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Evolving Air Modeling Issues

AWMA SS♦ September 11, 2019

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Introduction

- > AERMOD design criteria per *Model Formulation Document*
 - ❖ Provide reasonable concentration estimates with minimal discontinuities
 - ❖ Be user friendly with reasonable input data and computer resources
 - ❖ Capture essential physical processes while remaining fundamentally simple
 - ❖ Accommodate modifications with ease as the science evolves
- > Several recent updates to AERMOD and potential updates to modeling guidance reflect these criteria

AERMOD Version Updates

- > New version of AERMOD released in July 2019 (version 19191)
 - ❖ 2007 - version 07026
 - ❖ 2009 - version 09292
 - ❖ 2012 - version 12345
 - ❖ 2014 - version 14134
 - ❖ 2015 - version 15181
 - ❖ 2016 - version 16216
 - ❖ 2018 - version 18081
- > AERMET and AERMAP also periodically updated

Use of New Model Versions

- > Whenever a new version comes out, the first (or maybe second) question is “when do I have to start using this??”
 - ❖ As usual, the answer is “it depends”
- > Considerations
 - ❖ What is the status of the project?
 - ◆ Working on preliminary modeling, protocol approved, application submitted, permit on public notice?
 - ❖ How sensitive is the project?
 - ❖ When in doubt, best to use latest version
 - ◆ Work with reviewing agency to confirm preference

Over the years

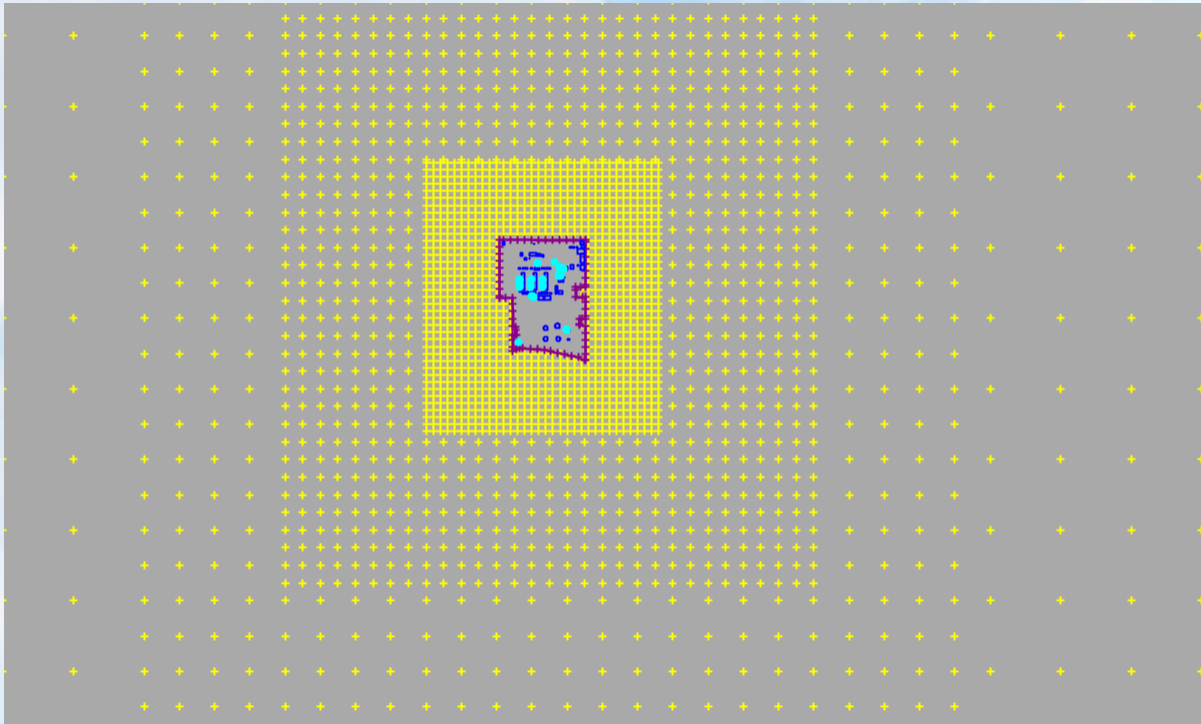
- > Various new pollutants and standards
- > PM_{2.5} and NO₂ typically present modeling challenges
- > PM_{2.5}
 - ❖ Initial PM_{2.5} NAAQS in 1997
 - ◆ 24-hour - 65 µg/m³
 - ◆ Annual - 15 µg/m³
 - ❖ PM₁₀ surrogate policy
 - ❖ 2006 Revisions to standards
 - ◆ 24-hour - 35 µg/m³
 - ◆ Annual - 15 µg/m³ (*lowered in 2012 again to 12 µg/m³*)
 - ❖ *Stringent project-specific SIL thresholds!*
 - ◆ 24-hour - 1.2 µg/m³
 - ◆ Annual - 0.3/0.2? µg/m³

Over the years (*continued*)

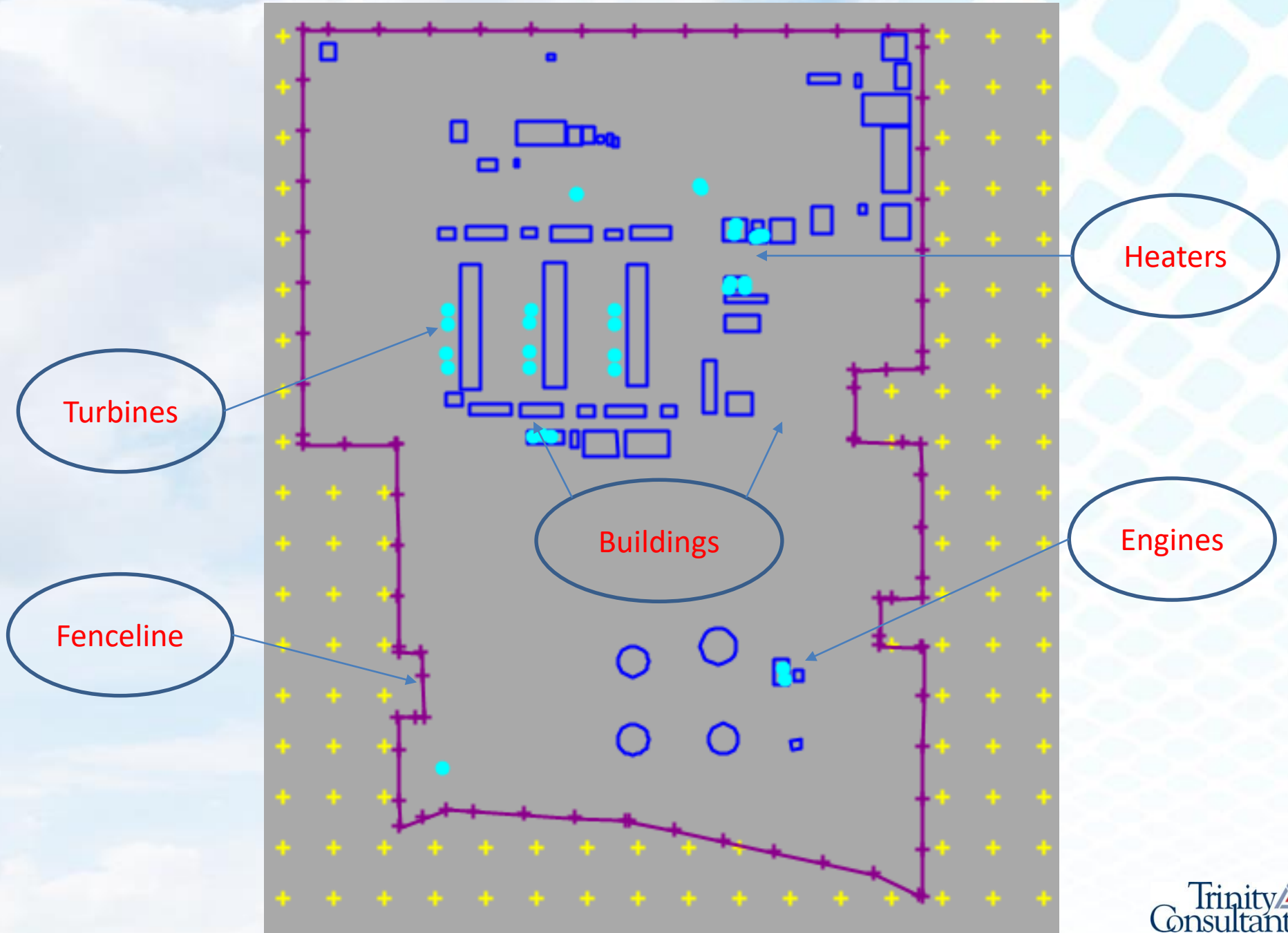
> NO₂

- ❖ Initial NO₂ NAAQS in 1971
 - ◆ Annual - 53 ppb (100 µg/m³)
 - ◆ Retained over the years
- ❖ 2010 Revisions to standards
 - ◆ 1-hour - 100 ppb (188 µg/m³)
- ❖ *Stringent project-specific SIL thresholds!*
 - ◆ 1-hour - **7.5** µg/m³ (*Interim values provided by EPA in 2010*)

Case Study Comparing Different Versions



- > Same Model Setup, no change to modeled emissions, structures, or stack information



Turbines

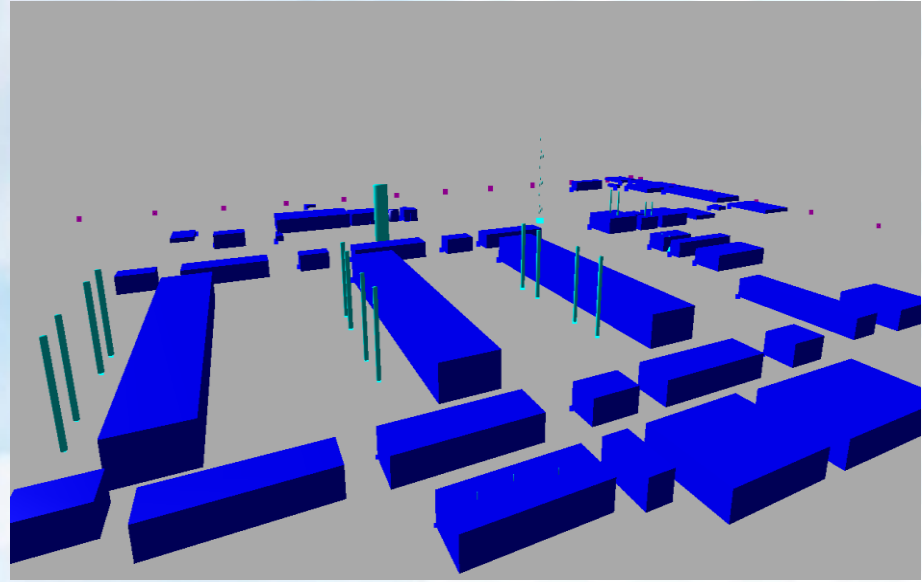
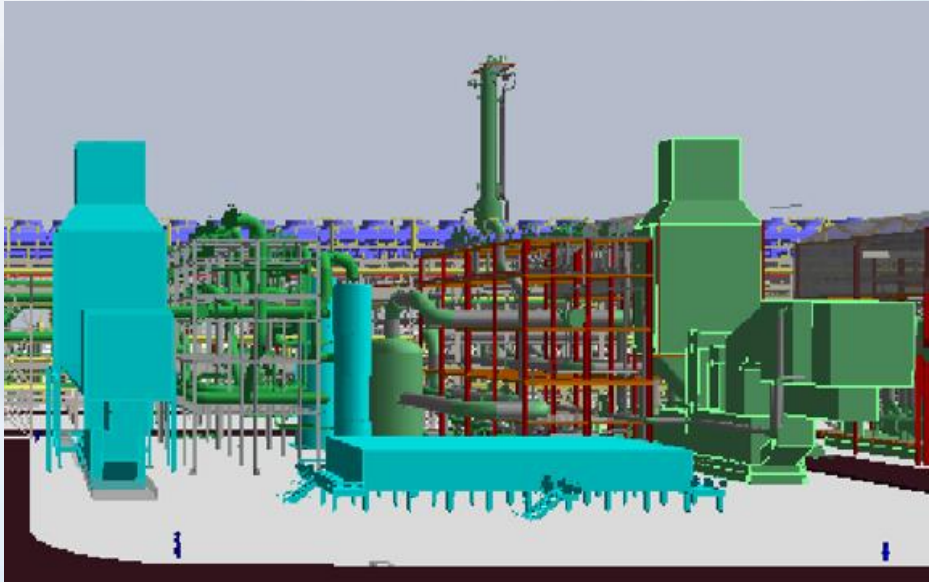
Fenceline

Buildings

Heaters

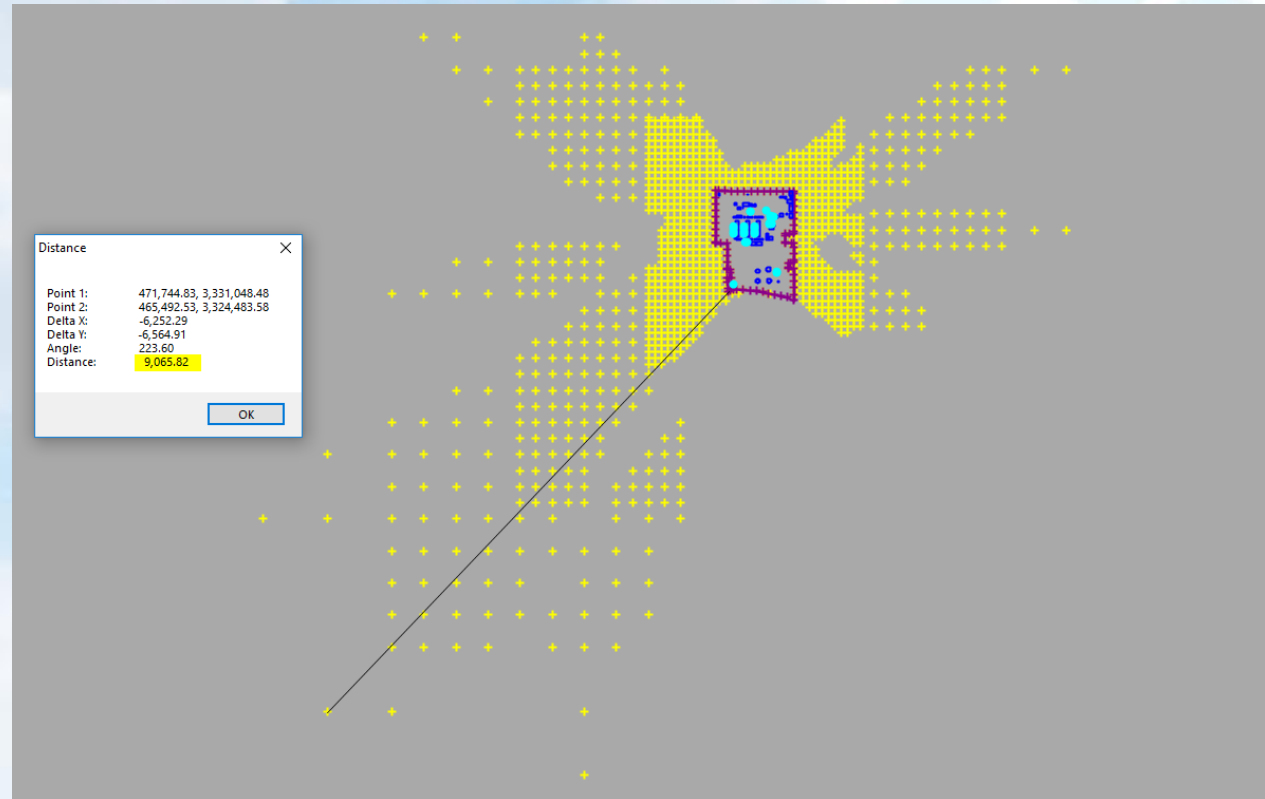
Engines

As-Built Design vs Model Setup



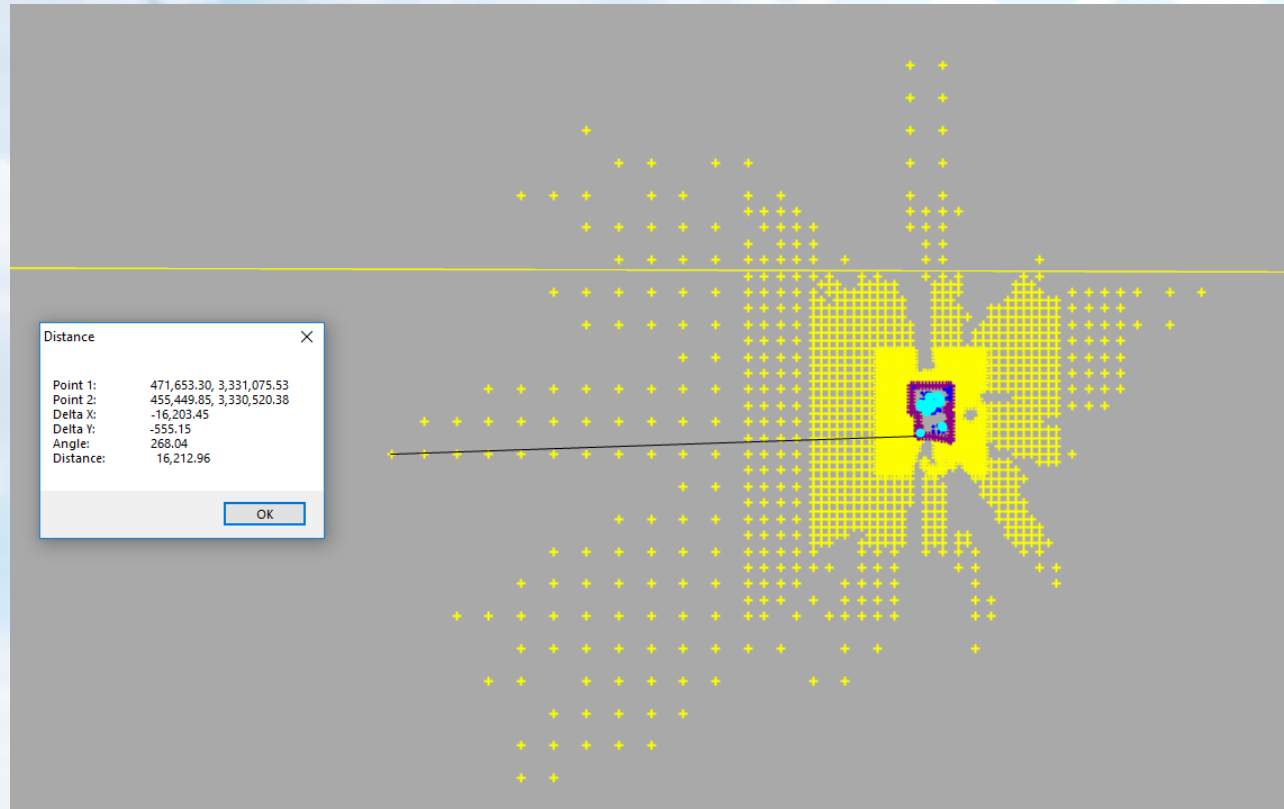
1-hr NO₂ Results Comparison

- > 2014 Version
- > 2009-2013 met. data
- > 1200 receptors
- > 9 km AOI
- > Result 18 µg/m³



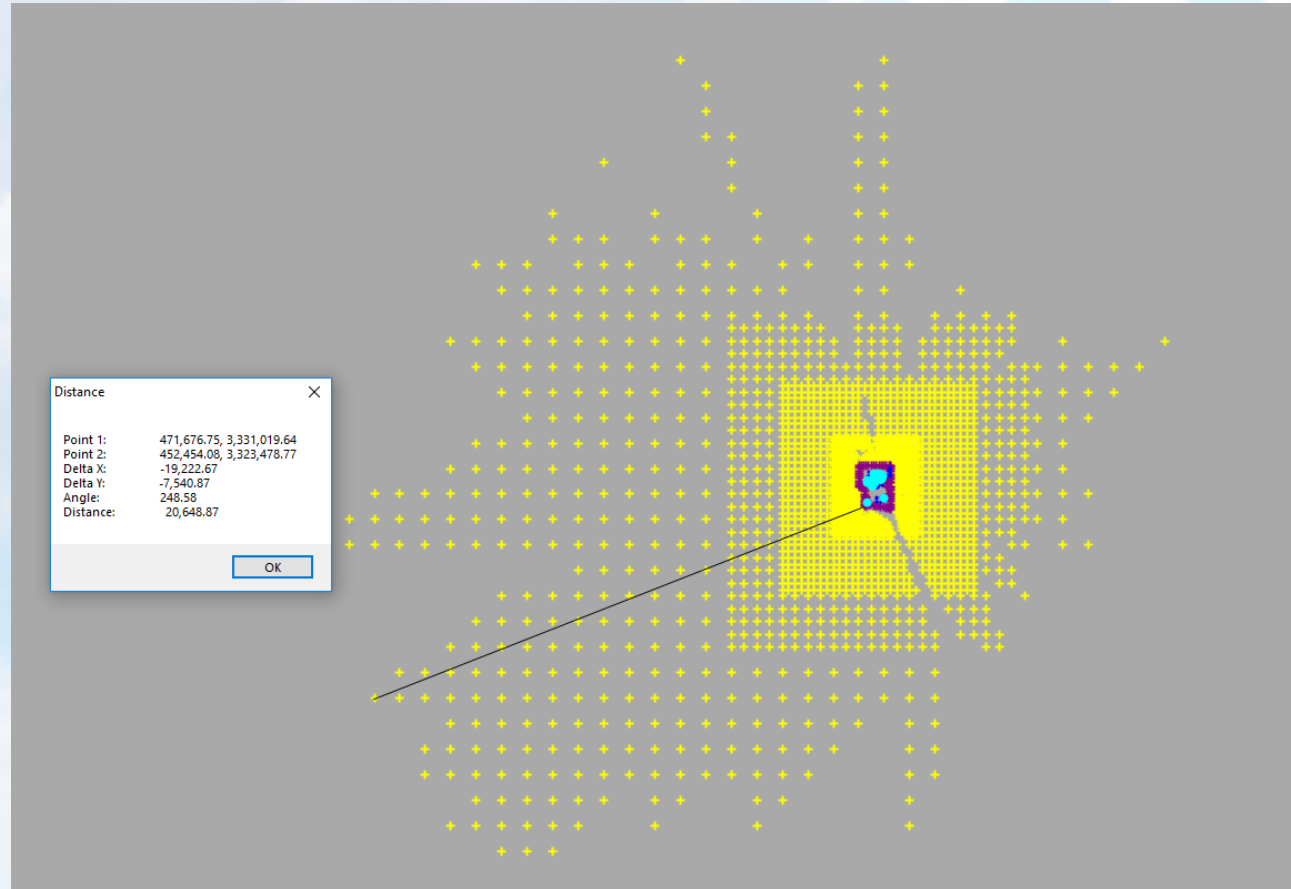
1-hr NO₂ Results Comparison

- > 2014 Version
- > 2013-2017 met. data
- > 2000 receptors
- > 16 km AOI
- > Result 20 µg/m³



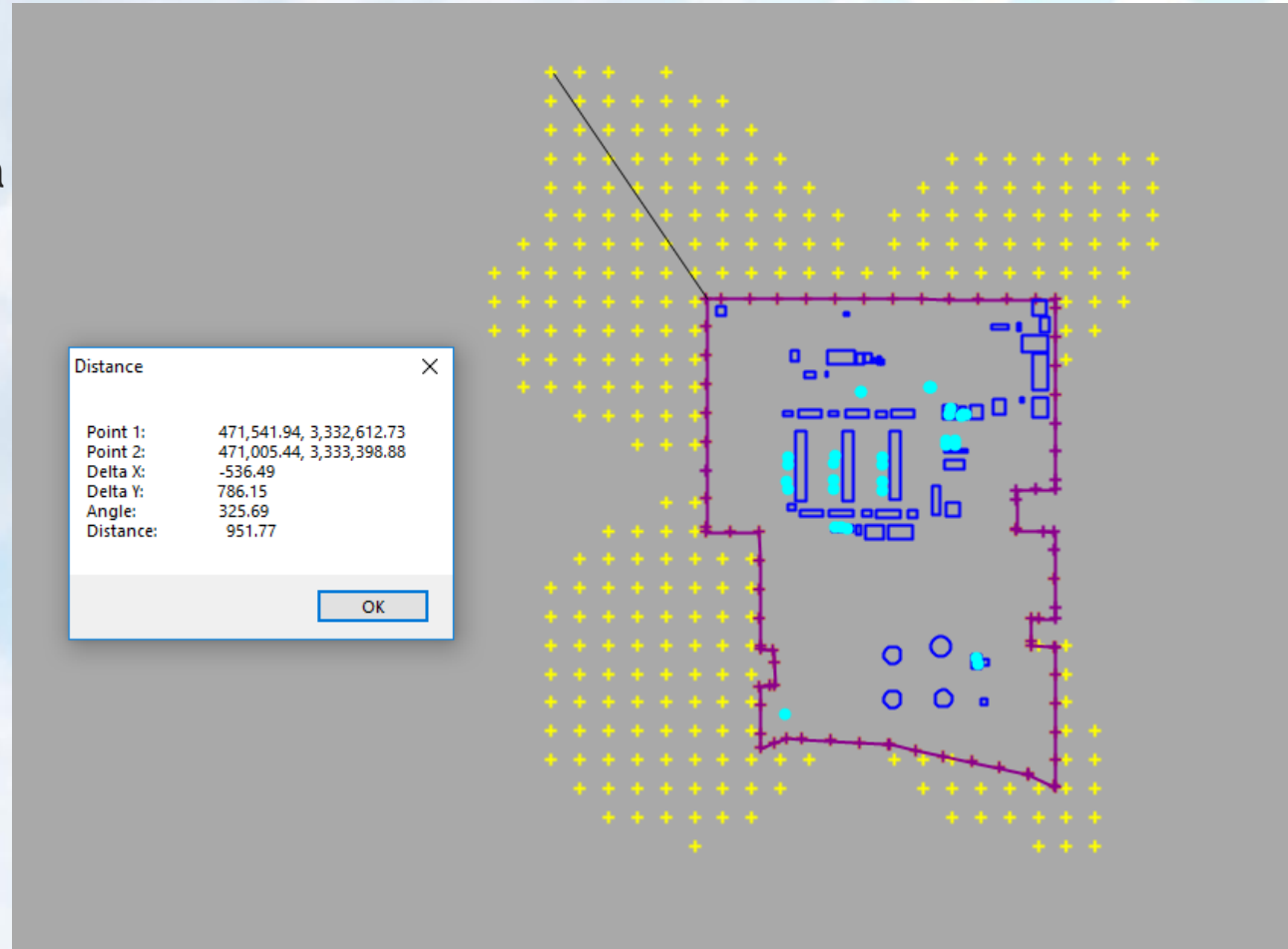
1-hr NO₂ Results Comparison

- > 2018 Version
- > 2013-2017 met. data
- > 2500 receptors
- > 20 km AOI
- > Result 17 µg/m³



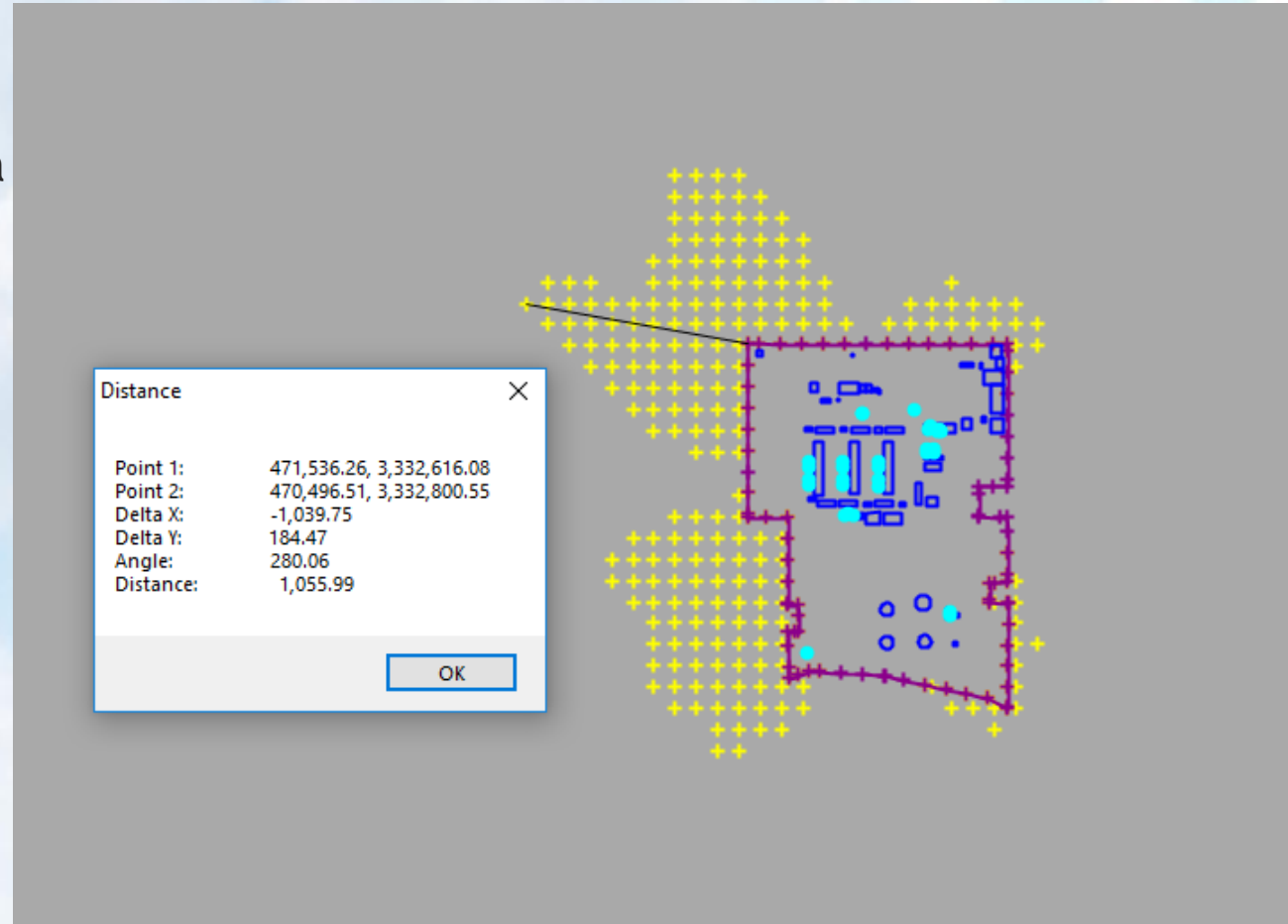
24-hr PM_{2.5} Results Comparison

- > 2014 Version
- > 2009-2013 met. data
- > 350 receptors
- > 0.9 km AOI
- > Result 3.5 µg/m³



24-hr PM_{2.5} Results Comparison

- > 2018 Version
- > 2013-2017 met. data
- > 280 receptors
- > 1.1 km AOI
- > Result 3.8 µg/m³



NO₂ 1-hr Results Comparison

Version	Meteorological Dataset	Result (µg/m ³)	Receptors	Area of Impact
2014	2009-2013	18	1150	9 km
2014	2013-2017	20	2000	16 km
2018	2013-2017	17	2500	20 km

Lower

Doubled

PM_{2.5} 24-hr Results Comparison

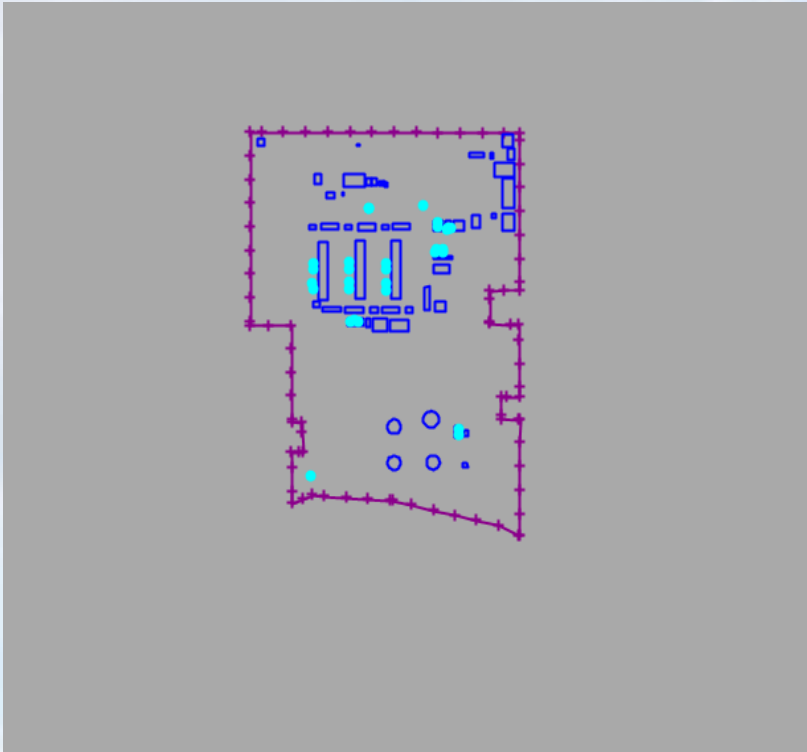
Version	Meteorological Dataset	Result (µg/m ³)	Receptors	Area of Impact
2014	2009-2013	3.5	350	0.9 km
2018	2013-2017	3.8	280	1.1 km

Higher

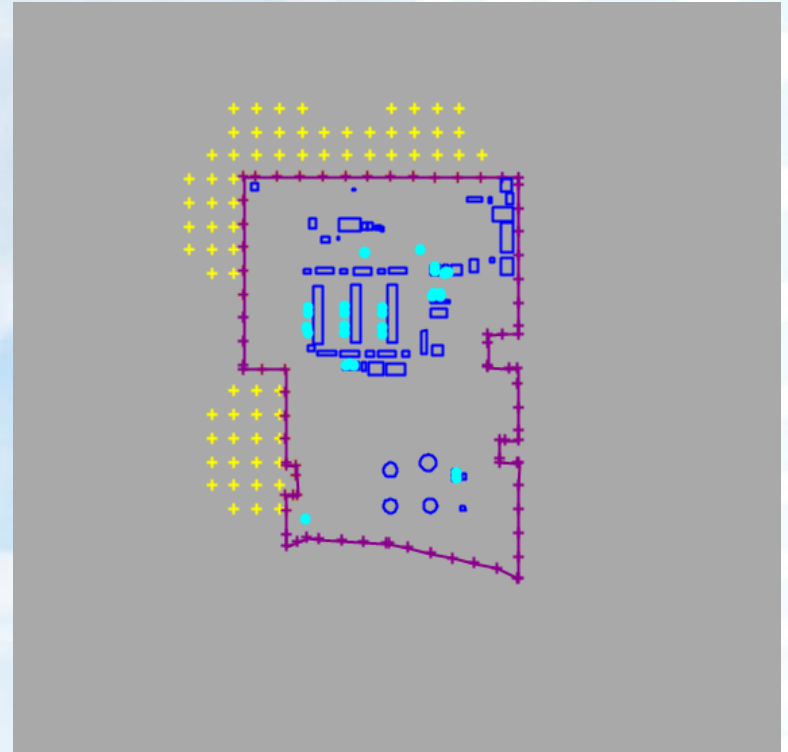
Fewer

Annual PM_{2.5} Threshold Change

Threshold at 0.3 $\mu\text{g}/\text{m}^3$



Threshold at 0.2 $\mu\text{g}/\text{m}^3$



Takeaways

- > Dispersion Modeling tends to play a large role in permit application timelines
- > Compliance has become more difficult over time
- > Changes in guidance and standards
- > Additional permitting and compliance costs for facilities
- > Communicate with state agency/ EPA to avoid surprises and re-modeling!!



Questions



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