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Modeling Challenges and Strategies for New NAAQS

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Agenda

- "New" NAAQS
  - "Probabilistic" Standards
  - $PM_{2.5}$, NO_2, SO_2
- PSD Modeling Steps
  - Significant Impact Analysis
  - Full Impact Analysis (NAAQS and Increment)
    - Nearby offsite source inventory processing
    - Cause and Contribute (Culpability) Analysis

New NAAQS in Probabilistic Form

- **24-hour $PM_{2.5}$ Standard – 35 µg/m^3**
  - 24 hour $PM_{2.5}$ standard is 3-year average of **98th percentile** of annual distribution of 24-hour concentrations
  - 24-hr $PM_{2.5}$ Significant Impact Level (SIL) - 1.2 µg/m^3
- **1-hour NO_2 Standard – 188 µg/m^3**
  - NO_2 standard is 3-year average of **98th percentile** of annual distribution of **daily maximum** 1-hour concentrations
  - NO_2 Significant Impact Level (SIL) – 4 ppb (7.5 µg/m^3)
- **1-hour SO_2 Standard – 195 µg/m^3**
  - SO_2 standard is 3-year average of **99th percentile** of annual distribution of **daily maximum** 1-hour concentrations
  - SO_2 Significant Impact Level (SIL) – 3 ppb (7.8 µg/m^3)

$PM_{2.5}$ vs. PM_{10} NAAQS

- $PM_{2.5}$ NAAQS is much more stringent
  - $PM_{2.5}$ 24-hr standard is 35 µg/m^3
  - PM_{10} 24-hr standard is 150 µg/m^3
    - Factor of 4.2 difference
  - Mean Monitored PM_{10} is approximately two times higher than monitored $PM_{2.5}$
  - Many facilities assume $PM_{2.5}$ = PM_{10}
    - Results in $PM_{2.5}$ being approximately four times more stringent than previous standard
    - Assumption not necessarily supported by actual ambient air monitoring data

$PM_{2.5}$ Modeled vs. Actual NAAQS

- Modeled concentrations are "conservative" for $PM_{2.5}$
  - Modeling: Highest 5-year average of 1st highest-high for modeling
  - Actual NAAQS Attainment: 3-year average of the 98th percentile from monitored data
  - Modeling 1st highest-high much more susceptible to extreme meteorological conditions

New vs. Old NO_2 NAAQS

- New NO_2 standard is much more "stringent"
  - Old standard annual average at 100 µg/m^3
  - New standard 1-hour average at 188 µg/m^3
    - Using the conversion factor of 0.08 this 1-hour average is equivalent to 15 µg/m^3 on an annual average
    - Approximately 7 times more stringent than before!

New vs. Old SO_2 NAAQS

- New SO_2 standard is also much more "stringent"
  - Old standard 24-hr average at 365 µg/m^3
  - New standard 1-hour average at 196 µg/m^3
    - Using the conversion factor of 0.4 this 1-hour average is equivalent to 78 µg/m^3 on a 24-hour average
    - Approximately 5 times more stringent than before!

PSD NAAQS Modeling
How can we pass?

Avoid modeling at the beginning

- PSD Modeling required for
  - New PSD major sources and
  - Major modifications at existing PSD major sources
- For existing facilities, PSD applicability is based on evaluating the following:
  - Project related emission increases
  - Net emission increase
    - Includes project related emission increases
    - Includes all "contemporaneous" increases and decreases at the facility
- Both the project related emission increases and the net emission increase must exceed the significant emission rates (SER) to require PSD modeling
  - Limit PTE from project related emission increases to <SER **OR**
  - Implement contemporaneous emissions decreases so that net emission increase is < SER

PSD Modeling Steps

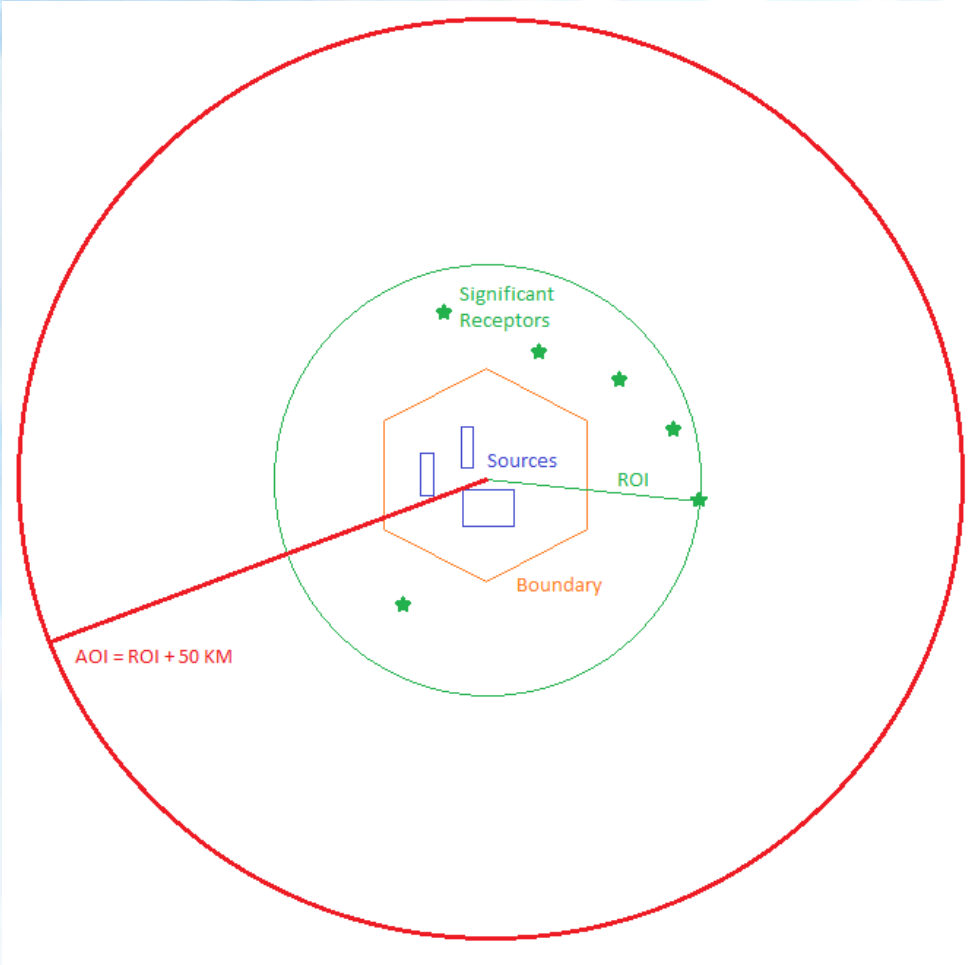
- If avoiding PSD applicability is not an option…
- Significant impact analysis
- Full impact analysis
  - NAAQS analysis
  - PSD increment analysis
  - May deal with a large offsite inventory
  - Includes background
  - "Cause and contribute" or "culpability" analysis

Significant Impact Analysis

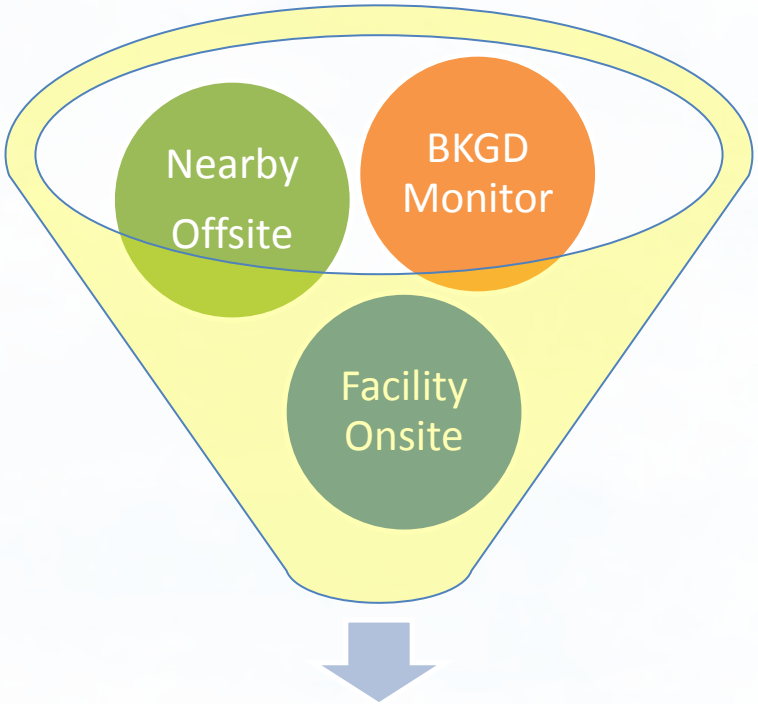
- Model the proposed project only
  - Model the significant net emissions increase
- Compare modeled result to Significant Impact Level (SIL)
- If modeled result is less than the SIL, model is passed and no further modeling for this pollutant is required

Next Steps…

- If modeled result is higher than the SIL, must do the full impact analysis
  - Define the significant receptors (receptors with a modeled result higher than the SIL) to be used in the full impact analysis
  - Define the radius of impact (ROI) and area of impact (AOI = ROI + 50 km)
  - All sources in AOI are evaluated for inclusion in the full impacts model



NAAQS Analysis



Offsite Inventory Processing

- Download or request the offsite inventory from LDEQ
  - Download from the LDEQ website
    - http://www.deq.louisiana.gov/portal/ONLINESERVICES/AccessERIC/tabid/2703/ctl/EIReports/mid/2333/Default.aspx
  - Request from the Public Records Request website if there are special needs
    - We have experienced excellent response time and reasonable pricing for special requests

Offsite Inventory Processing

- Pre-process LDEQ inventory
  - Distinguishing point sources, area sources, and volume sources
  - Quality assure the inventory data
  - Additional Permit research may be needed
    - Modeling inventory sources with limited data
    - Distinguishing alternate operating scenarios
    - Determining if any sources may be treated differently in the model

Offsite Inventory Processing

- Model sources individually
- Model merged source representative of similar sources
  - Merged sources can be overly conservative for some stacks, but can reduce model run-time if conservatism is not an issue

Background Concentration

- Air quality data should be used to establish background concentrations in the vicinity of the source(s) under consideration
- Section 8.2 of Appendix W allows adjusting air quality data to determine more accurate "background" concentration
  - Use air quality data collected in the vicinity of the source to determine the background concentration for the averaging times of concern
  - Determine the mean background concentration at each monitor by excluding values when the source(s) in question are impacting the monitor

Background Concentration

NAAQS 1st Tier

- Combine background (constant value) with modeled result (based on same modeling metric for SIL comparison)

NAAQS 2nd Tier

- Where modeled emissions are not temporally correlated with background levels then combine on a seasonal or quarterly basis

NAAQS 3rd Tier

- Consider more temporal and spatial pairing to determine better basis

Reference: Chet Wayland, New Monitoring Requirements and Proposals, NACAA 2010 Spring Membership Meeting

Background Concentration

- Add model results to the background concentration (Tier 1), compare results to the NAAQS standard
- If the result is lower than the NAAQS, the model is passed
- If the result is higher than the NAAQS
  - Evaluate potential need for Tier 2 and 3 background adjustments or
  - Continue to cause and contribute analysis

Cause and Contribute Analysis

- Identify all NAAQS model exceedances with paired location and time
- Determine if the proposed project causes a significant impact at these exceedances
  - If the significant impact analysis has SIL exceedances overlapping with the NAAQS model exceedances
- If no overlapping exceedances, the proposed project does not cause or contribute to any of the modeled exceedances and therefore the model is passed

Any remaining hope?

- If the model still does not pass
  - Selectively reduce emission rates or improve dispersion for sources which contribute to exceedances
    - May involve alternate operating scenarios to eliminate overlapping impacts from "problem" sources
    - May involve projects to reduce emissions or improve dispersion
    - May also involve additional research into offsite sources that contribute most to NAAQS impact

Conclusions – Coping with the New NAAQS Standards

- Option 1: Avoiding PSD Applicability
  - "Net-out" or reduce project emissions
  - Can be quickest permitting path
  - Trade-off between timing, certainty, and cost
- Option 2: Avoiding full impacts modeling
  - Model the net emission increase to show insignificant impacts (not as easy as before)
  - Slightly more time investment than Option 1
  - Slightly less certainty than Option 1
- Option 3: Full impacts modeling
  - Time investment can be uncertain given the additional variables of background and nearby sources
  - Use all the methods EPA provides to improve model accuracy and results

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