EPA RSL Dispersion Modelers' Workshop

FORUM ON DATA CENTER MODELING/COMPLIANCE DEMONSTRATION CHALLENGES - *STAKEHOLDER PERSPECTIVES*

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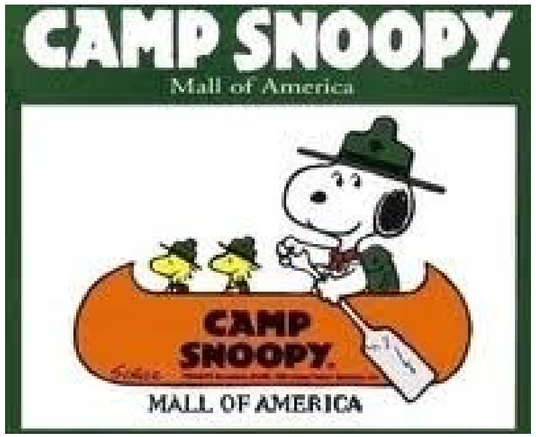
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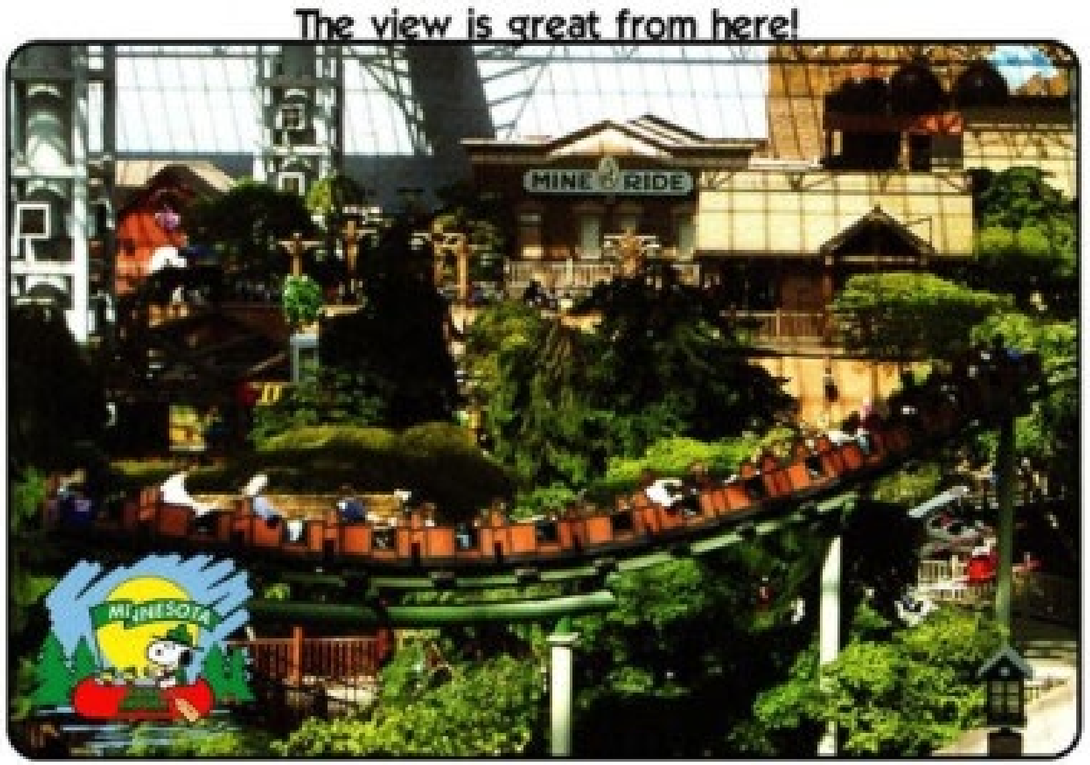
Q&A RESPONSE THEMES



Theme 1: “Ripsaw Roller Coaster : =
Regulatory Roller Coaster/
State -to -State Patchwork on
Modeling Requirements

Theme 2: “Paul Bunyan Log Chute” =
Bpip prime downwash issues + other
AERMOD technical shortcomings

ASKS

1. Issue DC & e-gen specific modeling guidance document

-Workshop collaboratively with regulated community and qualified consultants.
-Help remove some of the uncertainty and inconsistency for example on handling 1 hr NO2 (annualizing, excluding, vs modeling max hourly)

2. Acknowledge model limits and challenges

-Give regulators and applicants a defensible starting point for explaining modeled vs. real-world impacts.
-Align on how to handle wildfire background PM2.5. -Acknowledge limits for modeling intermittent sources w/ mtc/testing on variable schedules.

3. Open the door to more R&D, model alternatives

-Partner with industry to study:
-CFD for downwash.
-Lagrangian models for sub-hourly.
-Leverage photochemical datasets for cumulative.

Thank you!

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Forum/Panel Questions

Forum / Panel Charge Questions Set:

1. Please share challenges encountered with data center permitting, specifically with respect to air quality compliance demonstrations.
2. Are there specific NAAQS (or air toxics) pollutants that are particularly difficult to model (technical challenges) and/or demonstrate compliance?
3. When modeling, are there unique challenges with how you have to characterize your source(s)?
4. In particular, please share experiences with the source and emissions characterization of your emergency generators and various emergency, maintenance, and/or testing scenarios.
5. Please share any challenges and recommendations with respect to EPA's preferred near-field air quality model, the AERMOD Modeling System.
6. What is the most time-consuming aspect demonstration compliance for your facility in the permitting process?
7. Please share your experience and provide feedback on the consultation with the state/local (and EPA if applicable) permitting agencies.
8. Is there additional guidance or clarification that the permitting agencies and EPA could provide that would help?

1. Please share challenges encountered with data center permitting, specifically with respect to air quality compliance demonstrations.

- Disparate state and local requirements produce fundamentally different project outcomes — viability, schedule, controls, and operational flexibility all vary by jurisdiction.
- No federal guidance exists for data centers; regulators default to the 2011 EPA memo, which is dated and not DC-specific.
- Applicants occasionally bear the burden of educating regulators and the public on permitting pathways and model limitations — a role that should be supported by clear federal guidance.

2. Are there specific NAAQS (or air toxics) pollutants that are particularly difficult to model (technical challenges) and/or demonstrate compliance?

- 1-hour NO2 — most challenging. Requires screening-level NOx chemistry options and extensive additional inputs. The form of the standard is especially punishing for intermittent sources.
- PM2.5 — recently lowered annual SILs and NAAQS, combined with high background values (often smoke-influenced) across large parts of the country.
- Air toxics — formaldehyde, diesel PM, and benzene are common challenges for state/local risk assessments.

3. When modeling, are there unique challenges with how you have to characterize your source(s)?

- Backup generators operate on periodic but non-fixed testing schedules — fundamentally intermittent and probabilistic. No established, consistent method to model this in AERMOD.
- Depending on the state, applicants must model max hourly emissions every hour of the year, use averages, or skip modeling entirely.
- Many tests are sub-hourly (as short as 10 min). Assuming full-hour emissions overstates persistence, especially for heavily downwashed sources.
- 1-hour standard makes sub-hourly variability in met, emissions, and stack parameters overly conservative.
- The number of engines tested at once varies by test type; applicants must determine which combination produces worst-case impacts.

4. In particular, please share experiences with the source and emissions characterization of your emergency generators and various emergency, maintenance, and/or testing scenarios.

- Same core challenges as Q3 — the intermittent, probabilistic nature of testing operations is the fundamental issue.
- No standard method exists to characterize the range of emergency, maintenance, and testing scenarios in AERMOD.

5. Please share any challenges and recommendations with respect to EPA's preferred near-field air quality model, the AERMOD Modeling System.

- Intermittent sources: Cannot address spatial and temporal treatment of intermittent operations or sub-hourly inputs.
- NOx chemistry: Described by EPA as "screening level" even at Tier 3. Consistency and accuracy of NO-to-NO2 conversion need improvement.
- Downwash (PRIME): Algorithm hasn't been updated since 2004 despite noted deficiencies. Fixes are locked behind an experimental ALPHA option. Virtually all backup engine stacks are downwashed — this is a significant accuracy factor.
- Low winds: Adjust-u* helped in the 2010s, but issues remain during calm conditions.
- EPA's own development page documents these issues: epa.gov/scram/aermod-modeling-system-development

6. What is the most time-consuming aspect demonstration compliance for your facility in the permitting process?

- Project-only modeling: Understanding agency state-to-state specific requirements and remodeling to fit those.
- Cumulative NO2 modeling: The biggest time sink. Challenges include:
  - Domain-wide NOx chemistry (OLMGROUP ALL or ARM2)
  - Modeling the worst-case scenario for the project source
  - High background values
  - Mismatched NOx/O3 data from different airsheds
  - Modeling nearby sources with missing data, uncertain emissions, etc.
- EPA guidance on monitoring vs. modeling nearby sources is seen as qualitative and subjective.
- Documenting and explaining all of this to regulators and the public is itself a major burden with real project timeline implications.

7. Please share your experience and provide feedback on the consultation with the state/local (and EPA if applicable) permitting agencies.

- Same issues as Q1 — inconsistency across jurisdictions, no common framework, and the applicant bears the explanatory burden.

8. Is there additional guidance or clarification that the permitting agencies and EPA could provide that would help?

- DC/egen-specific guidance — so compliance demonstrations reflect actual operations, not worst-case-every-hour assumptions.
- Federal tools for AERMOD gaps — don't leave under-resourced states to develop ad hoc solutions independently.
- Acknowledge cumulative NO2 limitations — regulators and applicants need cover against baseless public comments (including AI-generated ones).
- Classify default AERMOD as screening — continuous operation + default options = screening tool; allow CAA refinement pathways.
- Open up ALPHA/BETA science options — encourage broader community engagement and data collection on downwash, NOx chemistry, sub-hourly, and low winds.
- Encourage alternative models — CFD for downwash; Lagrangian for sub-hourly and low winds.
- Leverage existing photochemical datasets — national/regional modeling contains full inventories, chemistry, and performance evaluations useful for cumulative assessments.