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Is AERSCREEN Always Greater Than AERMOD

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Background

- Current Appendix W Section 2.2 states:

  "The purpose of such (screening) techniques is to eliminate the need of more detailed modeling for those sources that clearly will not cause or contribute to ambient concentrations in excess of either the National Ambient Air Quality Standards (NAAQS) or the allowable prevention of significant deterioration (PSD) concentration increments."

- Proposed Appendix W Section 4.2.1.b states:

  "As discussed in paragraph 2.2(a), screening models or techniques are designed to provide a conservative estimate of concentrations."

- Thus, AERSCREEN should be conservative for all source types in all modeling situations but is it?

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Background

- Current version of AERSCREEN is 14147
- Current version of AERMOD is 14134
- AERSCREEN can use BPIP, AERSURFACE, and AERMAP output data
- AERSCREEN can be set up based on defaults with a limited few building dimensions, flat terrain, and land use defining variables
- Using defaults makes it almost like SCREEN3 Model

Methodology

- Apply AERSCREEN and AERMOD to seven different source types
- Apply AERMOD in four different locations with different climate, wind patterns, and land use
  - Orlando, Florida surface data; Tampa Bay upper air data; 2011.
  - LaGuardia, New York surface data; Brookhaven upper air data; 2013.
  - Bowling Green, Kentucky surface data; Nashville upper air data; 2013.
  - Dalhart, Texas surface data; Amarillo upper air; 2012.

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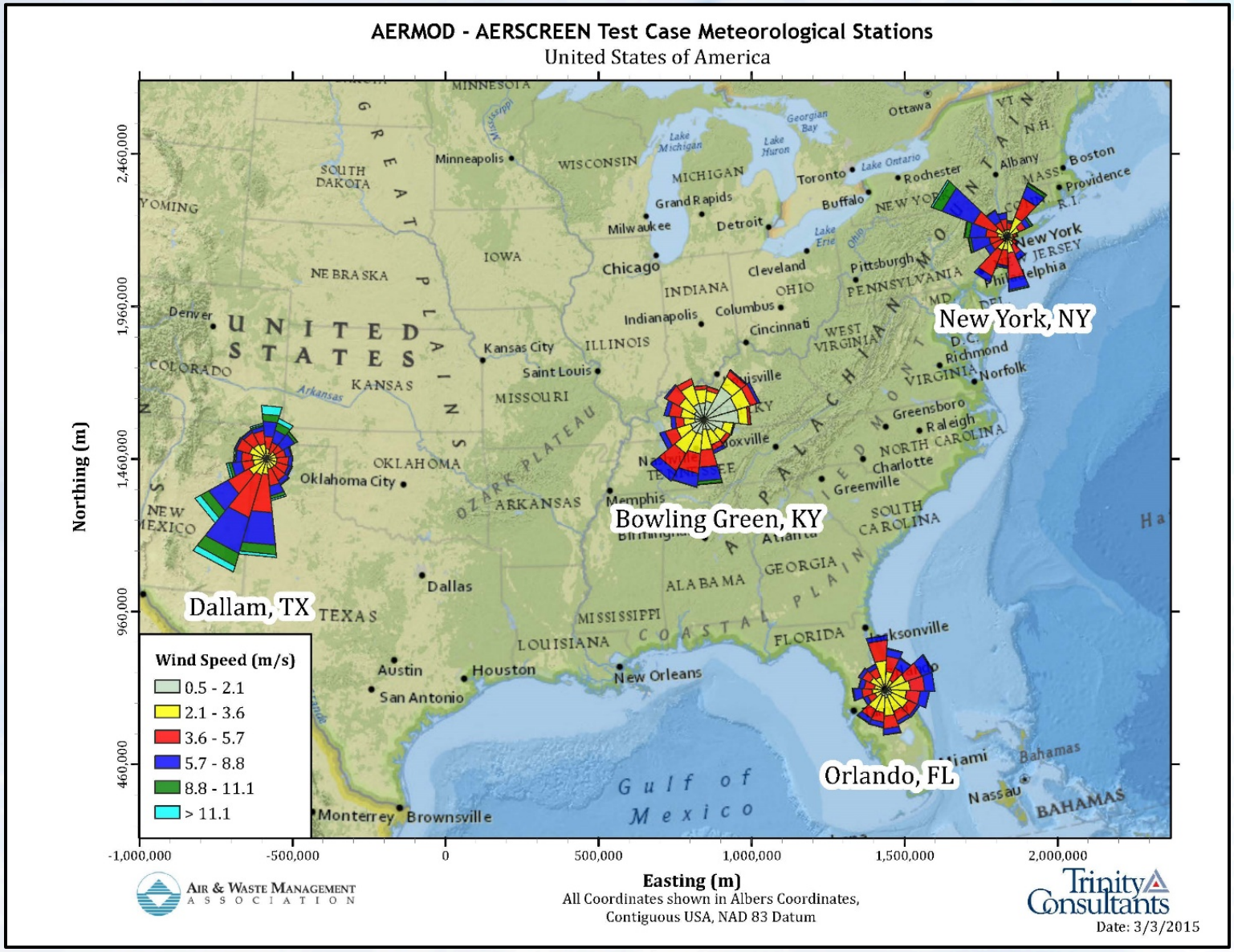
Sites Selected



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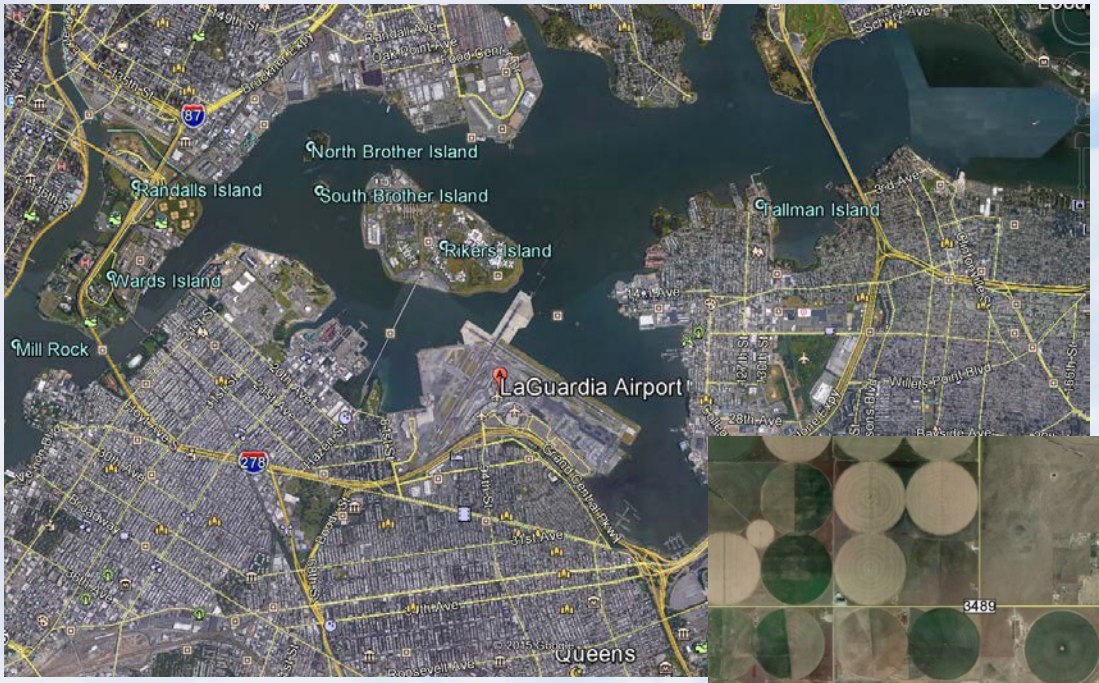
LaGuardia vs. Dallam Co.



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Methodology – Sites Selected

Site Name	Selected Land Cover Class	Albedo	Bowen Ratio[1]	Surface Roughness
Bowling Green Airport, KY	Low Intensity Residential	0.22	0.82	0.36
LaGuardia International Airport, NY	High Intensity Residential	0.21	1.30	1.00
Dallam County Airport, TX	Transitional	0.23	0.90	0.20
Orlando International Airport, FL	Low Intensity Residential	0.22	0.82	0.36

[1] Bowen ratios based on average precipitation

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Methodology – Sources Selected

Source Type	Source ID	Stack Height (m)	Stack Temp (K)	Stack Gas Velocity (m/s)	Stack Diameter (m)	Emission Rate (g/s)
Stack	STACK65	65	425	15.0	5.0	500
Stack	STACK35	35	432	11.7	2.4	100
Stack	STACK20	20	350	7.5	1.5	10
Stack	STACK10	10	325	4.0	0.5	2.5
Source Type	**Source ID**	**Release Height (m)**	**Horizontal Dimensions (m)**	**Initial Lateral σ_{yo}, (m)**	**Initial Vertical σ_{zo}, (m)**	**Emission Rate (g/s)**
Area Square	AREA	1.0	20X20	--	0.4651	0.1
Area Circle	AREACIRC	10	Diam = 40	--	4.6512	0.1
Volume	VOLUME	5	20X20	4.6512	2.3256	1.0

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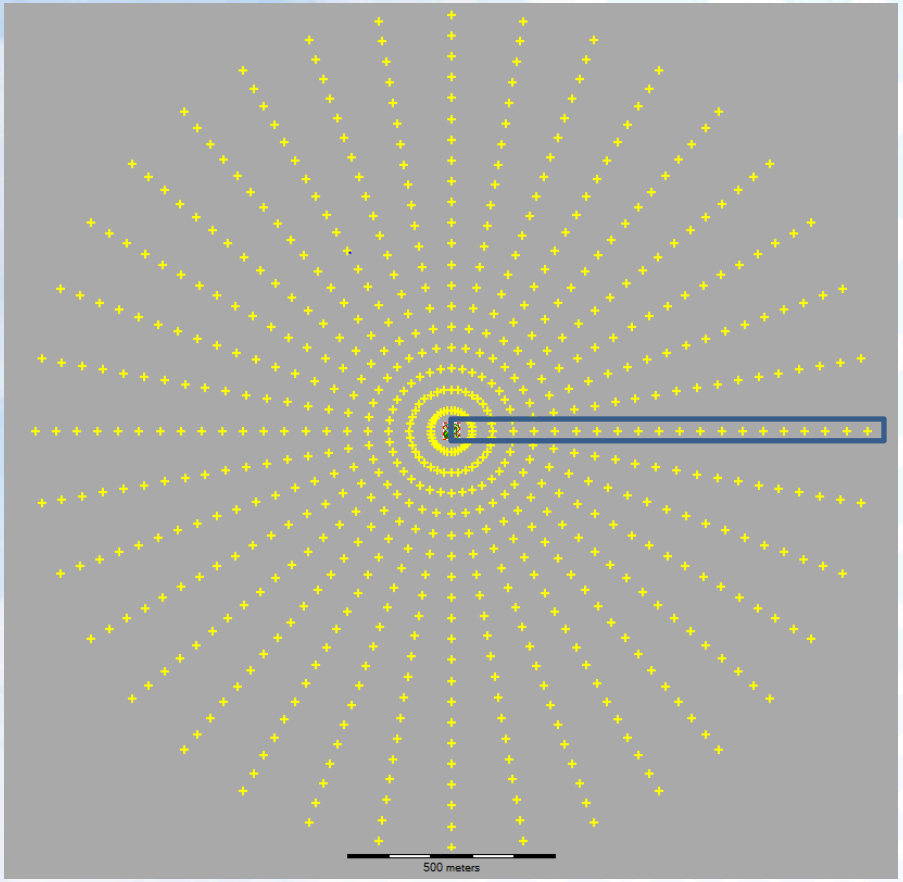
Methodology - Receptors

- AERMOD - 50m spacing out to 1000m in 36 directions
- AERSCREEN – one spoke
- No terrain



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Methodology

- No downwash
- Run AERMOD with each source for each receptor for each meteorological location for HFH 1-hr, 24-hr, and annual concentrations from block averages
- Run AERSCREEN/MAKEMET with each source for each receptor for annual average albedo, Bowen ratio, and surface roughness for 1-hr, 24-hr, and annual concentrations using adjustment factors

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Comparisons of Results

- Expectation – AERSCREEN would result in higher concentrations than AERMOD for each averaging period

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Comparison of 1-Hour Results

Met Station	Source	AERSCREEN Concentration (ug/m^3)	AERMOD Concentration (ug/m^3)	AERSCREEN > AERMOD?	AERSCREEN Distance (m)	AERMOD Distance (m)	Is AERSCREEN Distance Within 20% of AERMOD Distance?
Dalhart	10m Stack	754.4	669.7	Yes	137	50	No
	20m Stack	242.8	229.9	Yes	165	150	Yes
	35m Stack	430.1	398.1	Yes	439	300	No
	65m Stack	458.4	401.4	Yes	735	700	Yes
	Circular Area	237.7	134.2	Yes	50	50	Yes
	Square Area	5499.7	6375.4	No	50	50	Yes
	Volume	3155.6	381.8	Yes	50	50	Yes
LaGuardia	10m Stack	492.2	676.2	No	54	200	No
	20m Stack	252.2	262.9	No	82	100	Yes
	35m Stack	503.0	491.7	Yes	203	250	Yes
	65m Stack	468.2	617.4	No	428	1000	No
	Circular Area	197.8	245.0	No	50	50	Yes
	Square Area	491.1	1394.0	No	50	50	Yes
	Volume	465.5	472.8	No	50	50	Yes
Orlando	10m Stack	788.2	686.2	Yes	167	150	Yes
	20m Stack	268.1	220.2	Yes	160	250	No
	35m Stack	482.0	375.5	Yes	347	300	Yes
	65m Stack	481.7	382.1	Yes	612	650	Yes
	Circular Area	222.6	82.6	Yes	50	50	Yes
	Square Area	5076.9	2142.6	Yes	50	50	Yes
	Volume	3126.5	327.0	Yes	50	50	Yes
Bowling Green	10m Stack	788.2	761.1	Yes	167	150	Yes
	20m Stack	268.1	226.5	Yes	160	150	Yes
	35m Stack	482.0	375.4	Yes	347	300	Yes
	65m Stack	481.7	478.5	Yes	612	1000	No
	Circular Area	222.6	232.5	No	50	50	Yes
	Square Area	5076.9	6895.1	No	50	50	Yes
	Volume	3126.5	444.5	Yes	50	50	Yes

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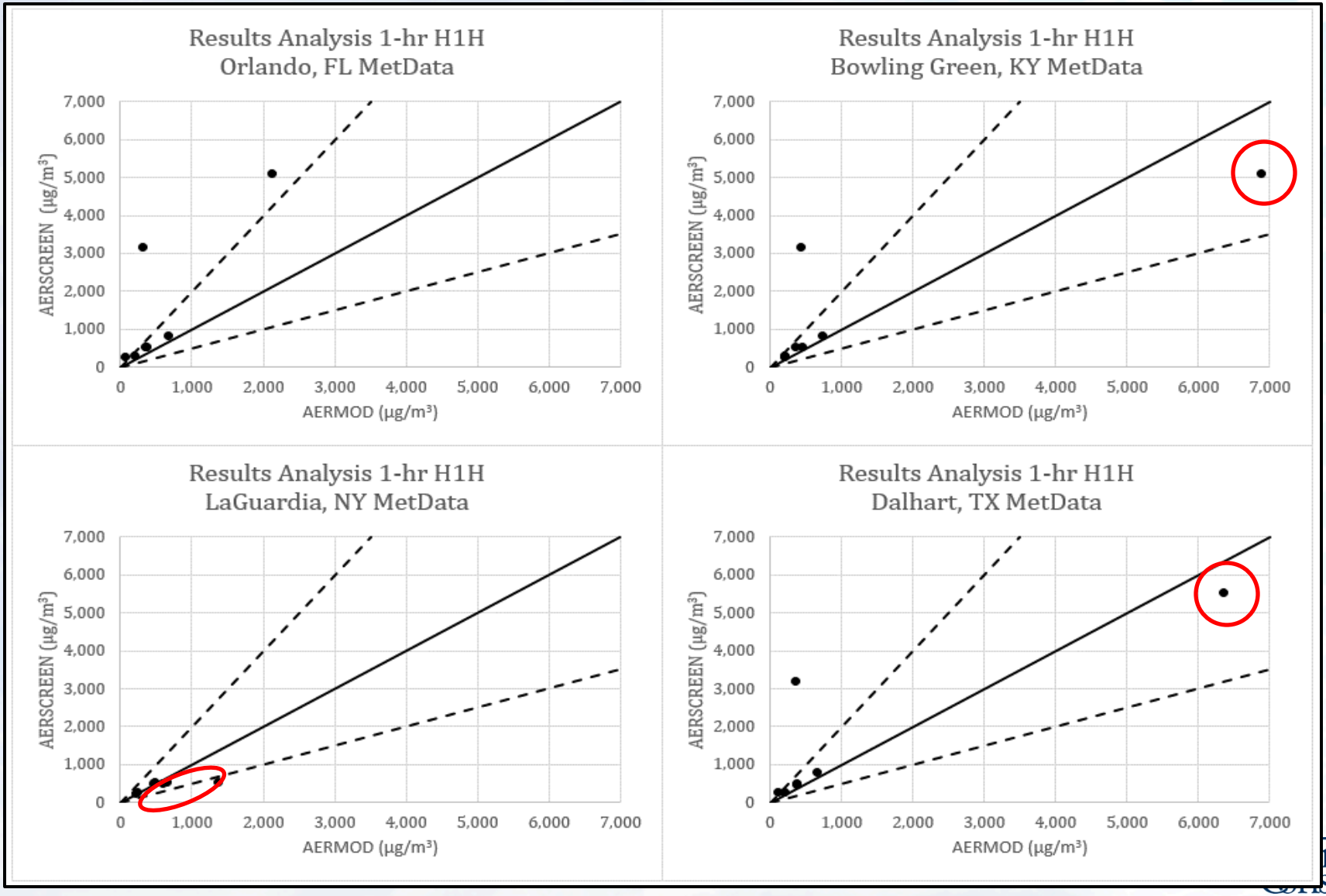
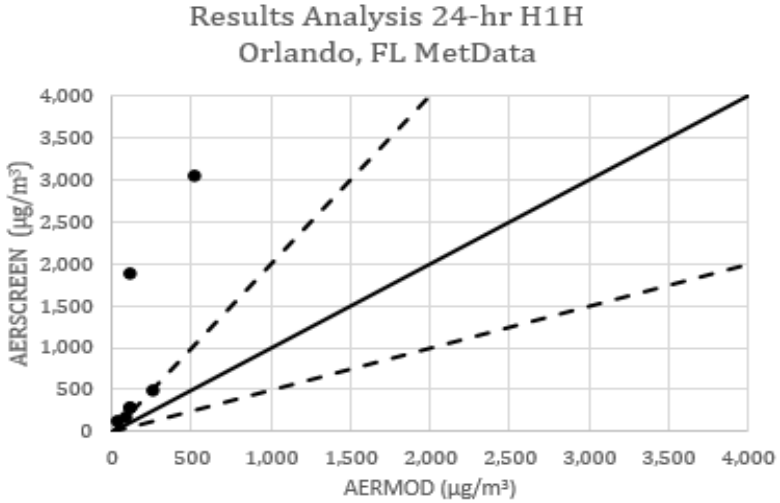
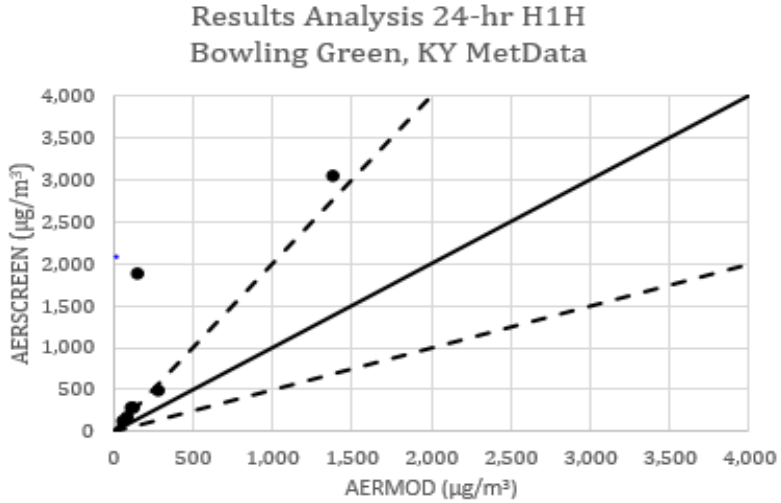
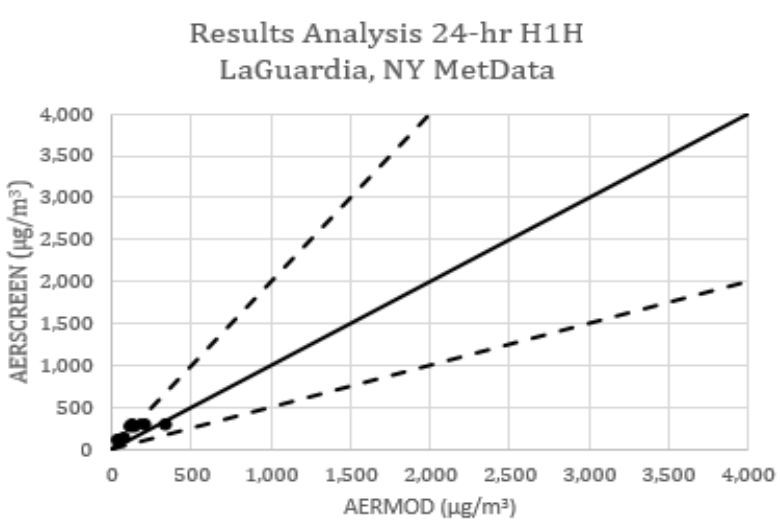
Comparison of 1-Hour Results

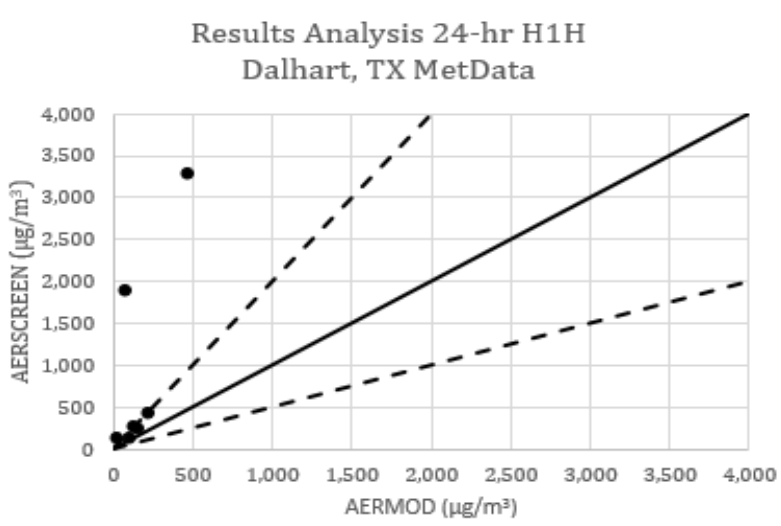


Comparison of 24-Hour Results

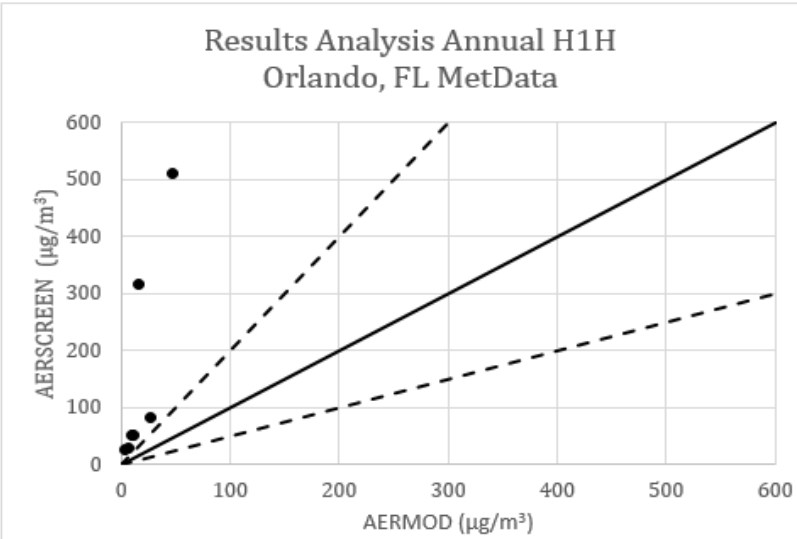


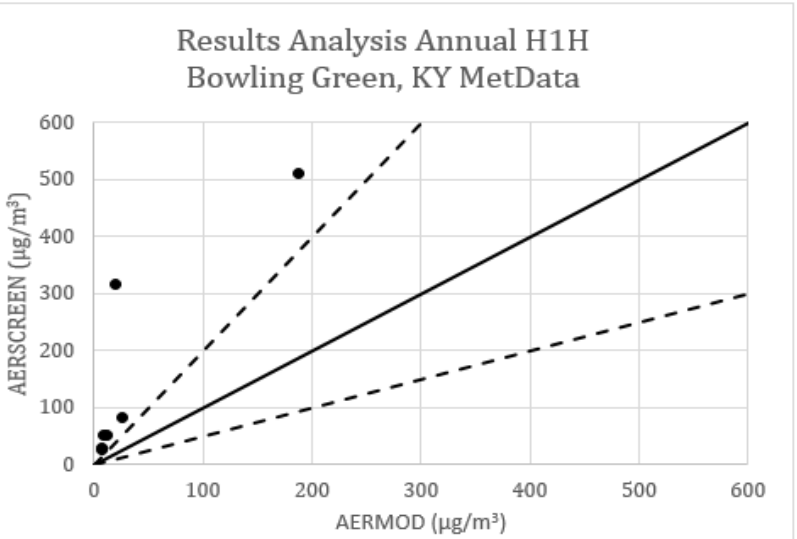


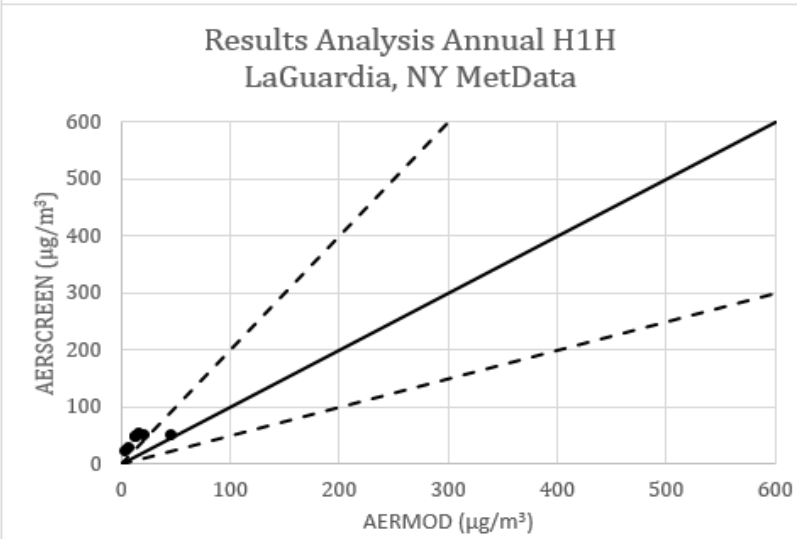


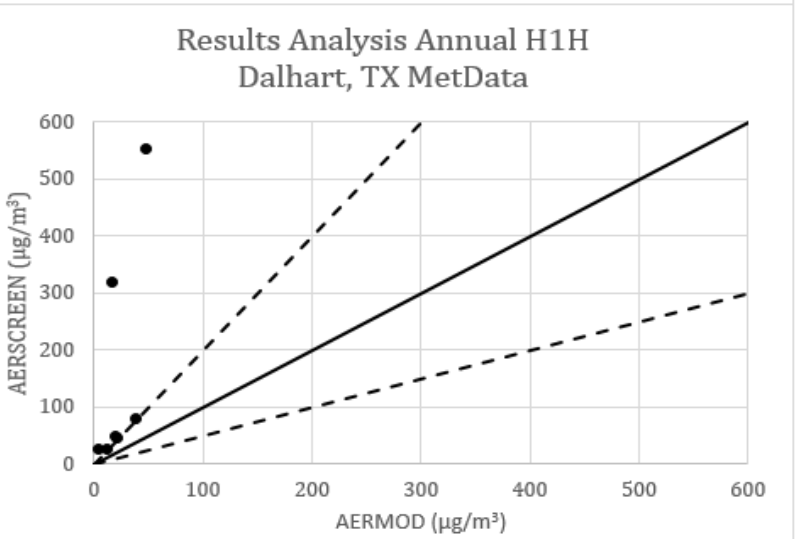


Comparison of Annual Results









Observations

1) AERSCREEN is not always higher than AERMOD for 1-hour concentrations
   a) Higher for stacks in rural
   b) Lower for most source types in urban
2) AERSCREEN is generally higher than AERMOD for 24-hour and annual concentrations except at LaGuardia

Conclusions

- AERSCREEN provides a basic screening tool that allows consideration of sources quickly
- AERSCREEN is not always conservative
  - Performs better in rural situations
  - Performs well for rural and area sources
  - Performs better for longer averaging periods
- Further comparisons of AERMOD to AERSCREEN should be conducted

Thank You

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