PSD Modeling:
Ozone and $PM_{2.5}$ MERPs Guidance

MERPs = Modeled Emissions Rates for Precursors

AWMA Southern Section Meeting

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History

- Until just a few years ago, most PSD air quality analyses did not directly address ozone or secondary $PM_{2.5}$.
- In 2010 EPA granted a petition by the Sierra Club and committed to engage in rulemaking to evaluate updates to the Guideline on Air Quality Models, and, as appropriate incorporate new analytical techniques or models for ozone and secondary $PM_{2.5}$.
- In 2017 EPA revised the Guideline on Air Quality Models with specific recommendations for quantitatively assessing ozone and secondarily formed $PM_{2.5}$ using existing valid modeling.
- EPA recently finalized the MERPs Guidance as a Tier 1 Demonstration Tool for Ozone and $PM_{2.5}$ under the PSD Permitting Program (April 30, 2019).

Ozone

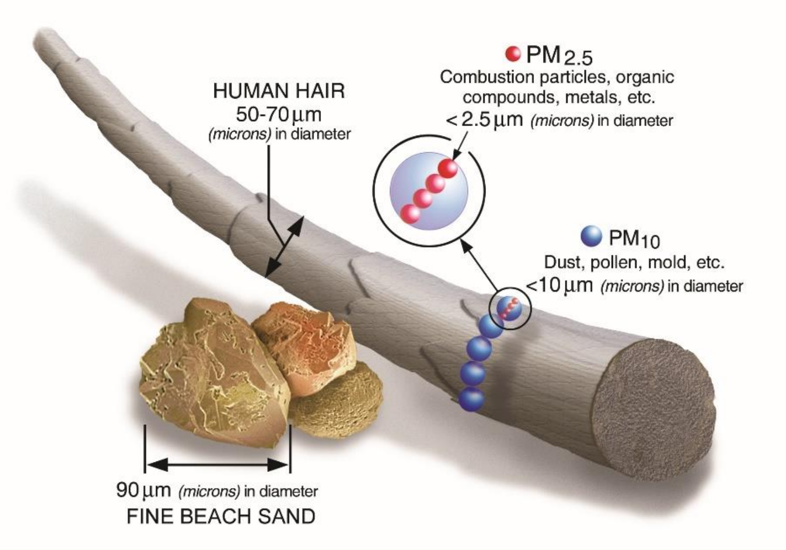
- Not emitted directly into the air
- Created by chemical reactions between oxides of nitrogen (NOx) and volatile organic compounds (VOC).
- This happens when pollutants emitted by cars, power plants, industrial boilers, refineries, chemical plants, and other sources chemically react in the presence of sunlight.
- Ozone is most likely to reach unhealthy levels on hot sunny days in urban environments.
- Ozone can also be transported long distances by wind, so even rural areas can experience high ozone levels.

PSD Air Quality Analysis For Ozone

- Ozone impacts from NOx and VOC emissions may now be addressed using recommended techniques in the Guideline on Air Quality Models (40 CFR Appendix W).
- Current guidance recommends that the air quality analysis address any component with emissions >/= the SER for NO_x or VOC.

Fine Particles ($PM_{2.5}$)

- Fine inhalable particles, with diameters that are 2.5 micrometers and smaller.
  - How small is 2.5 micrometers? The average human hair is about 70 micrometers in diameter.
- Two types of fine particles-
  1. Primary
  2. Secondary



Fine Particles ($PM_{2.5}$)

- **<u>Primary</u>** - Emitted directly from a source, such as construction sites, unpaved roads, fields, smokestacks or fires.
- **<u>Secondary</u>** - Most fine particles form in the atmosphere as a result of complex reactions of chemicals such as sulfur dioxide and nitrogen oxides, emitted from power plants, industries and automobiles.

PSD Air Quality Analysis for $PM_{2.5}$

- Current guidance recommends that the air quality analysis address any component with emissions >/= the SER for direct $PM_{2.5}$, SO_2 or NO_x.
- **<u>Direct</u>** – Direct emissions of $PM_{2.5}$ are modeled with a model such as AERMOD.
- **<u>Secondary</u>** impacts from NOx and SO_2 emissions may be addressed using techniques in the Guideline on Air Quality Models.
- Direct and secondary impacts are then summed to obtain the total impact.

Assessing Ozone and Secondary $PM_{2.5}$ Impacts

- 2017 revisions to the Guideline on Air Quality Models recommend a two-tiered approach:
  - **First Tier** – Use technically credible relationships between emissions and ambient impacts developed from *existing modeling* deemed sufficient for evaluating a PSD source's impacts.
  - **Second Tier** – A more sophisticated case-specific application of chemical transport modeling.

Modeled Emission Rates for Precursors (MERPs)

- For most PSD applications, EPA generally expects that most applicants would use a simpler Tier 1 approach.
- MERPs can be viewed as a type of Tier 1 demonstration tool under the PSD permitting program that provides a simple way to relate maximum downwind impacts with a critical air quality threshold.
- EPA has provided technical guidance on development and use of MERPs under Appendix W for PSD permitting.
  - *Guidance on the Development of Modeled Emission Rates for Precursors (MERPs) as a Tier 1 Demonstration Tool for Ozone and PM2.5 under the PSD Permitting Program* (EPA-454/R-19-003 April 2019)
- Final MERPs Guidance Webinar available on SCRAM: https://www3.epa.gov/ttn/scram/webinar/Final_MERPs/Final_MERPs_Guidance_Webinar-06132019.pdf

MERPs

- Properly supported MERPs provide a straightforward way to relate modeled downwind impacts to a critical air quality threshold such as a Significant Impact Level (SIL).
- MERPs can be developed from existing modeling performed for SIPs, from EPA's hypothetical source modeling documented in the MERPs guidance, or other existing (valid) modeling.

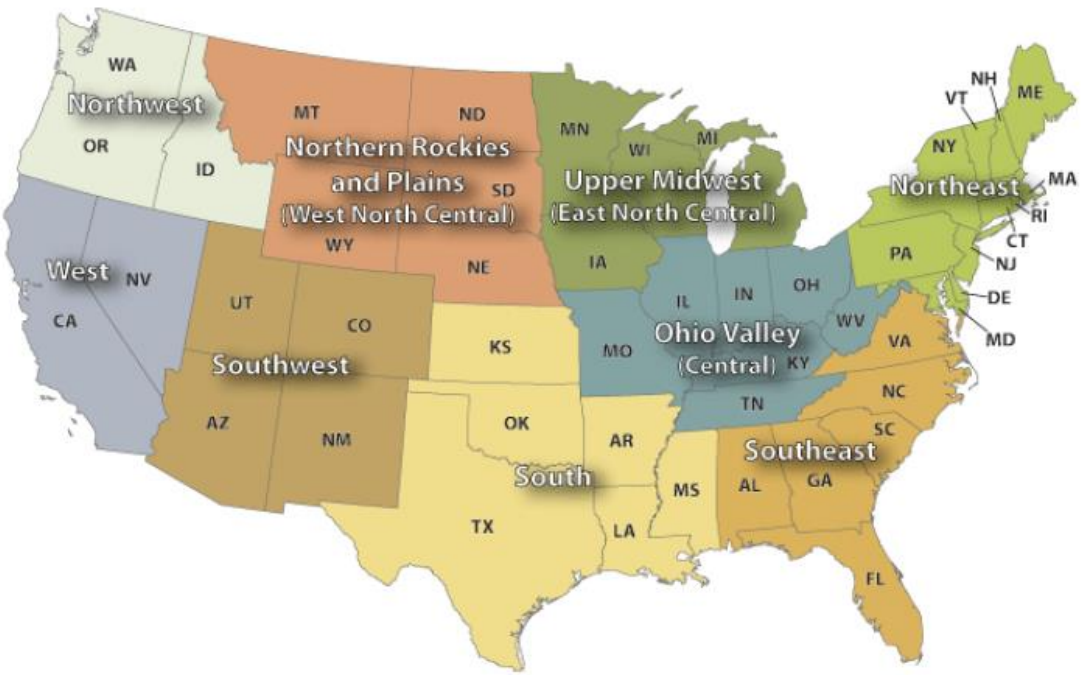
MERPs

- MERPs are typically expressed as a tons per year (tpy) emission rate of a precursor that corresponds to an air quality impact at the level of a SIL.
- Example –
  - An SO_2 MERP for the daily $PM_{2.5}$ standard is calculated to be 367 tons.
  - This means that if the PSD source emits 367 tpy, the daily $PM_{2.5}$ impact resulting from the SO_2 emissions would be at the level of the SIL or 1.2 $\mu g/m^3$

MERPs

- The modeling used as the basis for developing MERPs should be representative of the area in which the PSD source is located.
- PSD modeling report should provide justification for use of existing modeling used to develop MERPs unless regional defaults are used.
- *Representativeness Considerations:*
  - *Project source characteristics (e.g., stack height, emissions rate)*
  - *Terrain*
  - *Meteorology*
  - *Background pollutant concentrations*
  - *Regional/local emissions near project source (urban/rural)*

Climate Zones for “Default MERPs”



Climate Zone	Sources
Northeast	10
Southeast	9
Ohio Vally	19
Upper Midwest	12
Rockies/Plains	14
South	17
Southwest	15
West	6
Northwest	3

Default Regional MERPs from EPA Modeling

	8-hr O_3 from NO_X			8-hr O_3 from VOC		
Climate Zone	Lowest	Median	Highest	Lowest	Median	Highest
Northeast	209	495	5,773	2,068	3,887	15,616
Southeast	170	272	659	1,936	7,896	42,964
Ohio Valley	126	340	1,346	1,159	3,802	13,595
Upper Midwest	125	362	4,775	1,560	2,153	30,857
Rockies/Plains	184	400	3,860	1,067	2,425	12,788
South	190	417	1,075	2,307	4,759	30,381
Southwest	204	422	1,179	1,097	10,030	144,744
West	218	429	936	1,094	1,681	17,086
Northwest	199	373	4,031	1,049	2,399	15,929

Similar values are also provided for PM2.5

Development of MERPs Assessment Tool – 'MERPs View'

- EPA Region 4 and OAQPS are developing an online tool to assist in MERPs analyses
- The tool is based on the 'Qlik App' software which provides greater interactivity and visualization of the available MERPs data
- The tool will combine existing MERPs data with more detailed, refined assessments (i.e. air quality impacts as a function of distance from a modeled source)
- This tool will allow end-users to view and extract MERPs data that is most useful to them
- More details to come by the 12th Conference on Air Quality Models (RTP, NC), Oct. 2-3rd 2019

MERPs View

Refined PM2.5 Data by Distance

MERPs | AQ Data | Terrain Map

NAAQS
- Daily PM2.5
- Annual PM2.5
- 8-hr Ozone

Precursor
- NOx
- SO2
- VOC

Emissions

Stack
- 10
- 90

Climate Zone

State

County

Clear All

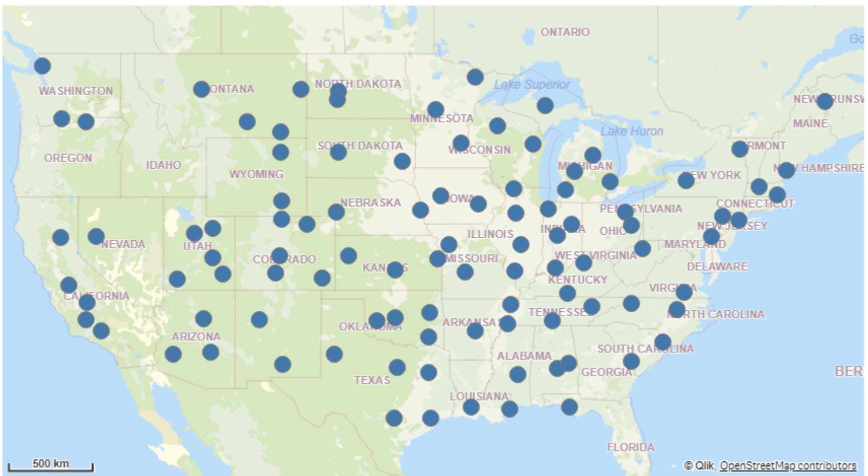


Table of PM2.5 Concentrations (ug/m3) by Distance (km)

State	Cou...	Distance	NAAQS	Precursor	Emissions	Stack	Concentra
Totals							**9.559616**
Florida	Bay	10	Annual PM2.5	SO2	500	10	0.08495
North Dakota	Mercer	10	Annual PM2.5	SO2	500	10	0.043685
California	Tulare	10	Annual PM2.5	SO2	500	10	0.042898
Louisiana	Acadia	10	Annual PM2.5	SO2	500	10	0.040120
Minnesota	Wadena	10	Annual PM2.5	SO2	500	10	0.039645
Texas	Harris	10	Annual PM2.5	SO2	500	10	0.038608
Nebraska	Adams	10	Annual PM2.5	SO2	500	10	0.037299
Mississippi	Smith	10	Annual PM2.5	SO2	500	10	0.034811
California	Tulare	10	Annual PM2.5	NOx	500	10	0.031429
Iowa	Iowa	10	Annual PM2.5	SO2	500	10	0.029687
Alabama	Autauga	10	Annual PM2.5	SO2	500	10	0.029385
South Dakota	Miner	10	Annual PM2.5	SO2	500	10	0.026888
Iowa	Carroll	10	Annual PM2.5	SO2	500	10	0.026031
Indiana	Porter	10	Annual PM2.5	SO2	500	10	0.025060
Maine	York	10	Annual PM2.5	SO2	500	10	0.024910
California	Merced	10	Annual PM2.5	NOx	500	10	0.023356
South Carolina	Horry	10	Annual PM2.5	SO2	500	10	0.023041
Maine	Aroostook	10	Annual PM2.5	SO2	500	10	0.021436
Louisiana	Orleans	10	Annual PM2.5	SO2	500	10	0.021210
Kansas	Johnson	10	Annual PM2.5	SO2	500	10	[illegible]

Chart of Distance (km) vs PM2.5 Concentration (ug/m3)

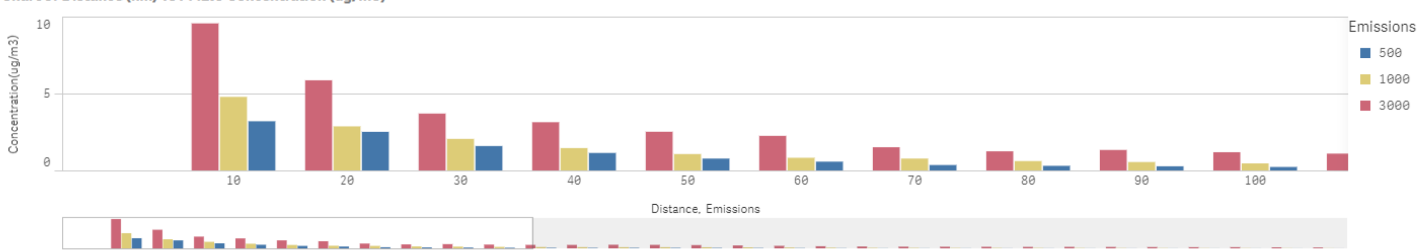


Chart Options

Chart By Emissions

Chart By Precursor

Chart By Stack

Make sure appropriate fields are selected to view data

Soon to be Released

- DRAFT Ozone & $PM_{2.5}$ Permit Modeling Guidance

Questions?