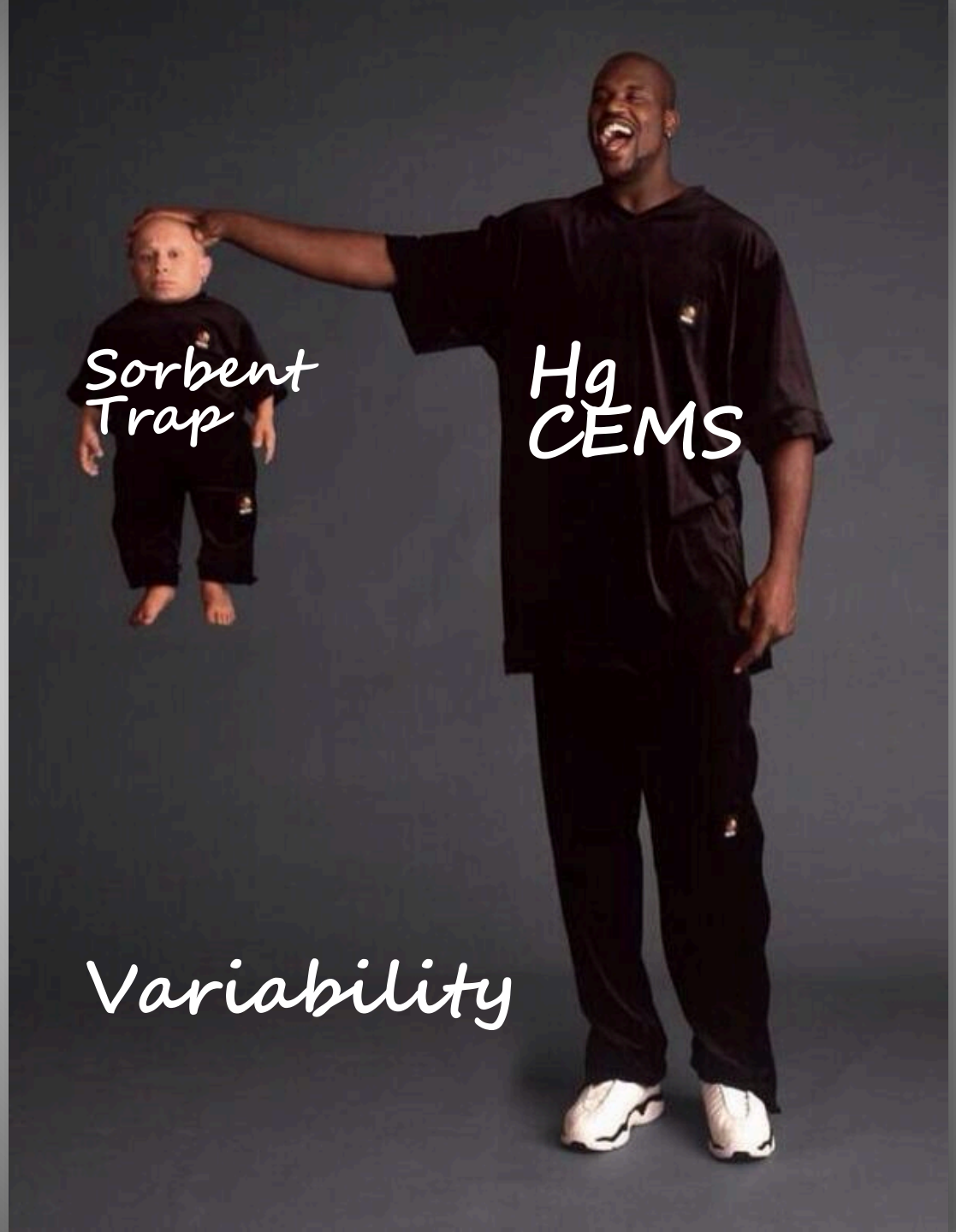


BIAS – PS12B to 30B

$(RM_{avg} - STMS_{avg})$

MeanDiff
-0.01238
0.06998
-0.03636
0.00357
0.00867
-0.05774
-0.26432
-0.13257




Sorbent Trap
Hg CEMS
Variability

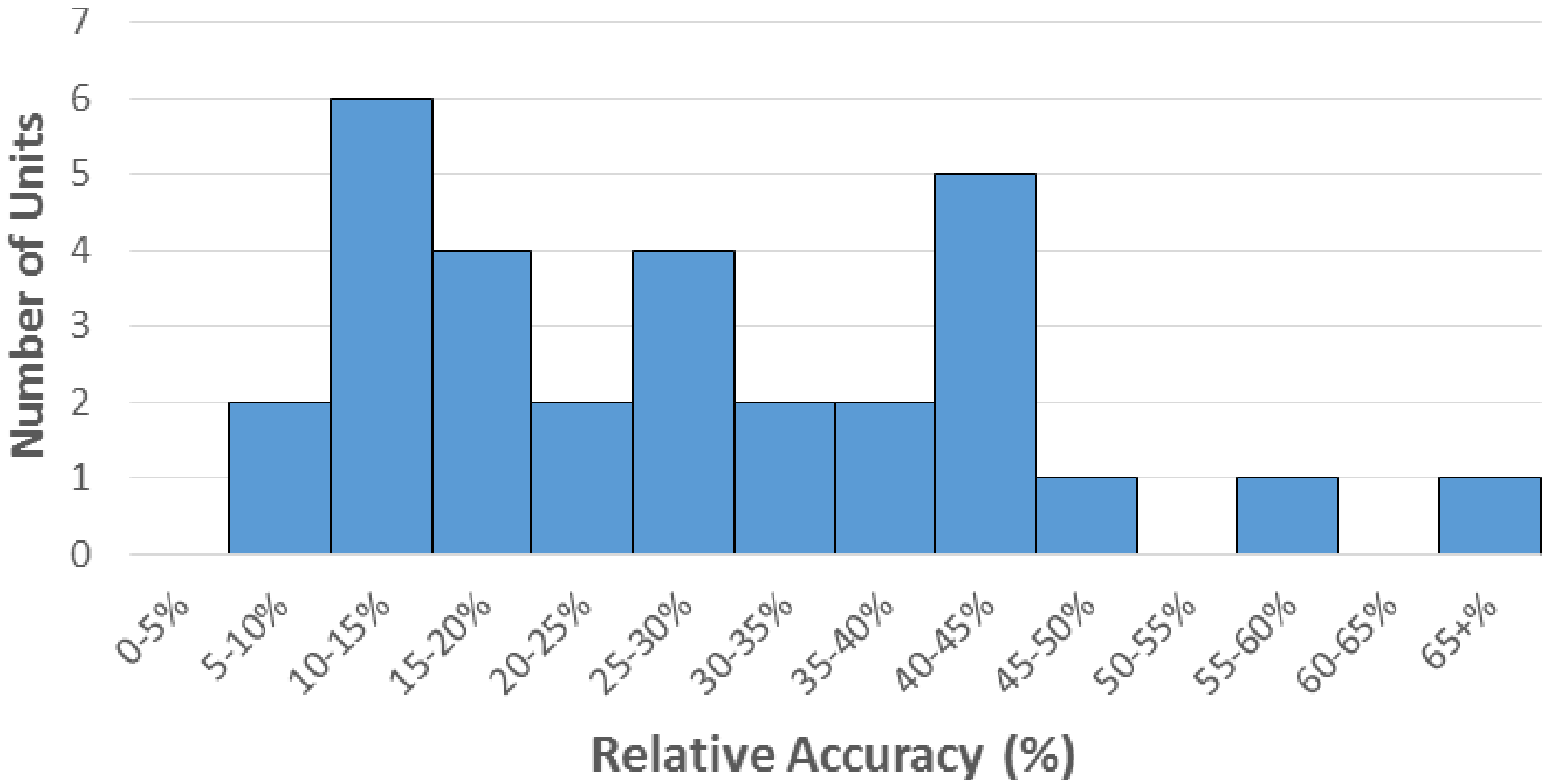
The Data Set – Hg CEMS RATAs

30 Units

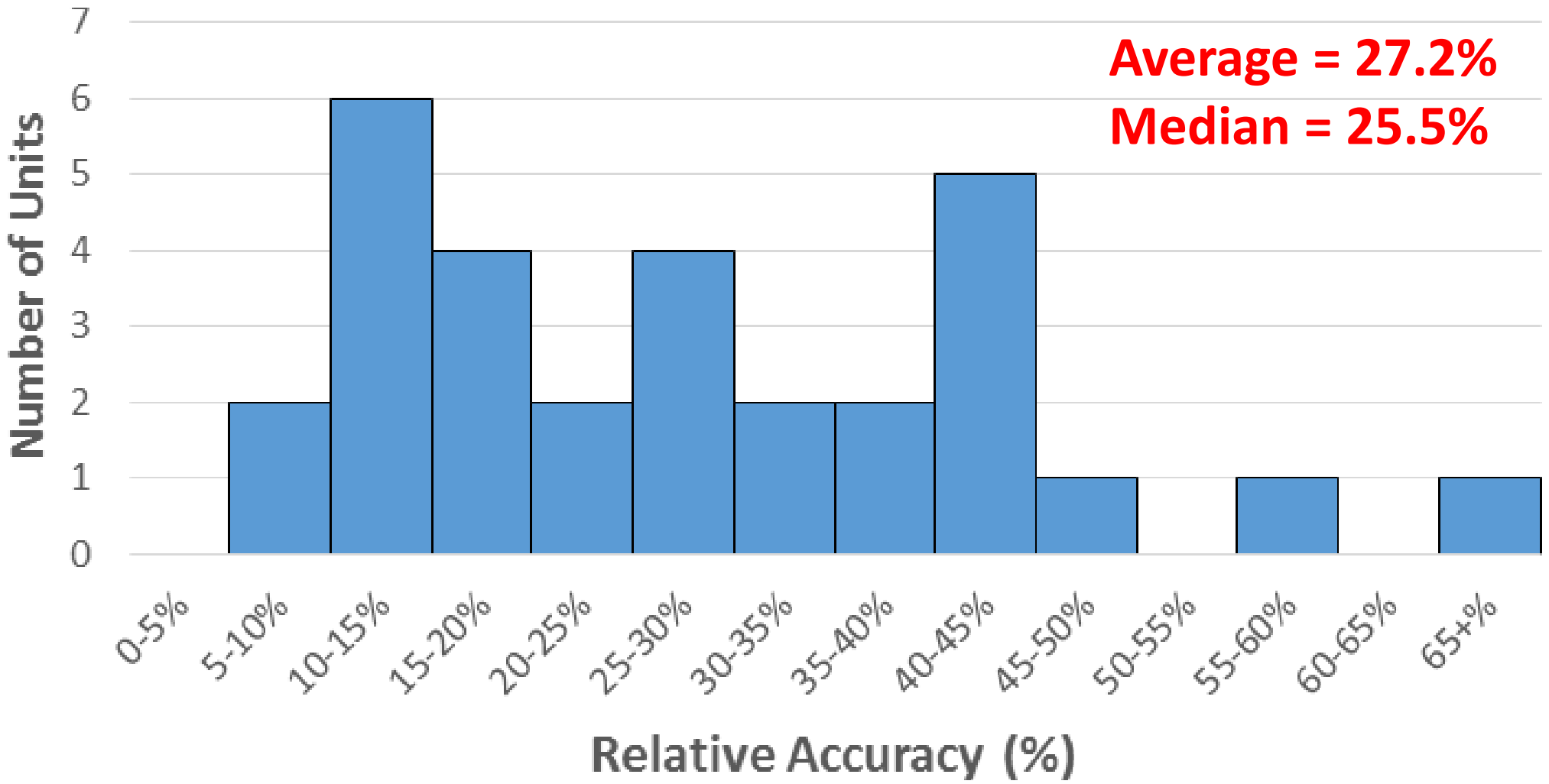
17 facilities (MATS)

2017

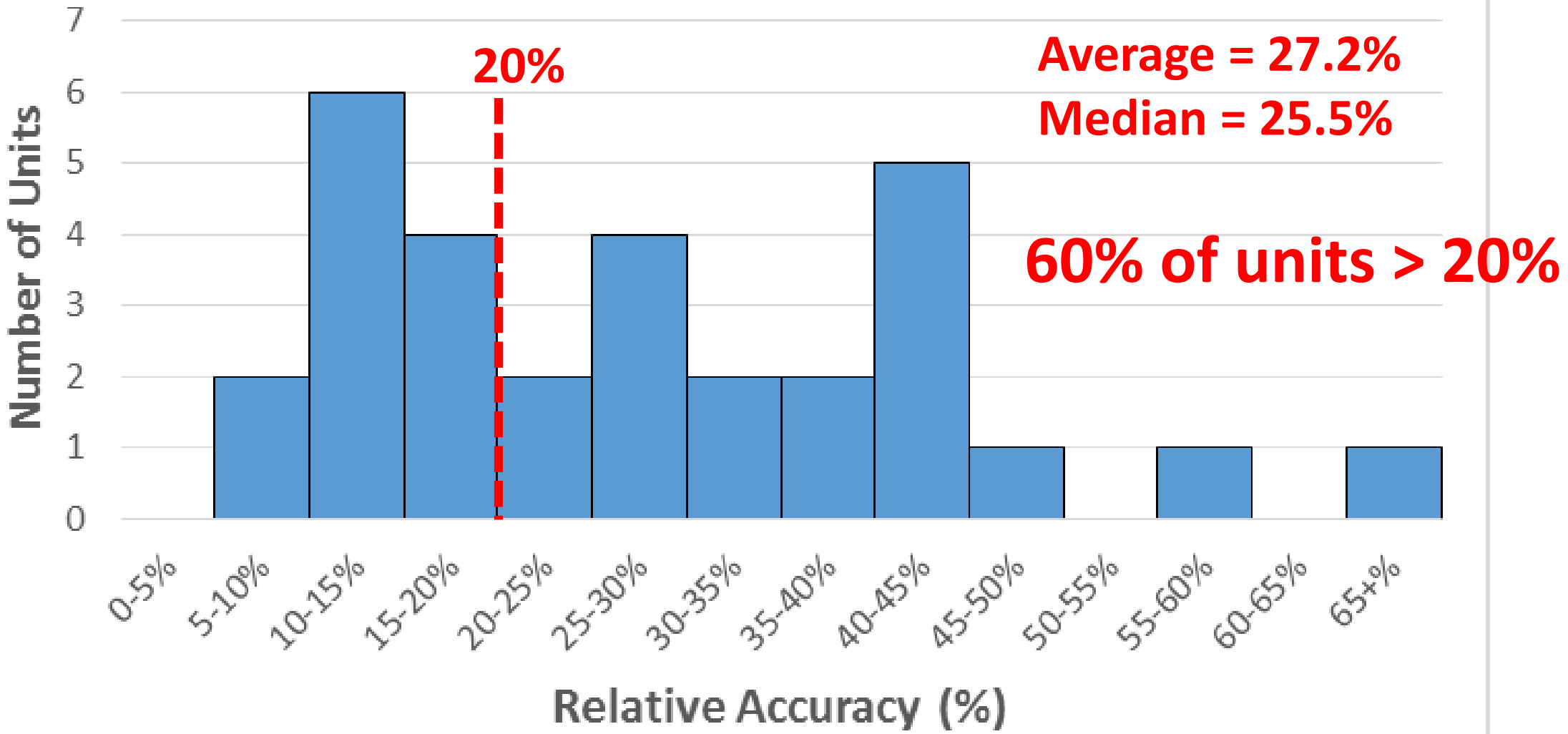
Hg CEMS - 2017 RATA Results - %RA



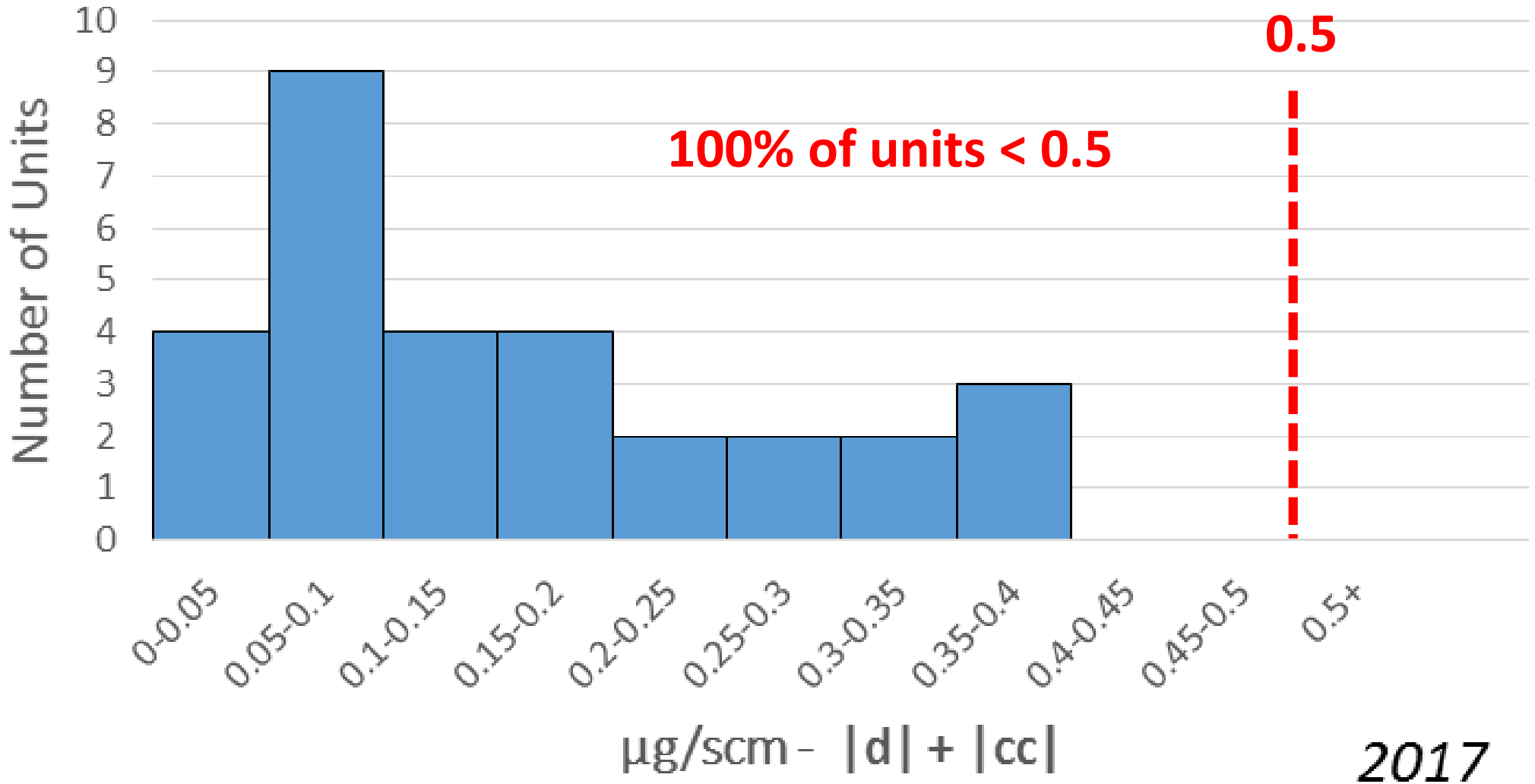
Hg CEMS - 2017 RATA Results - %RA



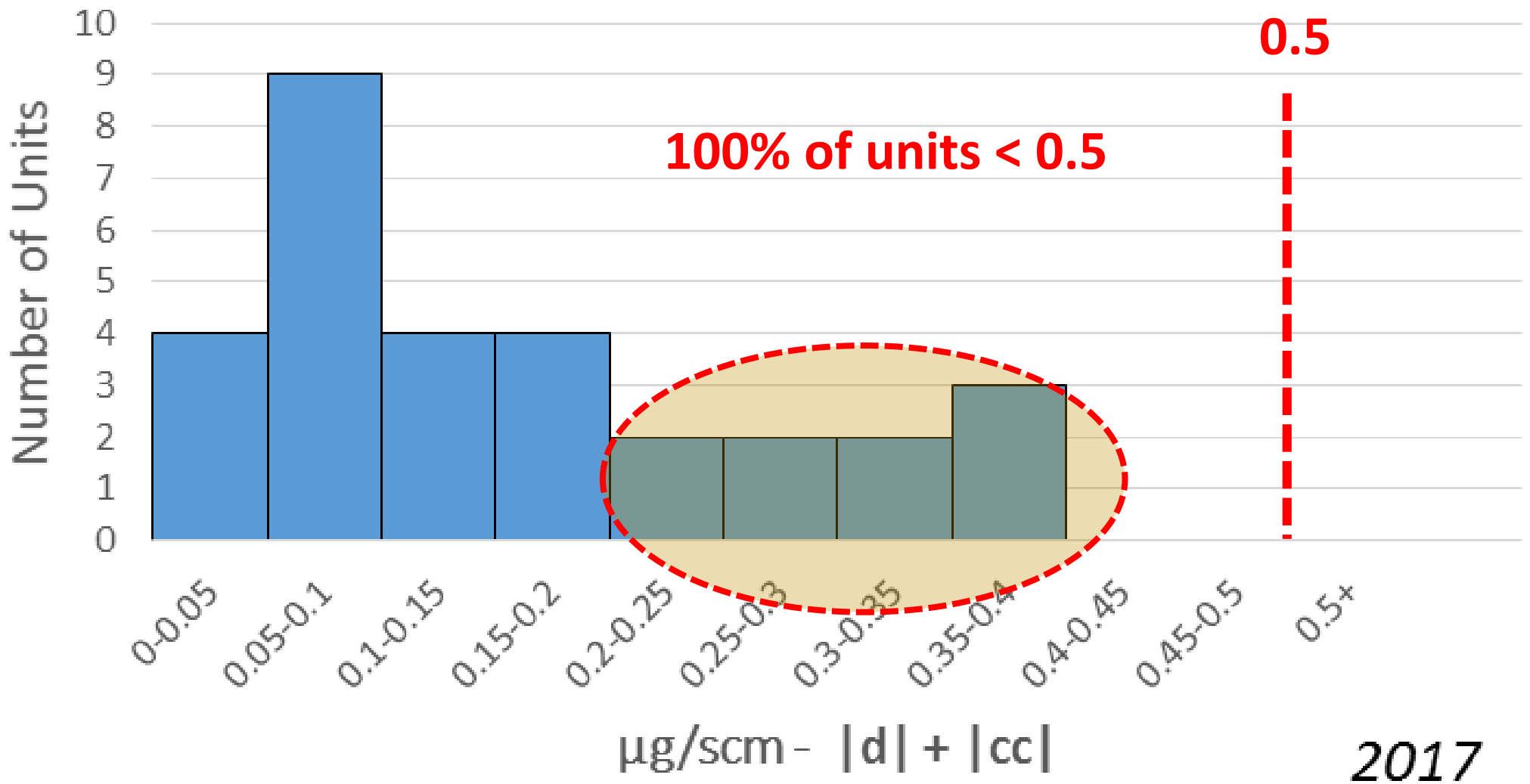
Hg CEMS - 2017 RATA Results - %RA



Hg CEMS - RATA Results - Alternate Specification



Hg CEMS - RATA Results - Alternate Specification



2017

BIAS (Hg CEMS vs EPA 30B)

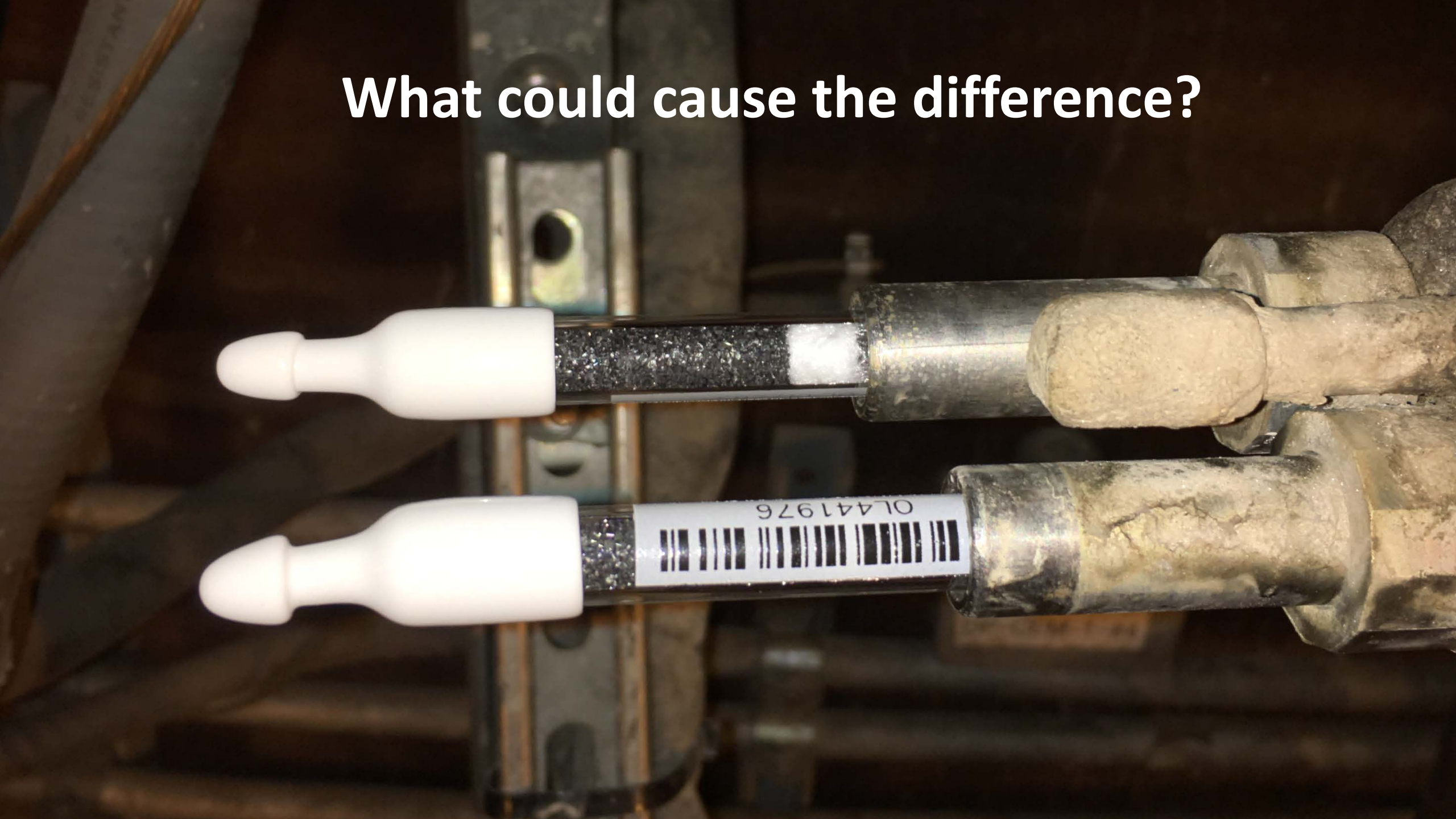
BIAS (Hg CEMS vs EPA 30B)

$(RM_{avg} - STMS_{avg})$	
−	+
44	24

$(RM_{avg} - Hg\ CEMS_{avg})$	
−	+
8	22
5	22

Hg CEMS lower than 30B 81% of time

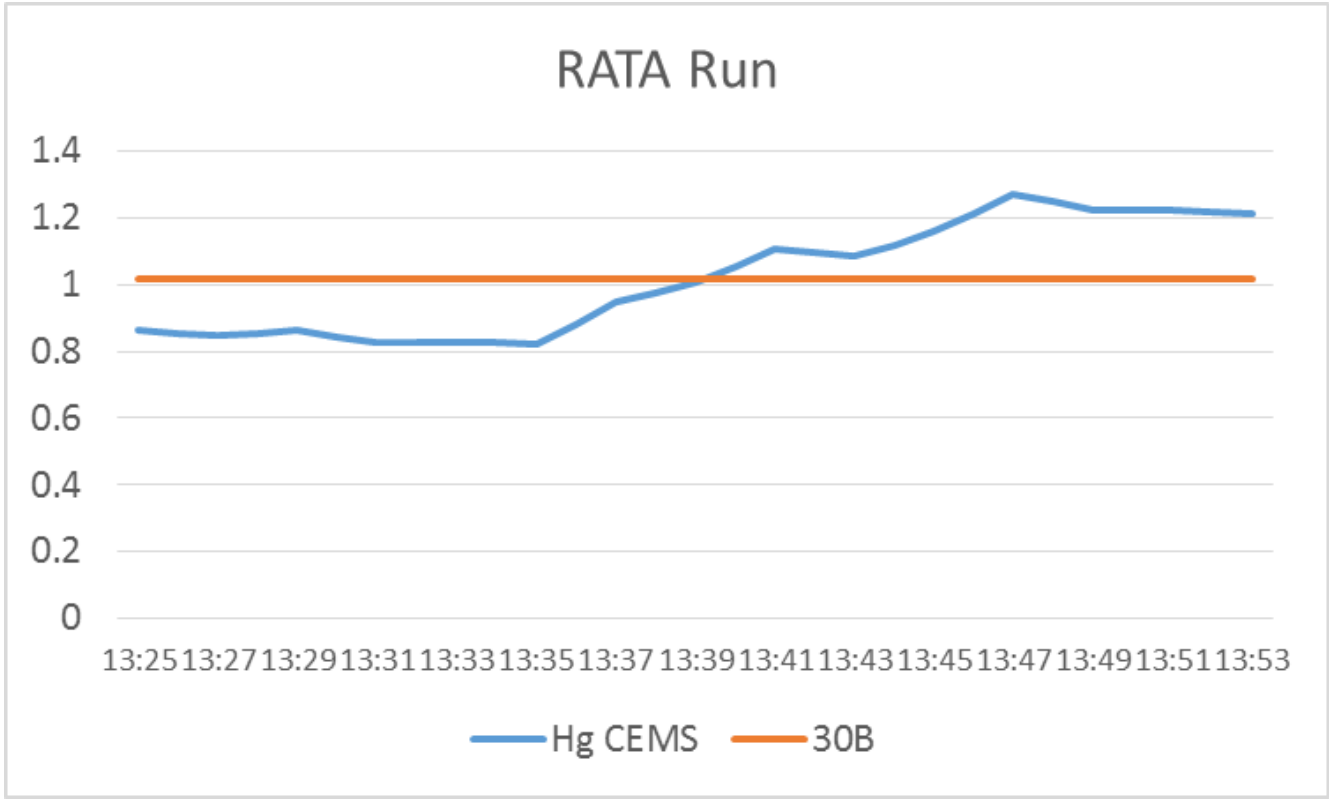
What could cause the difference?



Hg CEMS Concentration Variability during RATA

- Dynamic Hg Concentration during RATA?

Dynamic concentration movement does not seem to have significant impact on difference



Hg CEMS Concentration Difference to 30B

- Calibration Gases and Range - (<10% criteria)

EPRI Conference May 2017

“Hg CEMS Ongoing QA Data Analysis”
by William Roberson

Hg CEMS Concentration Difference to 30B

- Hg concentration levels in flue gas correlate to difference in measurements?
  - 0.11 to 2.4 µg/scm

No significant trend in Hg CEMS to 30B concentration difference between 0.3 and 1.2 µg/scm

Effect of Hg Concentration on RA%

- Higher concentrations easier to pass RA%? – *Not necessarily*
  - *No significant passing trend (RA%) between 0.3 and 1.2 µg/scm*
- *Below 0.3 µg/scm Alt Specification passes*
- *Lignite Fine Line*

Hg CEMS Avg.	30B Avg.	Difference	RA (%) - 20%	Alt Spec. (0.5)
1.57	1.35	-0.22	26.97	0.36
2.18	2.4	0.22	15.58	0.4

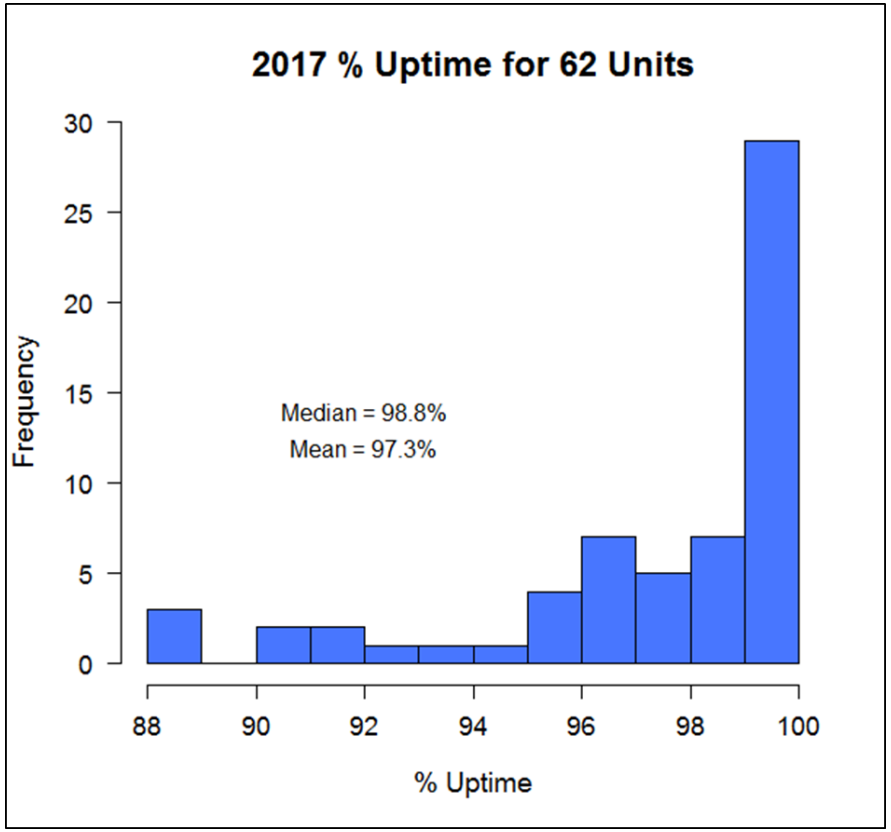
Hg CEMS Data Availability

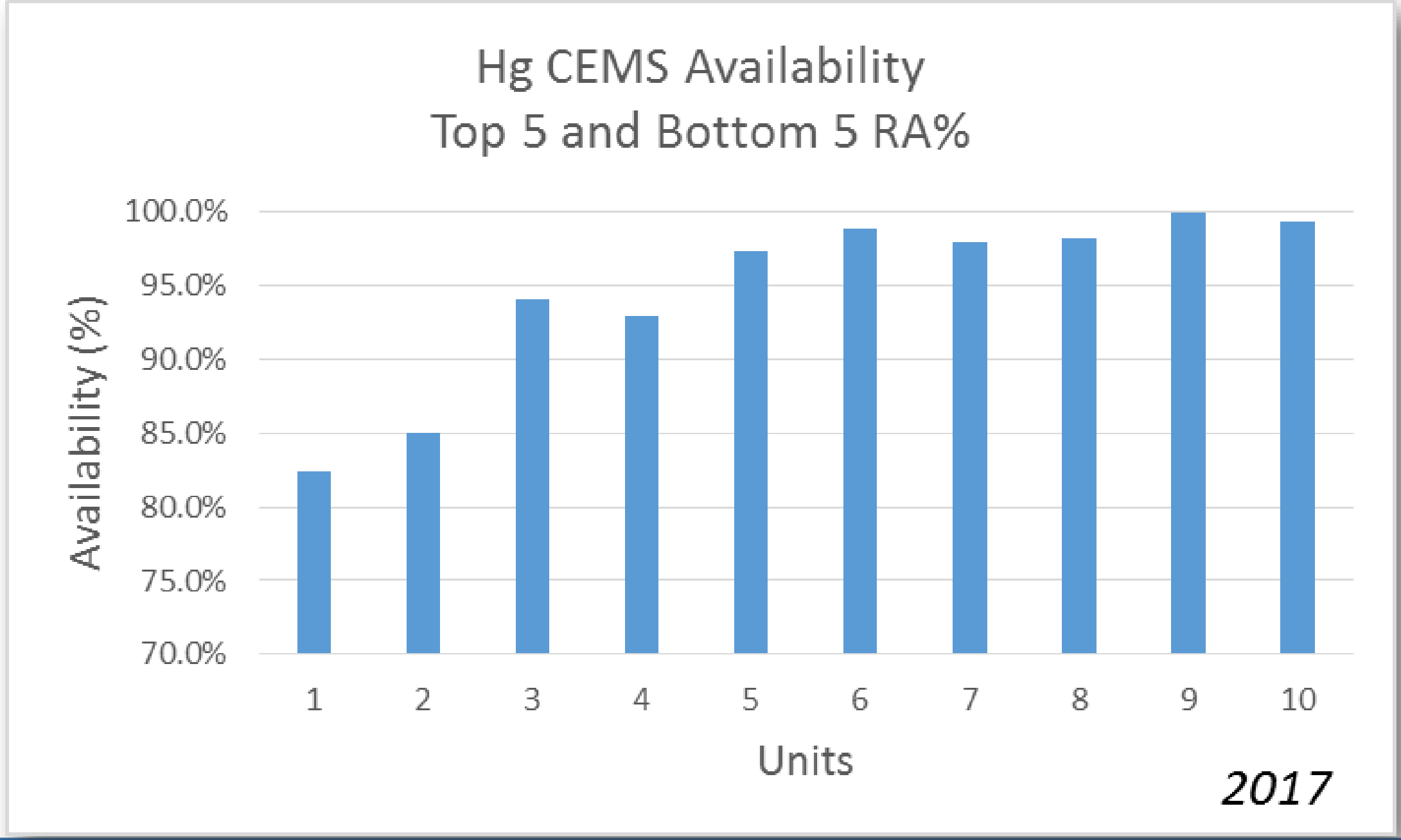
EPRI Conference May 2017

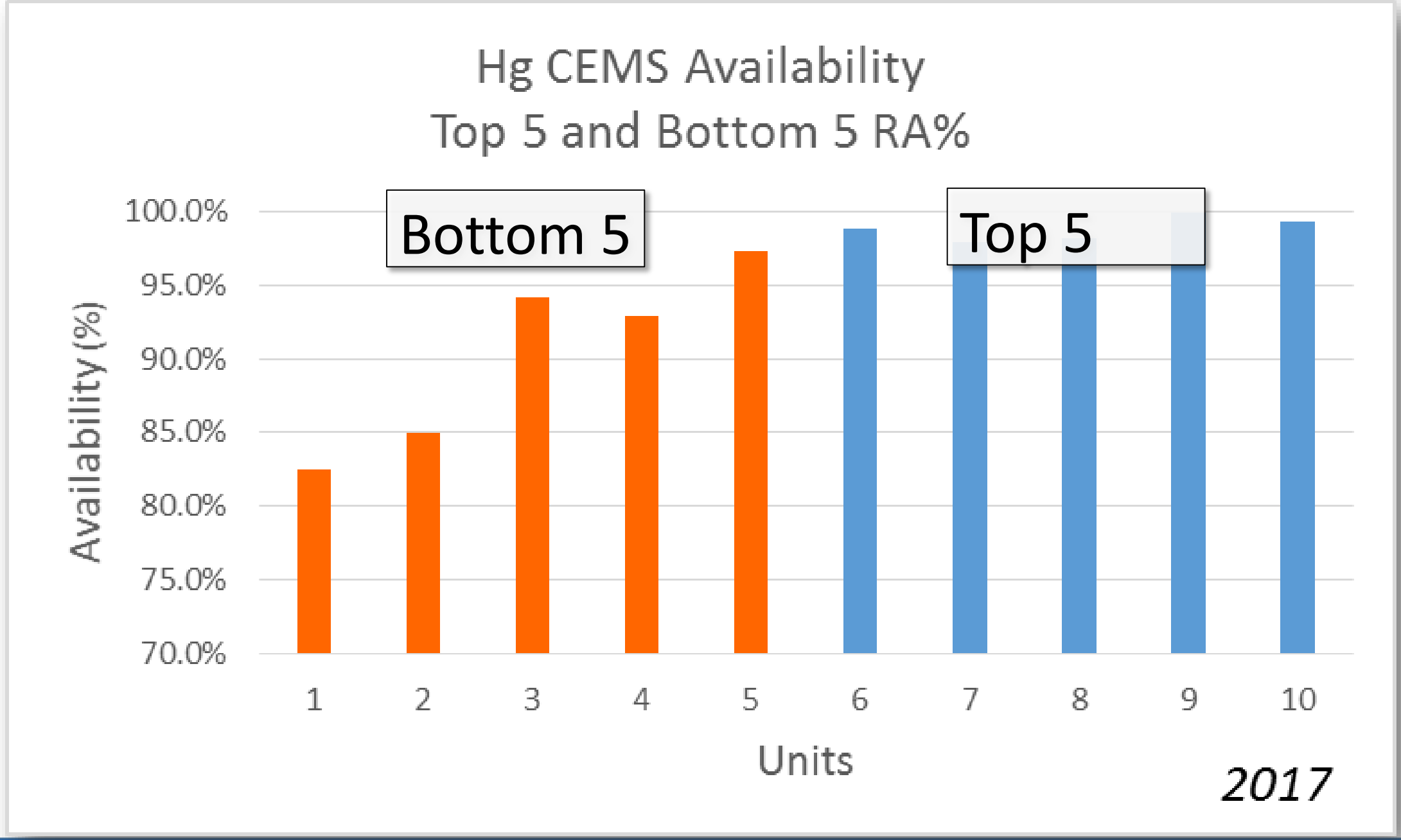
Q4 2017 Reported

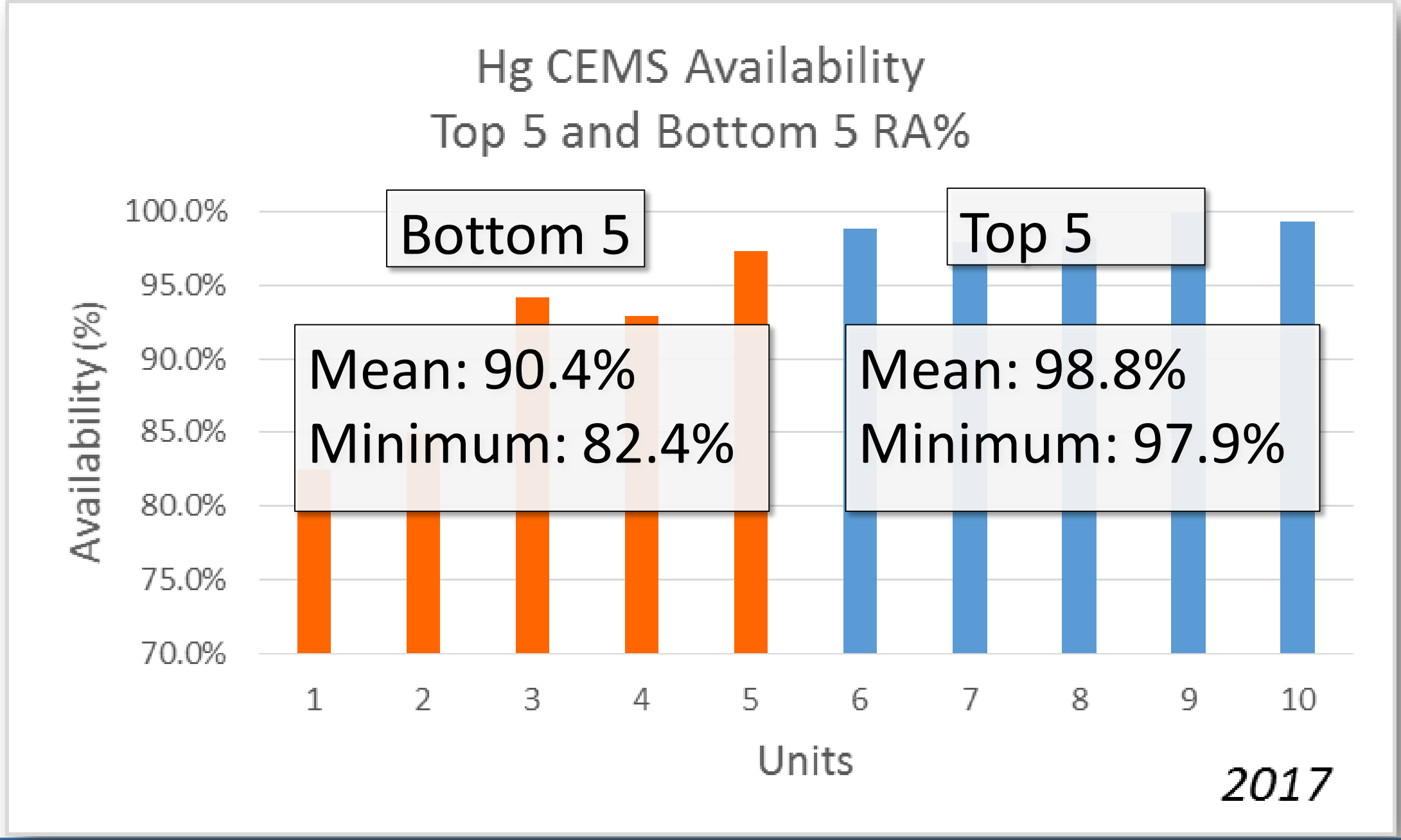
- Hg CEMS - 96%
- Industry STMS – 92%
- *CleanAir MET-80 STMS – 97.3%*

Relation to Hg CEMS RA performance – Snapshot of Bottom 5 and Top 5




Hg CEMS Availability
Top 5 and Bottom 5 RA%
100.0%
95.0%
90.0%
85.0%
80.0%
75.0%
70.0%
Availability (%)
1
2
3
4
5
6
7
8
9
10
Units
2017


Hg CEMS Availability
Top 5 and Bottom 5 RA%
Bottom 5
Top 5
100.0%
95.0%
90.0%
85.0%
80.0%
75.0%
70.0%
Availability (%)
1
2
3
4
5
6
7
8
9
10
Units
2017


Hg CEMS Availability
Top 5 and Bottom 5 RA%
Bottom 5
Top 5
Mean: 90.4%
Minimum: 82.4%
Mean: 98.8%
Minimum: 97.9%
100.0%
95.0%
90.0%
85.0%
80.0%
75.0%
70.0%
Availability (%)
1
2
3
4
5
6
7
8
9
10
Units
2017

Variability of Mercury CEMS vs Sorbent Trap Results

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