Advanced Air Permitting Seminar Modeling Update
September 25, 2013

Introduction and Background

Air dispersion modeling guidance for New Source Review (NSR) permitting has not kept pace with changes made to the National Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration (PSD) increments.

The lack of a settled modeling process directly affects the Air Permits Divisions mission and ability to meet permit timeframe goals. This uncertainty impacts the TCEQ staff, applicants, and the public.

The United States Environmental Protection Agency (EPA) has not provided clear and effective rule, policy, and guidance when it adopted the NAAQS and increments. This serious shortfall is significant because of the profound changes made to the NAAQS and increment. Without this key component of the air permitting program, the TCEQ has struggled to balance regulatory requirements with economic growth.

This paper will identify the problem; explain how we got to this point; outline the plan to resolve the problem; and describe how the TCEQ staff can help. The paper will briefly address the following topics:

- Regulatory changes,
- Lack of updated permit modeling guidance and tools,
- Challenges to existing permit modeling guidance,
- Minor source permitting program implementation,
- EPA's plan to update permit modeling guidance,
- EPA's plan to update air dispersion and photochemical models,
- TCEQ's plan to update the modeling guidelines, and
- How TCEQ can help applicants demonstrate compliance.

Regulatory changes

Why is the TCEQ having difficulty issuing permits?

The fact that we are having problems is not new -- we have always had issues when the EPA has adopted new standards or increments. While we have always asked the EPA to provide NSR implementation rules, policy, and guidance at or before adoption, this has rarely occurred and the lack of implementation guidance has limited the staff's ability to maintain an effective permitting strategy. Over the years, the implementation dilemma significantly increased as multiple rules became effective without a permit implementation plan. The resolution of these obstacles is ongoing and will evolve slowly.

Our recent issues are the result of overwhelming regulatory changes that began with the adoption of:

- the 8-hour ozone standard in 2008-
  - still no single-source photochemical model to predict ozone concentrations;

- 1-hour nitrogen dioxide (NO_2) and sulfur dioxide (SO_2) standards in 2010 with stringent concentration levels-
  - standards are based on statistics to address the probability of simultaneous occurrence of key factors such as emissions and meteorology, and
  - design concentrations are percentiles of highest daily hourly values averaged over a 3-year period;
- statistically based form of the particulate matter with particle size less than or equal to 2.5 microns ($PM_{2.5}$) standards in 1997 and lower 24-hour standard in 2006-
  - same statistical concept as NO_2 and SO_2 but the 24-hour design concentration uses percentiles of highest daily values averaged over a 3-period, and 3-year averages of annual concentrations;
- significant impact levels (SILs) and significant monitoring concentration (SMC) for $PM_{2.5}$ in 2010-
  - required evaluation of precursor pollutants that contribute to secondary formation of $PM_{2.5}$ to determine significant impact,
  - rule change made at adoption without notice, and
  - no models or modeling tools available to address secondary formation;
- 24-hour and annual increments for $PM_{2.5}$ in 2010-
  - regulatory conflict of statistically based NAAQS with exceedance-based form of the increments, and
  - no averaging of exceedances -- only one 24-hour exceedance allowed per year and none annually ;
- phase-out of the surrogacy program for $PM_{2.5}$ and the requirement to permit $PM_{2.5}$ condensable emissions in 2011; and
- annual $PM_{2.5}$ standard change in 2012.

Lack of updated permit modeling guidance, technical procedures, and tools

The lack of updated permit modeling guidance, technical procedures, and tools add to permitting challenges because we do not have the ability to delay the issuance of permits until we have all the implementation pieces in place. Some (not all) of the modeling guidance and technical issues are out of TCEQ's control to fix. In addition, without these updates, applicants will continue to have difficulty demonstrating compliance with 1-hour NO_2 and SO_2 NAAQS and the $PM_{2.5}$ NAAQS and increments. Some examples:

- no update to the *Guideline on Air Quality Models* (Appendix W to 40 Code of Federal Regulations [40 CFR] Part 51) since 2005-
  - technical models and tools have not kept up with significant policy changes on NAAQS development;
- EPA has not updated the 1990 draft New Source Review Workshop Manual – also referred to by EPA staff as the puzzle book;
- interim permit modeling guidance for 1-hour NO_2 and SO_2-
  - EPA provided interim guidance for NO_2 in June 2010 and March 2011 and SO_2 in August 2010, and

- these documents addressed some issues but raised others such as how to identify and evaluate intermittent emissions;

- draft $PM_{2.5}$ modeling guidance in March 2013 that updated modeling guidance the EPA provided in March 2010 and draft 1-hour SO_2 technical assistance document for attainment demonstrations in May 2013-
  - final documents for both due later this year but many questions remain,
  - models to evaluate $PM_{2.5}$ secondary formation not likely,
  - timeline to develop and conduct 1-hour SO_2 modeling for attainment demonstration extension not likely, and
  - the EPA stated it would not respond to comments for either document;
- significant emission rates (SERs) for $PM_{2.5}$ precursors may be conservative-
  - keeping SERs too low unnecessarily requires evaluation of $PM_{2.5}$ even when no direct $PM_{2.5}$ is emitted or emitted below major modification thresholds;
- current Ambient Ratio Method (ARM) to estimate conversion of nitrogen oxides (NO_X) to NO_2 is too conservative;
- no refined procedure to account for the ambient conversion of NO to NO_2 in the presence of ozone, and default NO_2/NO_X in-stack ratio is too conservative;
- model updates are needed to estimate chemical interaction and transformation of volatile organic compounds (VOC) and NO_X to create ozone, and NO_2 and SO_2 to create $PM_{2.5}$ after emissions are released from a facility;
- current guidance on the contribution of intermittent emissions, such as those from planned maintenance, startup, and shutdown (MSS), is vague, incomplete, and inconsistent;
- lack of air dispersion, single-source photochemical, and long-range transport models specifically updated or developed for use in the permitting process for new standards; and
- lack of field studies to support model improvements related to technical issues such as chemical transformation, downwash, and meteorology.

Challenges to existing permit modeling guidance

In addition to the lack of permit modeling guidance and tools, modeling resources are strained because of petitions and court decisions that have affected long-standing practices. Most PSD permits receive comments related to compliance demonstrations, and modeling resources must be redirected to respond to public comments and prepare and participate in contested cases. Following are some of the actions and issues:

- EPA's grant of TCEQ's $PM_{2.5}$ petition for reconsideration in December 2010;
- EPA's grant of Sierra Club's petition concerning ozone and secondary $PM_{2.5}$ formation in January 2012; and
- U.S. Court of Appeals for the D.C. Circuit January 2013 decision to vacate the SMC for $PM_{2.5}$, and vacate and remand the $PM_{2.5}$ SILs.

Minor source permitting program implementation

Lastly, EPA's focus is on major sources -- it is up to the states to develop, implement, and enforce a minor source permitting program to ensure the NAAQS and increment are met and maintained. The minor source program is a mandatory Federal Clean Air Act (FCAA) requirement and the TCEQ implements the major and minor programs in a consistent, reasonable manner. However, the TCEQ recognizes the need to have a consistent modeling approach for minor projects at major sites. The TCEQ does not want to inadvertently allow an approach for a minor project that will cause an applicant difficulty getting a PSD project approved in the future.

EPA's plan to update permit modeling guidance

The EPA's *Guideline on Air Quality Models* (GAQM) is outdated. The GAQM was developed in April 1978 to provide consistency and a common basis for estimating pollutant concentrations, assessing control strategies, and specifying emission limits EPA 450/2-78-027. In June 1978 (43 FR 26380), the EPA incorporated the GAQM by reference into the PSD regulations at 40 CFR 51.166(1) and 52.21(1). In July 1993 (58 FR 38816), the EPA published the GAQM as Appendix W of 40 CFR Part 51. The EPA last updated the GAQM in 2005.

The EPA started the process to revise the GAQM at the 10th Modeling Conference in March 2012 and will use the 11th Modeling Conference to discuss the rulemaking, with Notice and Comment Rulemaking estimated in the spring of 2015.

Major updates to the GAQM

The EPA plans to make comprehensive changes to the GAQM. The following issues are on the list:

- model improvements to existing regulatory models-
  - AERMOD and CALPUFF Modeling Systems;
- near road modeling;
- use of prognostic meteorology;
- tiered approach for NO_2 ambient ratio method and consideration of adopting Tier 3 screening techniques as refined methods;
- new models and techniques for long-range transport and single-source modeling for ozone and $PM_{2.5}$; and
- addressing compliance demonstration issues including use of SMCs and SILs for pollutants other than $PM_{2.5}$.

Coordinate updates with NSR and PSD rulemakings

The EPA plans to coordinate the GAQM update with other NSR and PSD rulemakings that will address court decisions and technical processes and tools:

Possible rulemaking (2013 -2014)

- Data requirements for determining attainment for 1-hour SO_2 implementation, December 2013. The rule will be based on EPA's SO_2 strategy paper and
  - describe how to determine whether sources and areas meet the NAAQS;

- provide policy and technical information concerning the use of ambient monitoring data and air quality modeling information;
- establish appropriate monitoring and modeling methods; and
- include timelines for states to conduct the required analyses and make the resulting data available for area designations.

- $PM_{2.5}$ Increment, SMC, and SILs, June 2014. The rulemaking will respond to the January 2013 court decision on the SMC and SILs and December 2010 TCEQ $PM_{2.5}$ petition for reconsideration and
  - re-propose the revised definition of increment baseline area that includes a new significance level for $PM_{2.5}$ and the requirement that $PM_{2.5}$ precursor emissions be included in the significant impact analysis;
  - remove the $PM_{2.5}$ SMCs from the PSD regulations;
  - re-establish $PM_{2.5}$ SILs and clarify their use; and,
  - possibly modify SERs for $PM_{2.5}$ precursors (NO_X and SO_2) for PSD applicability, control technology, and impact analysis, logically linking the SERs to the SILs.
- Ozone PSD and nonattainment NSR requirements, late 2014. The rulemaking responds to the Sierra Club petition for rulemaking to designate models to use for PSD permit applications with regard to ozone and $PM_{2.5}$ and
  - fulfill EPA's January 2012 petition grant; and
  - EPA plans to establish an ozone SIL and SERs for VOC and NO_X as precursors to ozone, logically linking the SERs to the SIL.
- Use outcomes from $PM_{2.5}$ SIL rulemaking to develop the approach for ozone.

EPA's plan to update or select additional air dispersion and photochemical models

The EPA Office of Office of Air Quality Planning and Standards (OAQPS) has an ambitious plan to partner with the various stakeholders, EPA's Office of Research and Development (ORD) and Office of Transportation and Air Quality (OTAQ), the Electric Power Research Institute, and the Interagency Workgroup on Air Quality Modeling to update preferred air dispersion and photochemical models.

AERMOD modeling system

AERMOD is EPA's preferred model for air permitting. The model, while an improvement over ISC, was not developed with today's standards and compliance demonstrations in mind. Implementation of new standards into the NSR permitting programs significantly lagged adoption of new standards. Model updates and improvements take time to research, develop, and test. The EPA is developing a plan and procedures to more effectively and efficiently manage the maintenance and development of the AERMOD modeling system. This plan will address:

- a standard protocol for updating the AERMOD modeling system;
- tracking, reporting, and timely assessment and correction of bugs;
- conducting and documenting evaluations of model performance; and
- assisting with revisions to Appendix W and possible revisions to regulatory options in AERMOD for the 11th Modeling Conference in spring 2015.

In December 2012, the EPA developed Beta options to address issues related to wind speed and

- added a minimum wind speed option in AERMET for 1-minute wind data;
- included a Beta option in AERMET to address low wind speed concerns raised at the 10th Modeling Conference and input from AERMIC committee and other scientific literature; and
- included two Beta options in AERMOD to help EPA and others evaluate effects related to low wind speeds.

These options should not be used for regulatory purposes without coordination with TCEQ and EPA, as applicable per EPA's model clearinghouse clarification statement on Beta options.

In the future, the EPA will

- consider updates to incorporate ORD's development of enhanced line-source characterization and algorithm focused on near-road environments;
- review issues with building characterization and downwash algorithms based on ORD research;
- review issues and options to include NO_2 chemistry in AERMOD; and
- consider including a buoyant line source option in AERMOD as alternative to the current preferred buoyant line plume (BLP) model.

CALPUFF modeling system

CALPUFF is EPA's preferred model for long-range transport, complex terrain, and complex wind flows. This non-steady-state puff dispersion model simulates the effects of time- and space-varying meteorological conditions on pollution transport, transformation, and removal. Currently EPA staff and federal land managers are reviewing CALPUFF version 5.8, which was updated to fix known bugs. In addition, this group will

- evaluate potential long-range transport replacement models;
- provide guidance for modeling single source impacts of secondarily formed pollutants in the near-field and for long-range transport; and
- propose updates to the GAQM, as appropriate, to address chemically reactive pollutants.

Roadway modeling updates

Quantitative hot-spot analyses are required for certain highway and transit projects. The PM hot-spot conformity requirements include project level modeling for many new roadway projects. EPA is working with ORD and OTAQ to

- evaluate concerns related to near roadway modeling for $PM_{2.5}$, ozone (O_3), and NO_2;
- coordinate research efforts;
- review the formulation and documentation of a new line source model, R-LINE (formerly AERLINE);

- evaluate R-LINE for potential implementation into AERMOD; and
- determine what Appendix W updates are necessary to appropriately address dispersion modeling of mobile and related sources.

Research efforts on model science

The EPA's ORD is supporting model improvements for air dispersion and photochemical models. For example, ORD is

- conducting wind tunnel research on downwash issues;
- developing with OAQPS and OTAQ a line source algorithm for AERMOD and evaluating air quality models that could be used for near-road assessments;
- working with OAQPS and Electric Power Research Institute (EPRI) to review fine-scale model development and evaluation such as SCICHEM and CMAQ-APT-
  - SCICHEM is a puff-model with chemistry. CMAQ-APT (Community Multi-scale Air Quality Model-Advanced Plume Treatment) is a plume-in-grid model with SCICHEM embedded into CMAQ; and
- working with OAQPS to develop credible photochemical screening tools for O_3 and $PM_{2.5}$.

Mesoscale model interface (MMIF)

The EPA is working with ENVIRON on an interface to use prognostic meteorology with air dispersion and photochemical models. The MMIF program converts MM5 or WRF meteorological output to formats appropriate for CALPUFF, SCICHEM, and AERMOD.

- The MM5 (short for Fifth-Generation Penn State/National Center for Atmospheric Research Mesoscale Model) is a regional mesoscale model for creating weather forecasts and climate projections; and
- The Weather Research and Forecasting (WRF) model is a mesoscale numerical weather prediction system with a dual use for forecasting and research.

The EPA's goal is to issue guidance on appropriate use of prognostic meteorological inputs for regulatory modeling and determine what updates to the GAQM are needed.

Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 3

The EPA is collaborating with the federal land managers in the United States Forest Service, United States Fish and Wildlife Service, and the National Park Service to

- provide guidance for modeling single source impacts on secondarily formed pollutants in the near-field and for long-range transport; and
- assist with EPA's commitment to update Appendix W, as appropriate, to address chemically reactive pollutants.

TCEQ's plan to update the modeling guidelines

The Air Dispersion Modeling Team (ADMT) removed the modeling guidelines from the web in 2008 because key sections did not represent modeling processes required to implement new standards or EPA requirements. The ADMT has provided interim guidance and attempted to update the TCEQ's modeling guidelines but has been

overwhelmed by continuous changes to the standards and EPA interim modeling guidance.

Rather than continue to wait until EPA updates the GAQM, the ADMT plans to develop a guideline that contains general modeling procedures that are not likely to change frequently with a series of appendices that either outline established procedures or the most current interim procedures. Stakeholders will have the opportunity to comment on a draft document before the ADMT publishes the update in 2014.

How TCEQ can help applicants demonstrate compliance?

General comments

Air Permits Division staff have worked closely with applicants to help them demonstrate compliance with NAAQS and PSD increments. Unfortunately, without settled permitting guidance to implement new or modified NAAQS, applicants must take steps to ensure their sources comply with all requirements, including protection of public health and welfare.

There are several factors to consider regarding the new standards. An applicant is not shielded from demonstrating compliance with new standards if the standards become effective after the administrative complete date. Per EPA policy, a PSD permit cannot be issued without the demonstration. In addition, a nonattainment permit is required if the area designation changes before a PSD permit is issued.

Other important factors applicants must consider are special conditions, controls, and emission rates in existing permits and whether they apply to a new or modified facility project undergoing review for a new standard and existing ambient air quality.

The ADMT staff want to help you get your permit when you want it. There are fixed times in the permit process related to public notice that the permit reviewer cannot adjust. Therefore, an applicant must consider the potential for refined air dispersion modeling as a potential chokepoint. In addition to ADMT resource limitations, an applicant must consider EPA and other TCEQ staff's time. For example, EPA reviews and comments on all major source protocols and Toxicology Division staff may evaluate modeling results if the project includes contaminants with effects screening levels.

Applicants should include extra time to prepare for and resolve issues related to permit modeling to ensure permits are issued "on time." They should anticipate the modeling chokepoint and meet with staff before they submit an application. Modeling protocols are required for major projects and protocols or checklists are recommended for minor projects.

The ADMT will help you develop a modeling protocol. An applicant should not assume that a protocol or checklist is not required because they have received a permit recently. Since the EPA continues to develop or change interim guidance at the national level, TCEQ does not have set modeling guidance yet for some pollutants and averaging times; what might have been ok previously will not be ok today.

So what happens if your initial modeling predicts an exceedance or violation of a standard? The ADMT understands that an applicant would prefer not to submit modeling for the public record. However, staff cannot help if you will not let them. Let

them know what you believe is the cause of a high prediction. Also, consider limits on planned MSS and facilities on the site that operate intermittently.

How do I conduct the air quality analysis for my project?

The ADMT developed interim guidance for conducting an air quality analysis (AQA) when relying on SILs, as well as to meet the preconstruction monitoring requirements of section 165 of the FCAA. This guidance generally follows EPA's recommendations.

The AQA for PSD and minor NSR permits begins with an analysis of the ambient air quality at the project site and in areas which may be affected by emissions from the project. For PSD permits, this analysis is required in order to meet the preconstruction monitoring requirements of the FCAA. For both PSD and minor NSR permits, this analysis can be used to justify the use of the SILs to streamline the AQA.

Analysis of the ambient air quality

The purpose of this analysis is to estimate existing ambient air quality at the project site and in areas which may be affected by emissions from the project. The analysis must be based on continuously gathered air quality monitoring data. When conducting the analysis, follow the basic procedure described in the following paragraphs. Note that the TCEQ could require pre- and post-construction monitoring.

Step 1: Collect representative monitoring background concentrations to establish the existing ambient air quality for the area that the project emissions would affect.

If site-specific ambient air monitoring data are not available, consider using monitoring data from an existing network of regional monitors if the data are representative. The applicant must justify why the monitoring data selected are representative for the existing air quality in the area of the project site. The justification can be based on a quantitative or qualitative assessment.

There are a number of factors used to determine the representativeness of a particular monitor's data used for background concentrations, such as:

- proximity of the monitor to the project site;
- similarity of topography, meteorology, and land-use for the project and monitor site;
- stationary source types and amount of emissions around the monitor compared to the project site; and
- emissions from mobile or other nonstationary-source activities.

For example, if the nearest monitor is located seven kilometers from an urban area surrounded by many industrial sources, but the project site is located in a rural area with no surrounding sources, an argument could be made that the air quality by the nearest monitor is indicative of a pollutant "hot spot" and not of the regional air quality around the project site. The use of this monitor may be considered conservative and the type of documentation to support this claim could be aerial photography of the two locations.

The documentation to support the selected monitor in the above example is based on a qualitative assessment. Some cases may require a more quantitative assessment that could include an analysis of the sources of emissions surrounding the project and

monitor locations. For example, the types of sources in the vicinity of each location; the magnitude of reported emissions and allowable emissions from sources in the vicinity of each location; etc.

The monitoring data identified in this step establishes the existing air quality and background concentration that will be used in Step 2 to determine if cumulative modeling is required.

If existing monitoring data are not available, or are judged not to be representative or conservative for the project site, go to Step 3.

Step 2: Determine the difference between the applicable NAAQS and the monitored background concentrations.

If the difference between the NAAQS and the measured background concentration design values is greater than the applicable SIL, then the applicant may conclude that a source with an impact less than the SIL value will not cause or contribute to a violation of the NAAQS and forego a cumulative modeling analysis.

Note: Design values are defined to be consistent with the individual NAAQS as described in 40 CFR Part 50.

For example, use the ambient air monitoring data collected in Step 1 to determine the three-year average of the 98th percentile of the annual distribution of the 24-hour background concentrations and the three-year average of the annual average concentrations for $PM_{2.5}$. Cumulative modeling should not be required if the difference between the 24-hour and NAAQS and monitored value is greater than 1.2 micrograms per cubic meter (µg/m^3) and the project impact is 1.2 µg/m^3 or less.

Similarly, if the difference between the annual NAAQS and the annual monitored value is greater than 0.3 µg/m^3 and the project impact is 0.3 µg/m^3 or less, cumulative modeling should not be required for the annual NAAQS.

Step 3: Establish a site-specific monitoring network. The applicant should coordinate with the permit reviewer for determining the scope of monitoring and for assistance in the preparation of a monitoring quality assurance plan.

How can an applicant get a PSD permit if the existing air quality is above the NAAQS?

Recently EPA highlighted an issue that could occur frequently in the future. In its response to comments on page 3261 in the Federal Register for the particulate matter NAAQS, EPA addressed the possibility that an applicant would be required to obtain a PSD permit if they want to locate or modify sources in attainment areas that monitor concentrations above the NAAQS.

If the design value concentration, not just a single monitored concentration is at or above the NAAQS, it would be difficult for an applicant to demonstrate that a new or existing source would not contribute to a NAAQS violation. Since this scenario rarely occurs, most applicants are unaware of the TCEQ §116.161 rule in Title 30 Texas Administrative Code.

The ADMT will assist as applicants try to refine modeling inputs to demonstrate that the project would be de minimis.

How can an applicant get a permit when modeling predicts a violation?

Occasionally, initial or test modeling predicts a NAAQS violation. When this occurs applicants have resolved this issue by refining model inputs and operational scenarios. But what can an applicant do if the modeling predicts a violation caused by an off-property source but the emissions from the project are not significant? This scenario was rare in the past but may occur frequently in the future with the changes to the NAAQS and possible conservatism with estimates of emissions and parameters from off-property sources.

As in the previous air quality scenario, the ADMT will assist as applicants try to refine modeling inputs to demonstrate that the project would be de minimis. However, if the project causes a significant impact, cumulative modeling may be required, and the project could cause or contribute to a NAAQS violation. However, the determination of significance has become complicated in some cases by emissions from off-property sources.

When modeling predicts a NAAQS violation, the applicant should contact the ADMT for assistance. If the predictions are the result of emissions from off-property sources, the applicant may need to contact those sources to refine or update the emissions inventory. Some issues that may need to be addressed include but are not limited to: incorrect stack locations, emissions, parameters, characterization; property lines; and hours of operation. The goal is to demonstrate compliance with the standard. However, if the applicant demonstrates due diligence in the attempt to acquire the necessary information, and the project is not significant at the predicted location of the violation, then a meeting with TCEQ would be necessary to determine a path forward.

Summary

The TCEQ mission is to protect our state's public health and natural resources consistent with sustainable economic development. To meet our clean air goal, the Air Permits Division works closely with applicants to issue permits that balance regulatory requirements with economic growth.

We are struggling now but look forward to participating with the EPA to improve the modeling process.

The following are the key points to remember:

- The permitting process has changed and more changes are likely;
- New standards create technical challenges for you and us;
- Help us help you; and
- Talk to us early -- and often!