SO_2 Modeling: Trends and Pitfalls

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Overview

- Emission Inventory and Source Parameter Development
- Model Selection
- Meteorological Data Development
- Background Concentration
- Model Validation
- Design Value Analysis

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Overview (Continued)

- Culpability Analysis
- Control Strategy
- Attainment Demonstration
- Federally Enforceable Limits

Emission Inventory and Source Parameter Development

- Identify Sources that need to be explicitly included in the modeling analysis and estimate emissions
  - Any source, or cluster of sources that may have a significant impact on the area to be modeled will need to be considered
  - Need to specifically address mobile emission sources
  - Any source not explicitly included in the modeling analysis will be accounted for in the background concentration
- Gather source parameters for every source explicitly modeled
  - Location, elevation, release height, etc.
  - For stack sources, make sure velocity and temperature are representative of the emission scenario (ie do not use average flow and temperature data for maximum emissions at 100% load).
  - Worst-case load scenario will need to be run (the maximum emission scenario at 100% load may not be worst-case due to better dispersion)
  - Stacks must be modeled at their GEP height – if actual stack height > GEP

Model Selection

- AERMOD is expected to be used for most applications
  - EPA's preferred near-field dispersion model
  - Applicable to a wide range of regulatory modeling studies in all types of terrain
  - Undergone extensive performance evaluation
  - Several actual value studies that compared measured to predicted SO_2 concentrations from power plants showed good agreement
  - In specific situations, other preferred models may be used

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Meteorological Data Development

- One year of on-site data (minimum) is preferred
  - If solar radiation measurements are not available, may need to be supplemented with NWS cloud cover data
  - On-site turbulence measurements should not be used when utilizing the urban option (check land use classification AND population density when making the urban/rural determination)
  - If more than 1-year of data is available, a longer dataset is preferred
- If on-site data is not available, 5-years of NWS data is preferred
  - If NWS data is used, AERMINUTE should be used to calculate hourly average wind data from 1-minute ASOS data, if available
- Twice-daily upper air soundings will generally also be needed in addition to either the on-site or NWS surface data
- If representative data is not available, collect 1-year of on-site data before running the analysis or use a screening model (ie AERSCREEN)

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Background Concentration

- Measured ambient concentration data collected in the vicinity of the modeled source is recommended for calculating the background concentration
- A regional monitoring site may be used if no representative monitors are in the vicinity of the source
  - Must have similar natural and man-made impacts
- Concentrations that are impacted by a near-by source may be excluded when calculating the background concentration
- Background concentrations can vary by hour of day and season

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Model Validation

- Critical to the defensibility of the study but still not generally done
- Provides additional confidence in the emission limits and control strategy used to model attainment
- Actual emissions should be used for comparison to actual measured concentrations
- The actual stack height should be used – NOT GEP
- Robust Highest Concentration values are commonly used when comparing short-term average predicted-to-measured concentrations
- Concentration gradients near the monitor should be taken into consideration
- Validation – NOT calibration

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Design Value Analysis and Control Strategy

- Sources modeled at maximum allowable emissions
- EXISTING federally enforceable production/emission limits should be considered
- The results of the design value analysis (including background) are compared to the NAAQS
- If the maximum predicted concentration is less than the NAAQS, the project is complete
- If greater than the NAAQS, a culpability analysis will be used to identify sources contributing to the high concentrations
- Source contributions will likely be different depending on the time and location of the impact. Each event greater than the NAAQS will need to be analyzed separately
- Source contribution data is used to develop a control strategy that will model attainment

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Attainment Demonstration

- Design value model input file is modified to include the control strategy and run for comparison to the NAAQS
- May need to re-run BPIPPRM if control strategy impacts downwash
- If the model still predicts concentrations greater than the NAAQS (including background), additional controls or limits will need to be taken
- Any change made to the design value inputs to model attainment will need to be made federally enforceable (regulation, consent judgment, etc)
- SO_2 guidance allows for long-term emission limits, up to 30 days, for monitoring compliance with the modeled emission limits
  - Intended to give flexibility to sources with variable emissions
  - The long-term emission limit would need to be reduced to give the same level of protection as the short-term modeled emission rate

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QUESTIONS?

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