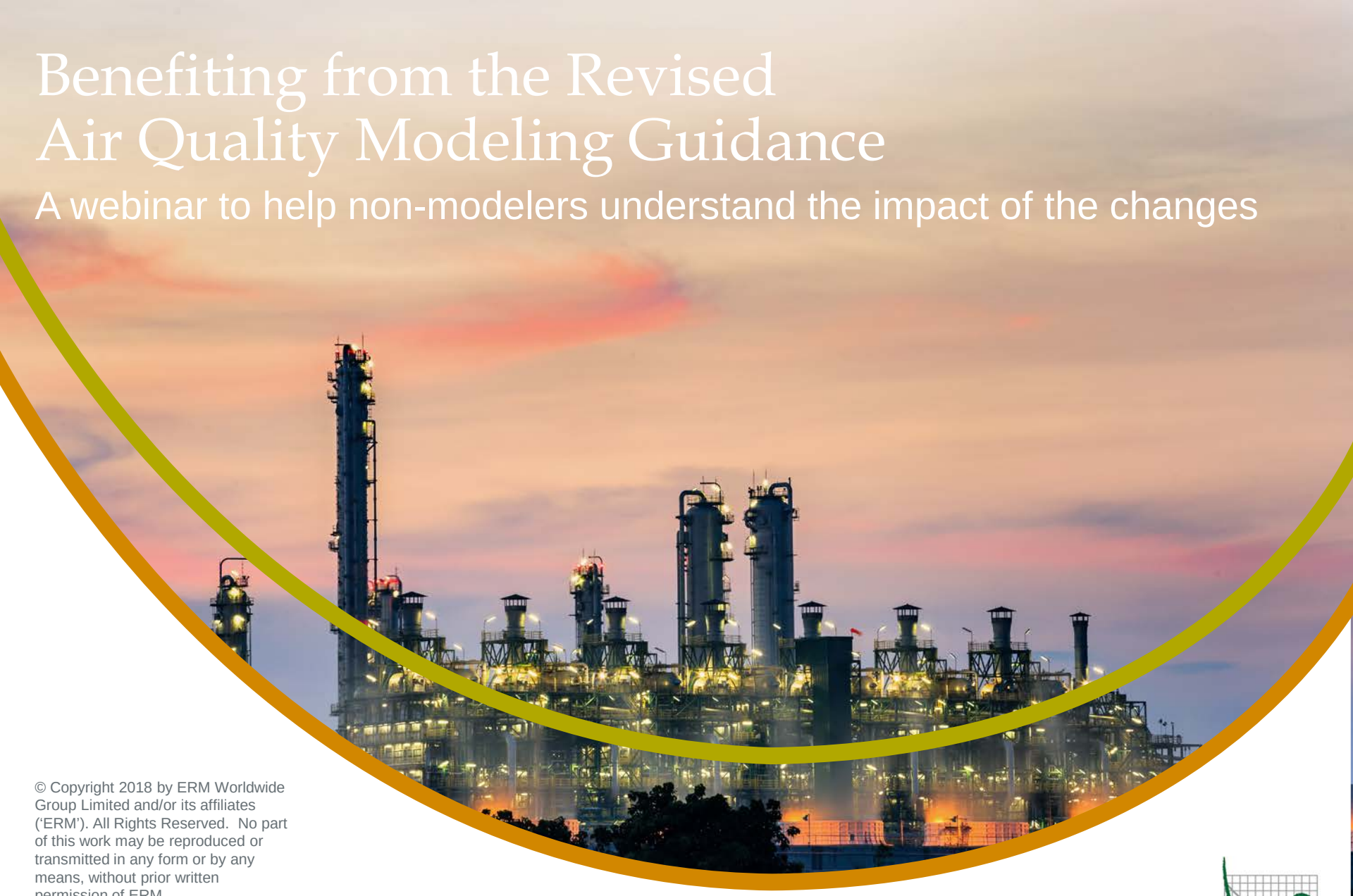
Benefiting from the Revised Air Quality Modeling Guidance

A webinar to help non-modelers understand the impact of the changes



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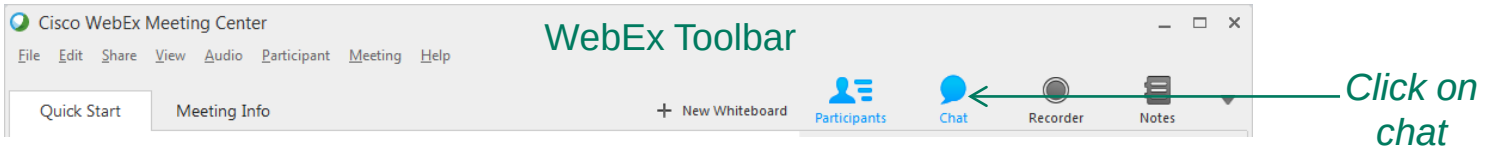
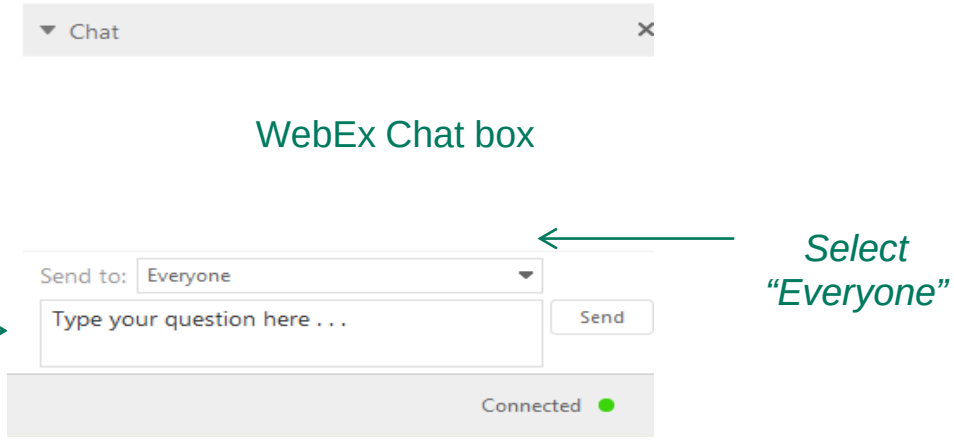
Welcome

- This presentation will be recorded and all who registered will receive a follow-up email containing a link to the presentation within a week.
- Participants can ask questions throughout the presentation using the WebEx chat function and they will be answered during the last 15 minutes of the webinar in the order that they were received.



- Send your question to “Everyone” so that those answering the questions will be able to see them.



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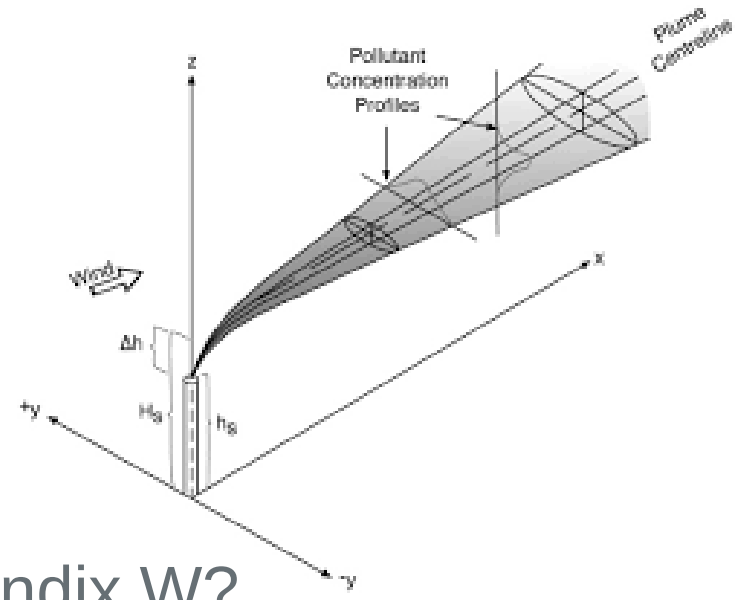
Webinar Overview

- Why and When is Modeling Required?
- What is Appendix W and Why is it important?
- How has Air Permitting been affected by the changes to Appendix W?
- Strategies for Benefiting from the Changes
- Pending Future Changes
- Questions and Answers



Why Air Dispersion Modeling?

The Clean Air Act (CAA) is the most complex of the US Environmental Laws

- Requires the EPA to establish and continuously update National Ambient Air Quality Standards (NAAQS)
- Mandated an EPA permitting program to enforce Prevention of Significant Deterioration (PSD)
- The Air Permit is the Permit to Construct for most large scale capital projects
- Impacts every industrial sector
- Opponents focus on using the CAA to block new development and shut down existing plants

What is Appendix W?

The Guideline on Air Quality Models (40 CFR Part 51, Appendix W) establishes approved models and modeling techniques that may be used for regulatory modeling

Local Scale (50km) – AERMOD

- Major Source Permitting
- Federal Designation Programs
- State-Specific initiatives and programs

Regional Scale (50km+)

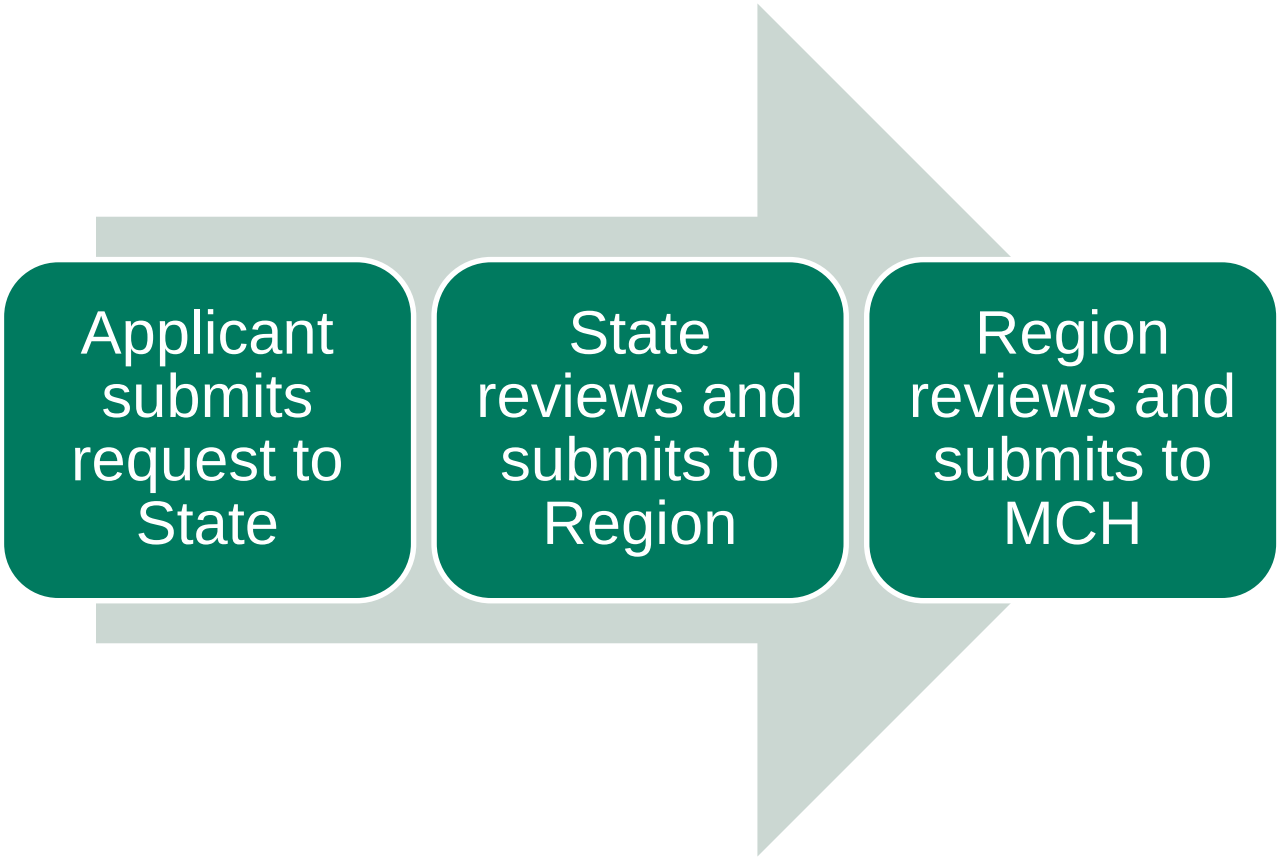
CALPUFF, CAMx, CMAQ, SCICHEM

- Class I Analyses
- Regional Haze
- State Implementation Planning
- Single Source Ozone and Secondary $PM_{2.5}$ Impacts

Key Appendix W Changes

1. When cumulative modeling is required and how it is performed
   - Use of the Significant Impact Level (SIL)
   - Simplification of cumulative modeling domain
2. Revisions to the AERMOD Modeling System
   - New version of AERMET & AERMOD including revised options for NO_x-to-NO_2 conversion and fixes dealing with known over-predictions in low-wind events.
   - A new option for generating prognostic meteorological data.
   - Incorporation of the BLP and CALINE3 models to cover buoyant line sources (e.g. aluminum pot lines, roof monitors) and highway emissions.
   - Replacement of SCREEN3 with AERSCREEN.
3. Removal of CALPUFF as preferred model
4. Requirement to account for secondary pollutant (Ozone and $PM_{2.5}$) formation for single sources.
5. Model Clearinghouse Procedure

Model Clearinghouse Process



Where the Rubber Met the Road

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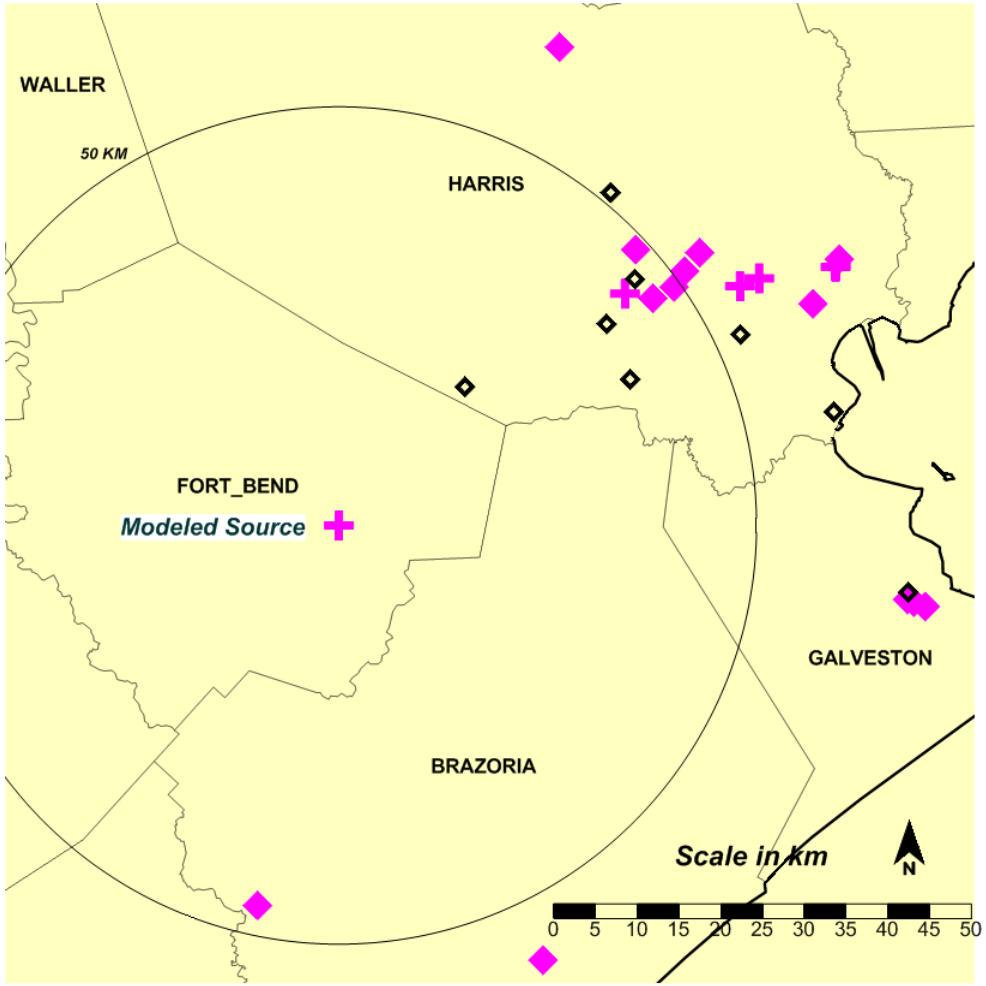
Case Study #1

Treatment of Background: Sources, Measurements



- Cumulative model runs are frequently the source of schedule delays and cost increases for new projects and for existing sources that must address NAAQS or PSD increments.
- Domain Size, coupled with poor inventories, is often one of the most significant time and resource- intensive parts of a NAAQS analysis
- EPA: “10-20 km”; states not all on board

Simple, effective solutions: Travel Time, Measurements

Case Study #1- Continued

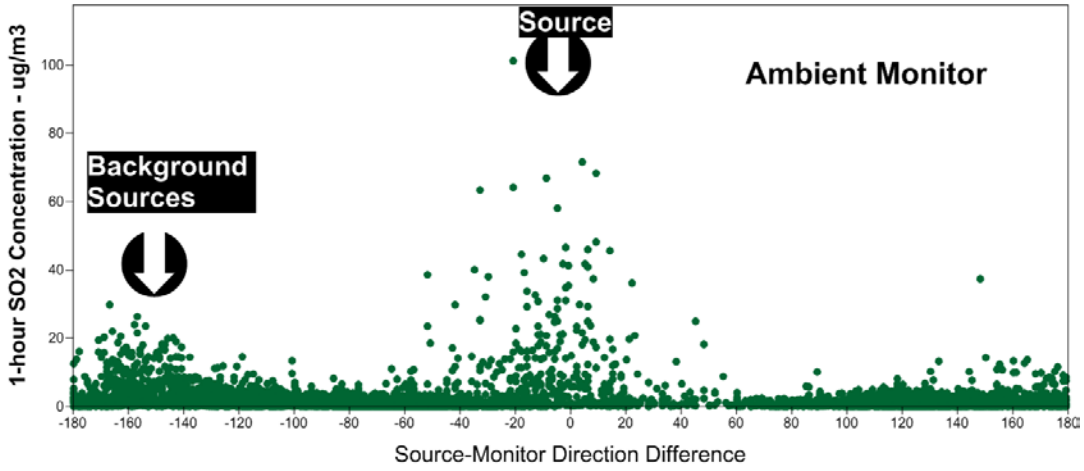
Treatment of Background: Sources, Measurements

			SO2 TPY (NEI 2011) within distance shown			Kilometers
			0-10 km	10-25 km	25-50 km	From Source
	Modeled Source		5	1	5,673	
Monitor i.d.	Name	City				
48-029-0059	Calaveras_Lake	San_Antonio	23,269	9	1,213	259.02
48-139-0016	Midlothian	Midlothian	6,704	54	743	357.58
48-139-1044	Italy	Not_in_a_city	0	4	7,026	320.65
48-167-0005	Texas_City	Texas_City	1,046	16	11,993	68.48
48-183-0001	Longview	Not_in_a_city	37	76,339	852	332.61
48-201-0046	North_Wayside	Houston	194	10,056	2,257	51.42
48-201-0051	Croquet	Houston	1	53,864	8,130	22.44
48-201-0062	Monroe	Houston	87	10,140	52,911	38.97
48-201-0416	Park_Place	Houston	5,287	4,974	52,608	40.07
48-201-1035	Clinton	Houston	5,915	6,278	49,874	46.06
48-201-1039	Deer_Park	Deer_Park	5,103	7,097	1,386	53.16
48-201-1050	Seabrook	Seabrook	49	8,419	4,930	60.72
48-245-0009	Beaumont	Beaumont	1,067	10,756	6,830	162.37

- **Measured Background: potentially problematical.**

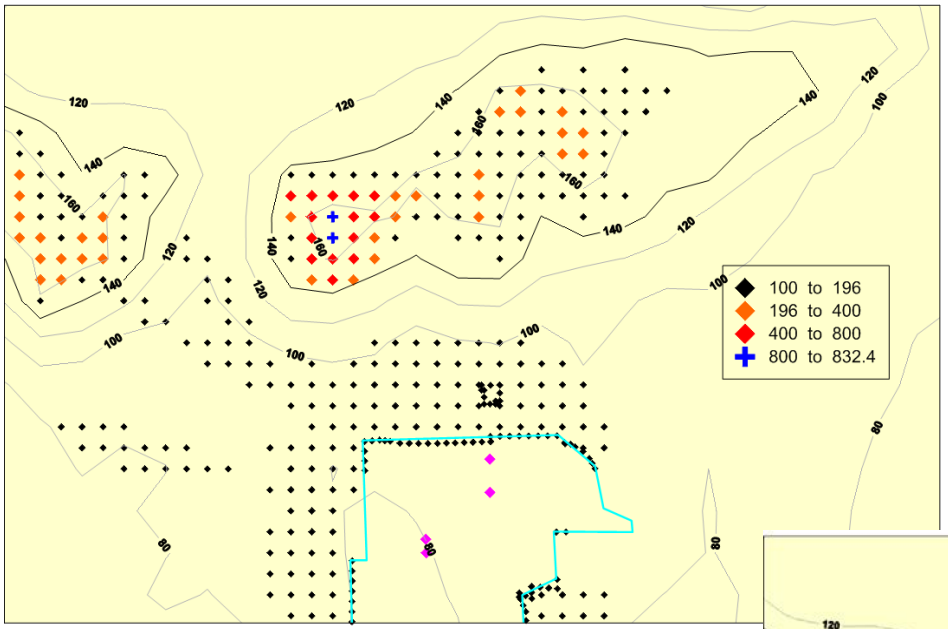
Surroundings, surroundings, surroundings

- **What is around the measurement site?**
- **What does the monitor see?**



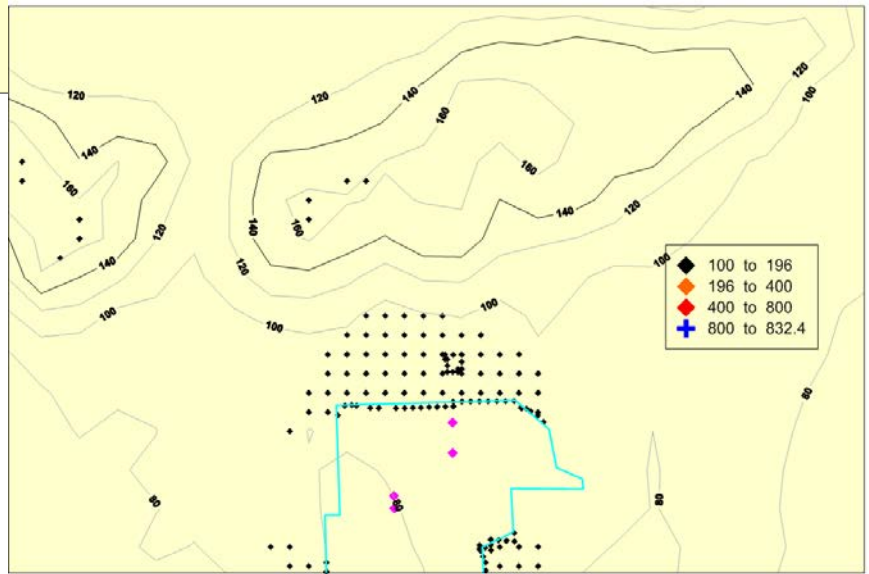
Case Study #2

Model Improvements: Low Wind, Downwash



Default

- **Models including AERMOD generally overpredict under low wind conditions**
- **Short history – hard to introduce better science, getting better**
- **ADJ_U* finally made it…**
- **The future – LOWWIND "Alpha" Options**
- **The future - better downwash treatment, including less of an effect under low wind conditions.**



LOWWIND3

Case Study #3

Status of CALPUFF

- Challenge
  - CALPUFF has been removed as a preferred model for long-range transport modeling.
- Issues
  - Can still be used as a screening approach for analyses beyond 50 km.
  - Class I PSD increment analysis is now approved on a case-by-case basis – risks delays while approach is negotiated and 3rd party intervention.
  - Federal Land Managers (FLM) have not yet updated their guidance, but have stated that CALPUFF will remain their preferred model for Class I Air Quality Related Value (AQRV) analyses.

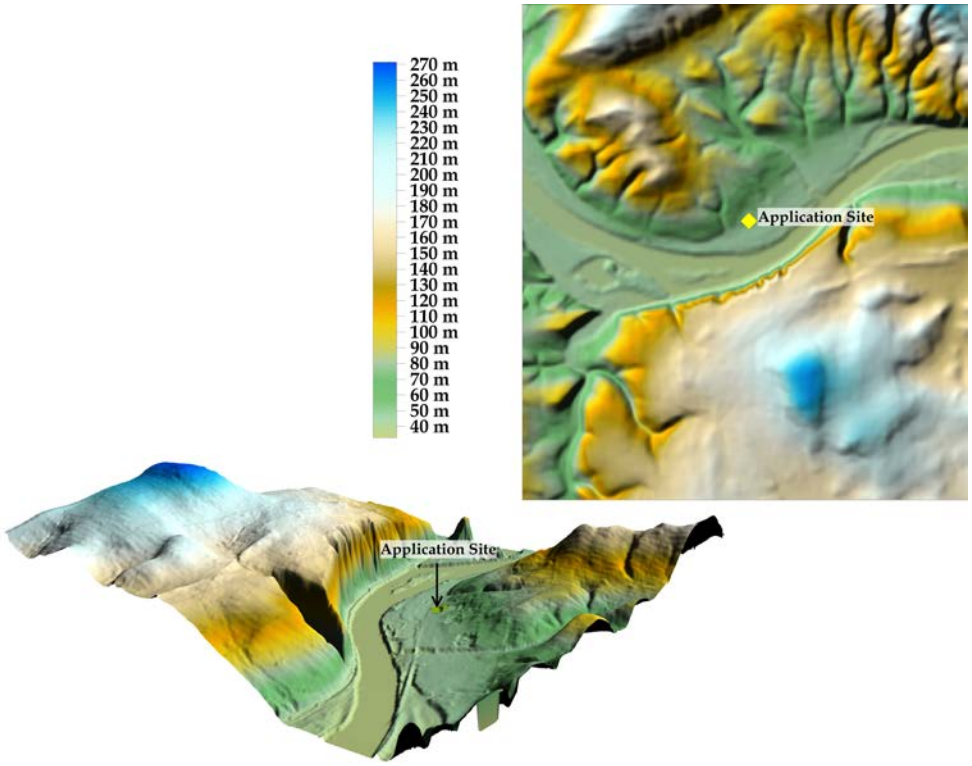
For Projects where long range transport modeling may be required:

Attempt to screen out of Class I modeling if possible (q/d method may be useful).

Engage with agency responsible for the Class I area of concern, along with the permitting agency, as early as possible to establish and agreeable approach.

Case Study #4

Use of Prognostic Meteorological Data

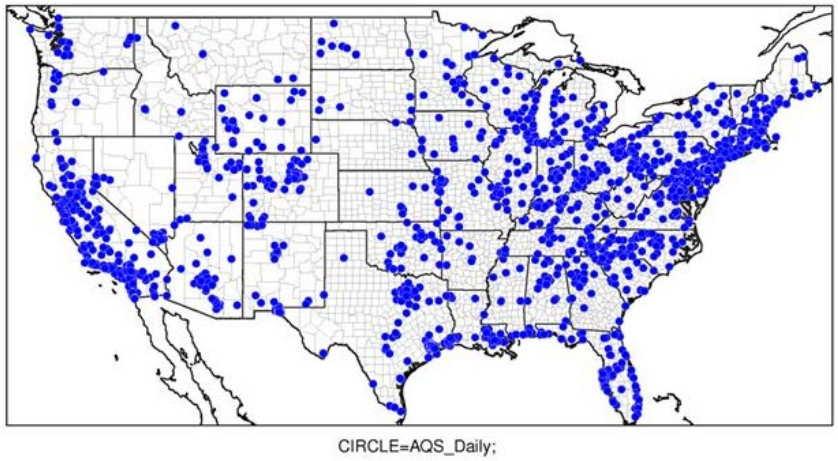


- PSD Air Quality Modeling Analyses require representative meteorological data for use in the dispersion model
- Application site has regional NWS data at regional airports in the vicinity
  - Local terrain causes representativeness issues
- The revised Appendix W allows prognostic data to be used where a representative NWS or comparable meteorological station are not available
- The use of prognostic meteorological data for this project resulted in significant cost and time savings compared to meteorological monitoring

- **EPA WRF Data Available for the CONUS at 12-km Resolution**
- **Finer resolution WRF data (used in this case study) need to be developed on a case-by-case basis**

Case Study #5

PSD Air Quality Analyses for Ozone



Ozone Monitor Locations – AQS Network
Source: USEPA

For Large Projects – 1000's of TPY of NOX, VOC:

Need to plan ahead – Will a Tier 1 analysis work?

- *Need to determine current ozone monitor values*
- *Need to engage regulators early – State/Local and EPA*

Tier 2 – Additional Engagement with Regulators

- *Additional Time and Complexity*
- *Separate Protocol*

- The revised Appendix W specifies a two tiered approach for single source ozone assessments
  - Tier 1 – Based on Existing Photochemical Modeling
  - Tier 2 – New photochemical modeling conducted specifically for the new source
- EPA "MERPs" Guidance
  - Tier 1 approach – many hypothetical sources placed throughout the continental US that can be used as reference points
  - Ratio of project to hypothetical source emissions
  - Air quality threshold
    - SIL?
    - Something else?
- EPA willing to use the "room" under the NAAQS of 70 ppb based on current air quality monitor data as a relevant threshold, even for Tier 1.

Case Study #6

NO_X-NO_2 Conversion Refinements

- Revisions to Appendix W made all Tiers default options.
  - Tier 2 Ambient Ratio Method revised (ARM2). Old conversion rate for 1-hour was 0.8, now varies from 0.5 to 0.9 depending on concentration.
  - Compared to previous ARM, compliance range increases from 235 to 376 $\mu g/m^3$.
  - At NO_X concentrations below 149 $\mu g/m^3$, ARM2 provides LESS refinement than ARM did.
  - More difficult to stay under the SIL:
    - ARM NO_X concentration that resulted in NO_2 impacts below the SIL = 9.4 $\mu g/m^3$.
    - ARM2 NO_X concentration that resulted in NO_2 impacts below the SIL = 8.3 $\mu g/m^3$.
- Benefits
  - ARM2
    - Better for scenarios where the overall NO_X concentration is high.
    - Based on better science
    - Ratio lower than 0.5 can be negotiated.
  - Tier 3 now default – less negotiation

For Projects where NO_2 is of concern :

Be Prepared: Will ARM2 Work? If not, Tier 3 (OLM/PVMRM) Requires:

- *In-stack NO_X/NO_2 ratios for as many sources as possible.*
- *Representative hourly ozone data from a nearby monitor.*

Tier 3, while default, still requires consultation with the regulating agency to agree on methodology.

Case Study #7

Buoyant Line and Point (BLP) Algorithm Added to AERMOD

- Challenge:
  - Proper Characterization of buoyant line sources not possible in previous versions of AERMOD.
- Issues:
  - BLP code implements into AERMOD.
  - Problems with implementation:
    - Only one distinct buoyant line source at a time
    - Code placed on the wrong side of NO_X/NO_2 conversion methods.
- Solution:
  - ERM has been working with state, regional EPA, and OAQPS on a workaround solution – currently passing through EPA Model Clearinghouse.
  - Fix will be included in next AERMOD.

For Projects where buoyant line sources are useful:

Discuss issues with agency – make sure they are aware of the issues and confirm that they are onboard with the workaround solution.

Strategies for Benefiting from the Changes

- Understand the changes: Know your available options
- Talk to permitting agencies early in the planning process:
  - Call to discuss modeling issues before submitting a protocol to present your case.
  - Some state agencies are less sophisticated with regard to air dispersion modeling. Find out how they are implementing the changes.
- If non-default options are being considered, get EPA Region involved early to ease path through the Model Clearinghouse.
- When possible, design your approach to avoid any modeling that might require case-by-case determination:
  - Class I Modeling
  - Ozone and Secondary $PM_{2.5}$

Pending Future Changes

- Finalization of MERPS and Ozone and $PM_{2.5}$ SIL's
- EPA Approach
- White Papers
  - LOWWIND
  - Saturated Plumes
  - Downwash Algorithms
  - NO_2 Modeling Techniques – Further refinement of Tier-3.
  - Mobile Source – Integrate R-LINE into AERMOD
  - Overwater – AERMOD to Replace OCD
- Next Version of AERMOD due soon
  - Alpha vs Beta options
- New Source Review (NSR) Reform - EPA is working to streamline the NSR process with a series of memoranda scaling back requirements.

Q&A

Thank You

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