Case Studies on the Impact of Draft SIL Guidance for Permitting

NCASI West Coast Regional Meeting

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Background – PSD Modeling

- Modeling to demonstrate compliance with NAAQS required for …
  - New major sources (> 100 or 250 tpy depending on "List of 28" status)
  - Major modifications to existing sources
    - Existing minor sources…
      emissions increase > 100 or 250 tpy
    - Existing major sources… emissions increase > PSD Significant Emission Rate ("SER")

      Ozone – 40 tpy of VOC or NO_2
      $PM_{2.5}$ – direct 10 tpy or 40 tpy of SO_2 or NO_2
      (unless demonstrated not to be a precursor)

PSD Modeling Flow Chart

Role of SIL

- It's a good thing…
- Significance analysis is the first step in PSD modeling
- If modeled project impact < SIL
  - PSD modeling obligation is complete
  - Significant reduction in project timeline
  - Significant resource savings
  - Avoid potential issues with demonstrating compliance with NAAQS
  - Optimal solution for areas with very small to no headroom

Proposed Ozone & $PM_{2.5}$ SILs

NAAQS level	NAAQS SIL Concentration	PSD Increment SIL Concentration		
		Class I	Class II	Class III
Ozone 8-Hour (70 ppb)	1.0 ppb	There is no O_3 increment value		
$PM_{2.5}$ 24-Hour (35 mg/m^3)	1.2 $\mu g/m^3$	0.27 $\mu g/m^3$	1.2 $\mu g/m^3$	1.2 $\mu g/m^3$
$PM_{2.5}$ Annual (12 mg/m^3)	0.2 $\mu g/m^3$	0.05 $\mu g/m^3$	0.2 $\mu g/m^3$	0.2 $\mu g/m^3$

- $PM_{2.5}$ 24-hour derived value 1.3 $\mu g/m^3$
- $PM_{2.5}$ Annual current value in rule 0.3 $\mu g/m^3$
- No additional justification may be required

$PM_{2.5}$ SIL Sample Project #1

- Minor Source State Permitting Project.
- State Requires SIL analysis for projects that are > 50% of SER for $PM_{2.5}$.
- Pulp and paper mill adding a precipitated calcium carbonate (PCC) Plant and rerouting a portion of existing Lime Kiln exhaust to new PCC Plant. Affected sources included:
  - Lime Kiln (147ft Stack-0.24lb/hr)
  - PCC Plant (170ft Stack-1.13lb/hr)
  - PCC Plant Cooling Tower (31ft Stack-0.25lb/hr)
  - PCC Lime Storage Silo (84ft stack-0.31lb/hr)

$PM_{2.5}$ SIL Sample Project #1

- AERMOD
- Simple Terrain
- 5-Years of NWS Meteorological Data
- Relatively Large Ambient Air Boundary

Analysis Type	Averaging Period	Form	Proposed SIL μg/m³	Modeled Concentration μg/m³
NAAQS	24-Hour	5-Year Average H1H	1.2	1.16
	Annual	5-Year Average Annual	0.2	0.13*

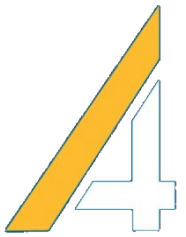
*achieved using stack height modification

Ozone SIL Case Study

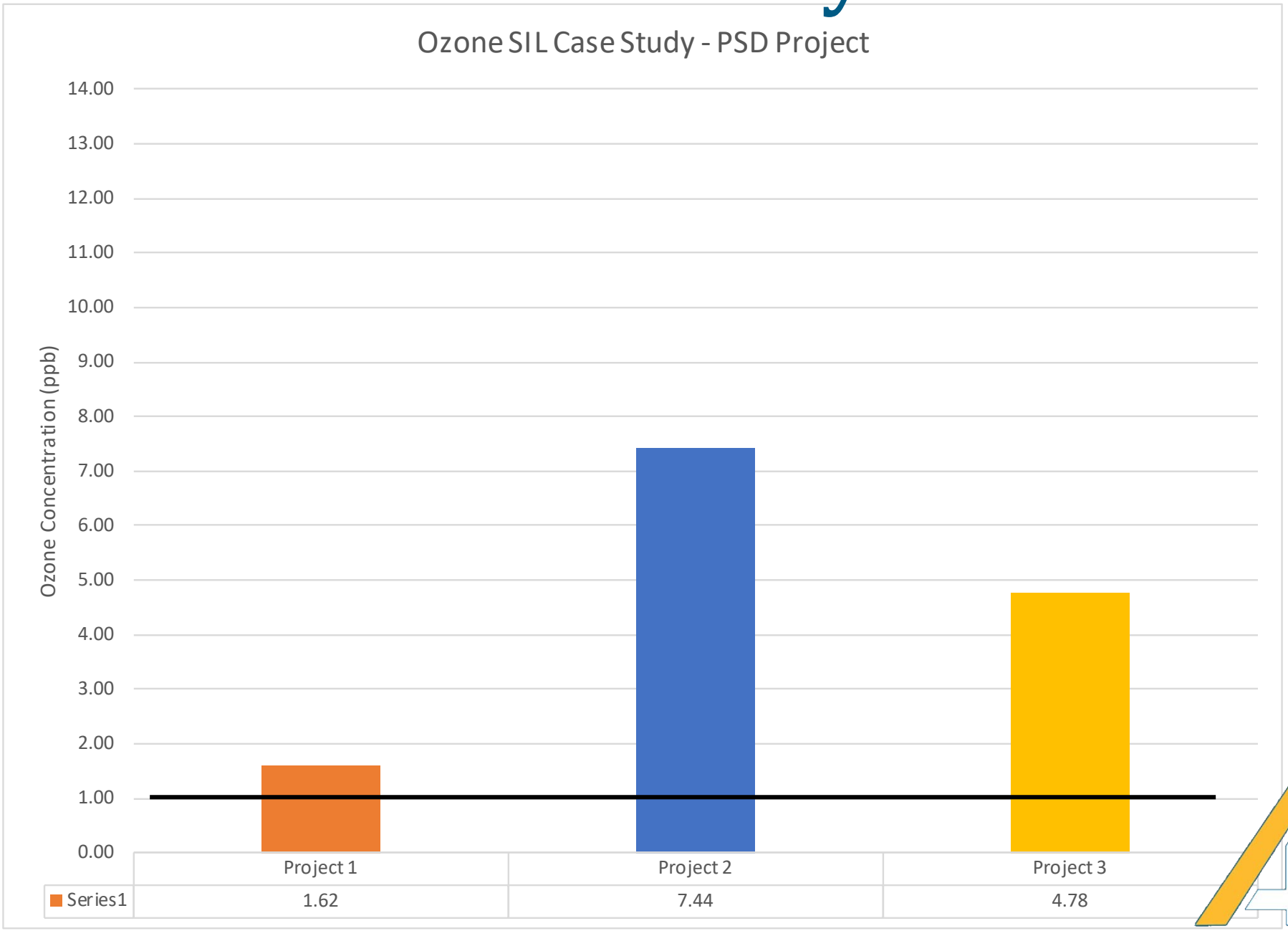
- There is no single source model for ozone modeling. AERMOD is used in lieu.
- Ratio Method
  - Determine maximum NO_2 concentration from project emission increases at 10 kilometer (km) radius
  - Assume full NOx to NO_2 conversion
  - Convert the maximum highest 1st high (H1H) NO_2 concentration from µg/m^3 to ppm
  - Determine ozone concentration by assuming 90% of NO_2 is converted to ozone using conversion ratio of 1 mole of NO_2 produces 3 moles (or 5 moles) of ozone

Ozone SIL Case Study

- Three hypothetical PSD projects at mills in Alabama, Maine, and Michigan
  - Project 1 – Paper machine modification to change the product to unbleached linerboard production
  - Project 2 – Recovery furnace modification to increase recovery cycle capacity
  - Project 3 – Lime kiln modification to increase the production or natural gas conversion
- For simplicity, the project emission increase was set to 1xSER (40 TPY) and individual sources normalized



Ozone SIL Case Study – Results



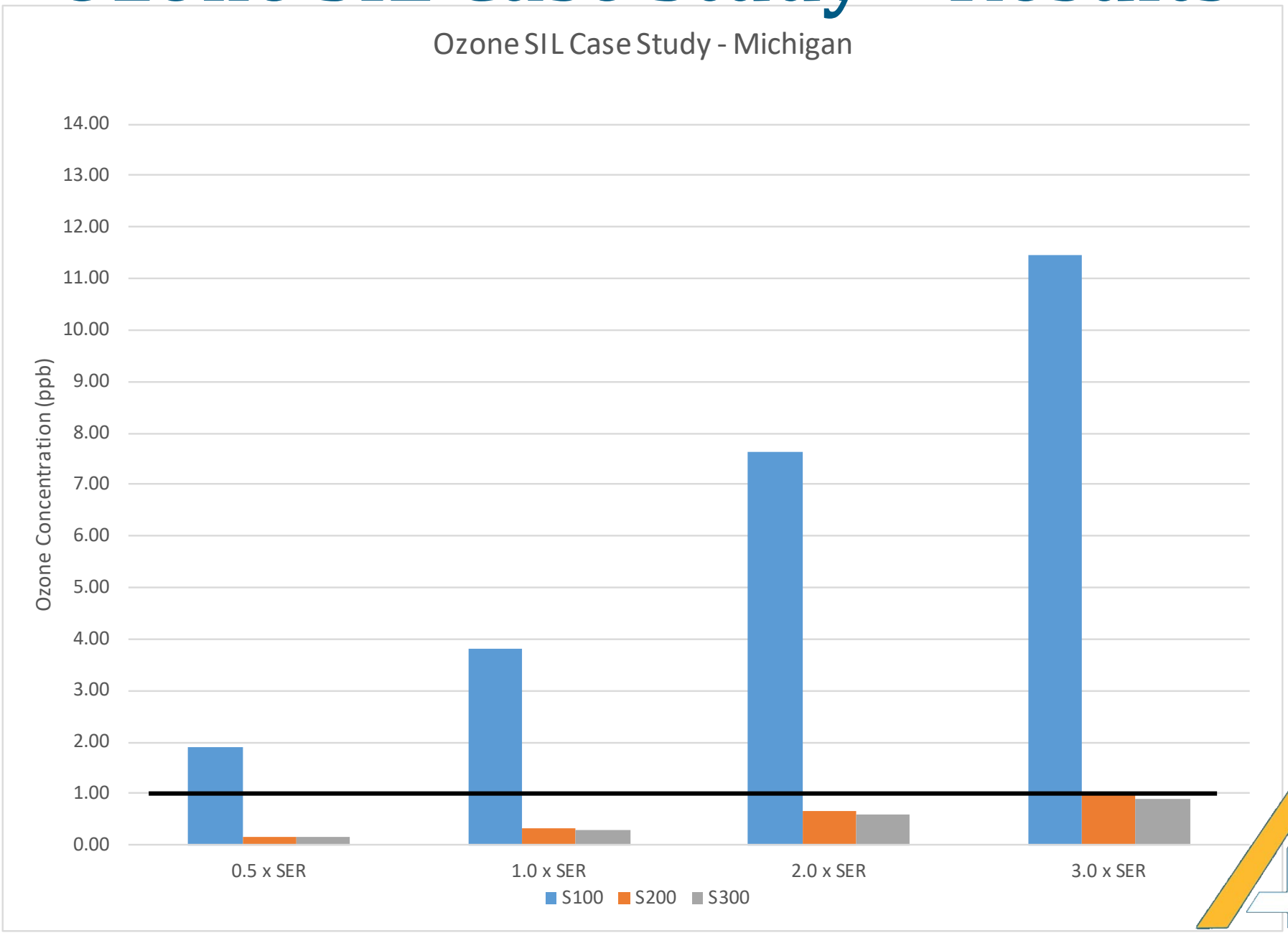
Ozone SIL Case Study

- Three hypothetical sources at three locations in Michigan, Pennsylvania, and Virginia
- Consider four project emission increases of NOx
  - 0.5 x SER
  - 1.0 x SER
  - 2.0 x SER
  - 3.0 x SER

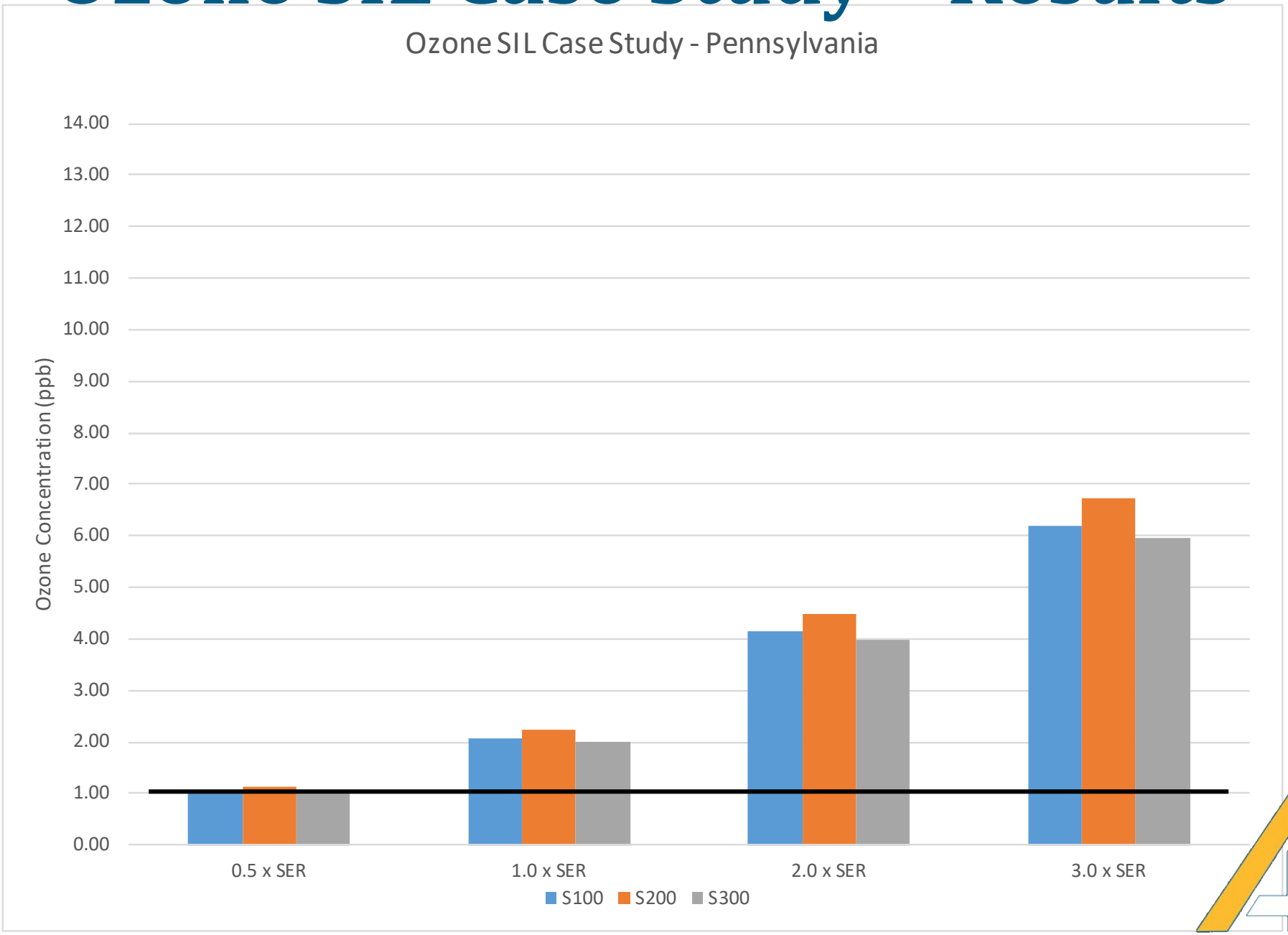
Description	Stack Height (ft)	Stack Temp (K)	Stack Velocity (m/s)	Stack Diameter (ft)
S100	100	922	3.9	3.94
S200	200	466.5	27.8	7.55
S300	300	360	13.1	9.75

- Three different stack configuration representing various combustion and process sources e.g. auxiliary boiler, re-heaters, thermal oxidizers, coaters etc.

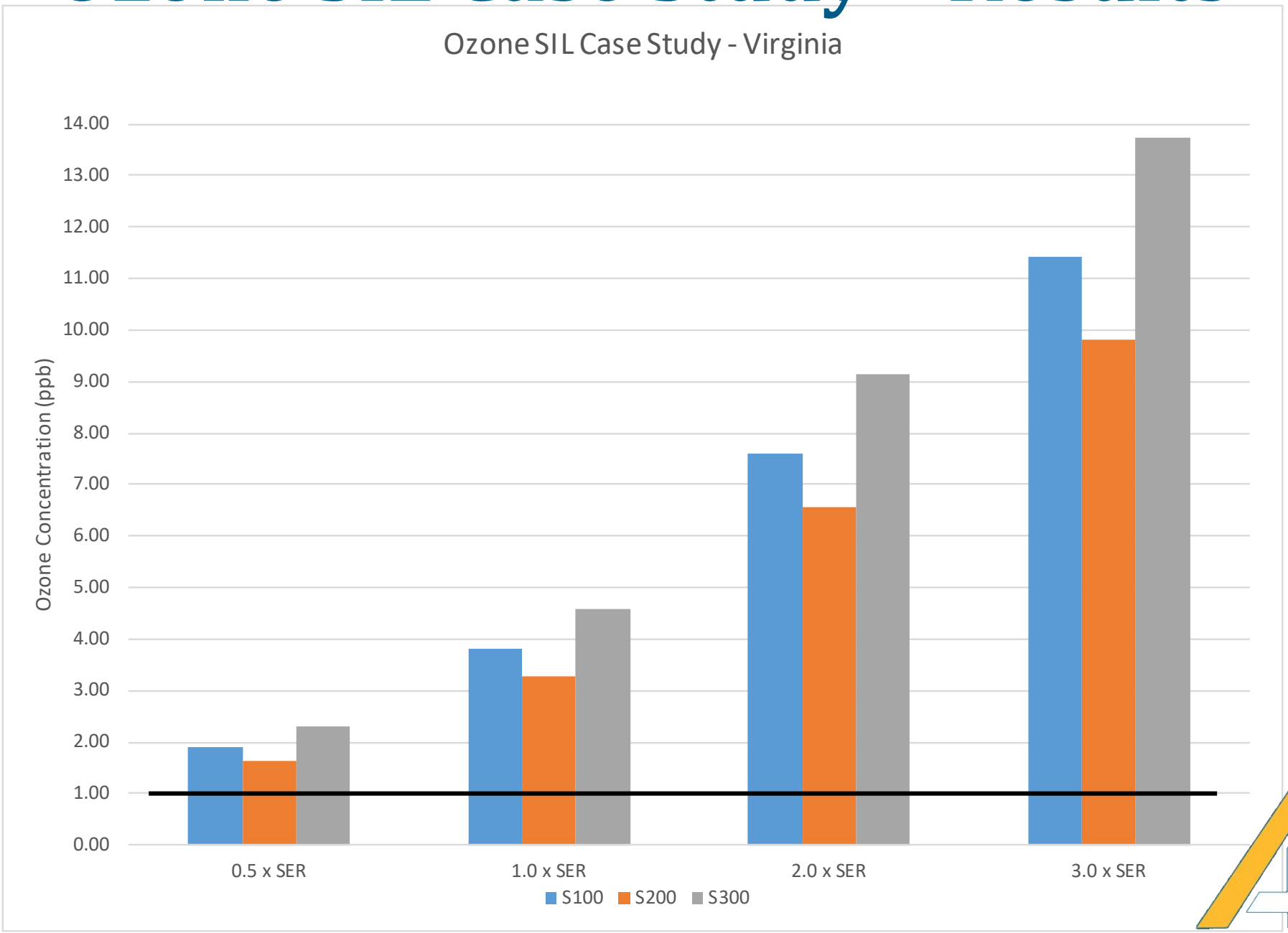
Ozone SIL Case Study – Results



Ozone SIL Case Study – Results



Ozone SIL Case Study – Results

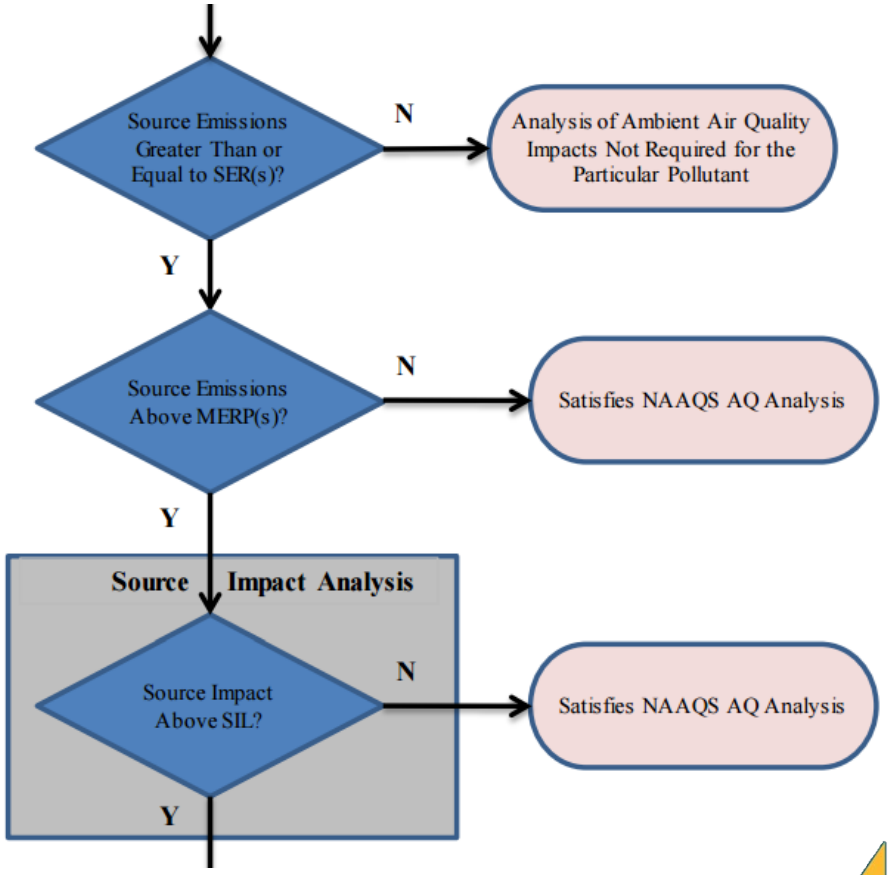


Ozone SIL Case Study

- Currently, there is no EPA preferred or recommended single source ozone model
- Qualitative or pseudo quantitative methodology such as ratio method are the only options currently available but these methods are conservative
- All sources configurations can trigger full impact analysis even at small emissions rates
- How will MERPs fit in?
- Ozone is a regional phenomenon, therefore, use of an universal SIL value needs to be evaluated

What about MERPs?

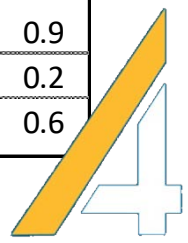
- Model Emissions Rates for Precursors (MERPs) is a new concept introduced as part of the proposed Appendix W changes
- A source with precursor emissions below the MERP level will have ambient impacts that will be less that the SIL
  - Current status – unknown
  - Format of MERP – unknown
  - Separate rulemaking will be required
- MERP will not replace SER



Ozone SIL Case Study - Solution

- Photochemical Modeling – CAMx or CMAQ
- EPA's proposed Appendix W updates suggest use of photochemical models CAMx or CMAQ
  - Advanced photo-chemistry
  - More realistic results
  - More resources and time required (??)
- CAMx experience with ozone assessments

Project Description	Emissions Increase (tpy)	AERMOD Predicted Ozone Concentration (ppb)	CAMx Predicted Ozone Concentration (ppb)
Expansion Project at a LNG Facility	~ 2,000	~ 6.0	0.9
Greenfield Cement Plant	~ 500	~ 3.0	0.2
PSD project at a Chemical Plant	~ 200	~ 3.0	0.6



How will this affect PSD Project?

- Availability of SIL means possibility to avoid full impact NAAQS analysis
  - Significant time and resources savings
- However:
  - The proposed SILs are very stringent and demonstrating impact below SIL will be very difficult
  - Potentially significant controls might require
  - Current techniques used to predict ozone and secondary $PM_{2.5}$ concentration are not sufficient to tackle these stringent SIL values
  - Advanced models such as CAMx and CMAQ can be very useful to demonstrate compliance with SIL
  - Plan ahead – conduct fatal flaw analysis

Questions and Discussion

Thank You !!!

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EPA Methodology

- EPA used air quality variability approach to derive the SIL values
  - Conceptual statistical framework of "***statistical significance***" to identify level of change in air quality concentrations
  - Use of bootstrapping method to estimate the distribution of the air quality levels
  - Quantification of the degree of air quality variability at an ambient monitoring site and confidence level (CI) or statistical measure to determine the ***noise*** at each monitor
  - The 50% CI at each monitor selected decide the bounds that represent statistical insignificance

Implementation and Timeline

- This is a non-binding guidance to permitting authorities to consider the use of SIL
  - Permitting authorities can use the same SIL values without any justification
  - Permitting authorities can use different SIL values with valid justification
  - Permitting authority can elect ***NOT*** to use SIL values
- Comments on the draft guidance are requested by September 30, 2016
- EPA is not clear on when the draft guidance will be finalized, if past such guidance are any indication it will be ***never***

Implementation and Timeline

- Permitting authority
  - ***State agency*** for states with SIP-approved PSD program
  - ***EPA*** for states without SIP-approved PSD program
- EPA's plan:
  - Gain valuable experience and information on use of discretion by permitting authorities and justification
  - Use this experience to assess, refine, and codify SIL values in a potential binding rulemaking
- EPA is currently ***NOT*** considering any such rulemaking for Ozone or $PM_{2.5}$ SIL in near future