

SOUTHEAST TEXAS PHOTOCHEMICAL MODELING TECHNICAL COMMITTEE

Meeting Summary

February 29, 2012

H-GAC Offices

3555 Timmons Avenue

Houston, Texas

Members and Guests Present:

Dan Cohan, Dan Baker, Judy Bigon, Bruce Davis, Rohit Sharma, Paul Petitt, Ryan Perna, Barry Lefer, Bernhard Rappenglueck, Victor Cheng, Shelley Whitworth, Marvin Jones, Jim Smith and Dick Karp, and via telephone, Steve Smith, Peggy Travis, Liz Hendler, Jim Wilkinson, and Marise Textor.

All presentations are available on the SETPMTC Web site,
http://www.tceq.state.tx.us/implementation/air/airmod/committee/pmtc_set.html.

SIP Planning and Implementation Update:

General Information – Lola Brown (TCEQ)

Lola gave a verbal update, which included the following:

- The retirement of Mark Vickery as executive director,
- The opportunity to make public comments on the *Texas Emissions Reduction Plan – Guidelines for Emissions Reduction Incentive Grants (RG-388)*,
- The revision of Texas Low Emission Diesel Rules (Rule Project No. 2009-001-114-EN), which is scheduled for proposal at the March 7, 2012, commissioners' agenda, and
- Updates on the Beaumont-Port Arthur (BPA) and the Houston-Galveston-Brazoria (HGB) SIP revisions to replace the on-road mobile source motor vehicle emission budgets (MVEBs) with those developed using MOVES

For questions or more information, please contact Lola at lola.brown@tceq.texas.gov.

EPA Recommended HGB Nonattainment Area – Donna Huff and Dick Karp (TCEQ)

Donna gave a verbal presentation regarding the nonattainment designation of Hood and Wise counties in the DFW area, and Matagorda County in the HGB area. A letter from the Governor's office is being sent to EPA, which includes technical analyses challenging the proposed nonattainment designation for these counties. In particular, Donna reported that the submitted materials:

- document that none of the counties have measurements indicating nonattainment or suggesting a contribution to nonattainment in other counties,
- provide air quality analyses that do not support nonattainment designations, and
- list the regulatory control measures already applicable to the counties (e.g., RVP, loading/unloading, Stage 1 vapor recovery, TxLED).

Based on the submitted materials, the letter requests EPA reverse their decision and designate these counties attainment/unclassifiable. EPA is expected to make a final decision by the end of May 2012.

In response to a question regarding the material being sent, Donna indicated she would send a copy of the letter and attachments for posting on the SETPMTTC web site.

Dick gave a short presentation showing the results of the Anthropogenic Precursor Culpability Assessment (APCA) source apportionment analysis conducted for Matagorda County. As Dick indicated, the APCA technique was applied to the 2005 and 2006 baseline modeling, which was used for the March 2010 HGB SIP revision and is the most recent, fully validated modeling. The APCA analysis was configured with four monitoring sites: Manvel Croix (MACP, CAMS 84), Wallisville (WALV, CAMS 617), Northwest Harris County (HNWA, CAMS 561), and Texas City (TXCT, CAMS 620), the same sites EPA addressed in their technical document supporting proposed nonattainment designations. In particular, the APCA results presented at these four sites showed the average and maximum contribution to the eight-hour ozone concentration (for eight-hour averages > 75 ppb), attributed to ozone forming emissions in Matagorda County. The average contribution from Matagorda to eight-hour ozone concentrations at all four sites is < 0.20 ppb, and the maximum contribution is < 2.0 ppb. This strongly suggests the contribution from Matagorda County on high ozone days is minimal and quite probably insignificant.

Dick was asked about the modeled days in 2005 and 2006, and how many of the days had winds from Matagorda County. Dick responded that 53 days were modeled for the 2005 and 2006 baseline, about equally split between the two years. Dick also indicated that he recalled about four days with wind trajectories through Matagorda County when ozone was in exceedance of 84 ppb.

For questions or more information, contact Donna Huff (donna.huff@tceq.texas.gov) or Dick Karp (dick.karp@tceq.texas.gov).

H-GAC Air Quality Issues – Shelley Whitworth (H-GAC)

Shelley reported that H-GAC is quite interested in what the classification of the HGB area is going to be for the 2008 standard. Based on recent information, it seems HGB will be classified marginal with an attainment date of 2015. The 1990 Clean Air Act amendments do not require marginal areas to submit an attainment demonstration (AD) as part of their State Implementation Plan (SIP) obligations. There is some uncertainty on how this may affect emission budgets, which currently go out to 2018.

Shelley also reported that the MOVES grace period has been officially extended to March 2, 2013. Presumably, this extension will provide enough time for the TCEQ to submit a SIP revision substituting MOVES-based emission budgets and for the EPA to deem them adequate for conformity purposes.

Shelley showed a chart of current and future estimates of Voluntary Mobile Emissions Reduction Program (VMEP) by categories, based on the MOBILE model. When asked about developing current and future estimates with MOVES, Shelley responded that they should be available later this year, not in time for the TCEQ SIP revision modeling, but in time for the corroborative analysis section.

Shelley also mentioned that they have a contract with Environ, which has provided MOVES2010a emission factors for heavy trucks and buses by model year and for calendar year 2018, as well as a sample fleet analysis completed with revised MOVES2010a emission factors. In addition, Environ is developing a tool for quantifying air quality benefits from emission reduction programs, including emissions reductions of greenhouse gases. Shelley specifically mentioned the drayage trucks at the various ports in the HGB area and the need to quantify the emissions from idling and the older fleet of trucks in use.

For questions or more information, please contact Shelley at Shelley.whitworth@h-gac.com.

EPA SIP-Related Update – Erik Snyder (EPA, Region 6)

Dick reported that Erik had called a couple of days before the meeting explaining that EPA would be unable to participate.

Summary 2011 Ozone Monitoring –Ryan Perna (TCEQ, Houston)

Ryan presented a review of the 2011 ozone season in the HGB area, including the extreme temperatures and drought conditions. Ryan showed that over the past few years (i.e., 2009 through 2011), the Manvel Croix (CAMS 84) monitor consistently has been the site with the highest fourth-high daily maximum eight-hour ozone concentration, and the monitor with the most days exceeding the 75 ppb standard. One of the graphics Ryan presented was an annual time series (2006 – 2011) of the average design values of the HGB regulatory monitors, which suggests that the area-wide average has been relatively similar over the past three years.

For questions or more information, please contact Ryan at ryan.perna@tceq.texas.gov.

Status of HRVOC Flare Data Request – Marvin Jones, Ph.D. (TCEQ)

Marvin reported that data requests were sent to 82 facilities addressing about 200 flares. As of January 1, 2012, 67 facilities had responded covering 176 flares. Staff, with the assistance of contractual help, is currently reviewing the data received and is contacting facilities for missing data.

Marvin indicated that the largest segment of missing data is the voluntary information on air or steam assist rates. Some facilities indicated they did not trust the assist data and therefore were advised not to send it. A discussion ensued concerning the need to have assist data to estimate the assist-to-vent gas ratio and the combustion zone gas net heating value. The TCEQ 2010 Flare Study showed that the combustion efficiency (CE) and destruction removal efficiency (DRE) are related to these two parameters. TCEQ staff indicated that for those assisted flares for which no assist data was submitted, a range of assist rates would be assumed based on manufacturer's recommended minimum rates, and/or where appropriate, use of assist rate provided for similarly operated flares. In addition, TCEQ staff indicated they would be seeking feedback from the SETPMTC throughout the process.

Paul Petitt, with Equistar Chemical, indicated that some operations use steam as a carrier gas to help move the combustible constituents to the flare, but that this carrier steam is not typically counted in the steam assist, and was wondering how these situations would be dealt with. Dick responded that the request was for all vent gas constituents including steam and that the net heat value should reflect the steam content. Paul indicated that the vent gas analyzer has a steam trap, so the steam in the vent gas is not measured. Dick asked if the net heating value would reflect the amount of steam, and Paul indicated that when the net heating value is calculated instead of monitored, typically only the combustible constituents are considered.

Judy Bigon, with ExxonMobil, indicated that due to a concern about the quality of their assist data, their legal staff recommended not submitting the assist data. As this may be the case for a number of the facilities, Judy asked how the TCEQ planned to impute data. TCEQ staff responded that we intend to use what data we did receive to develop estimates for those flares with missing data. Staff also indicated they would be working openly with the facilities and the SETPMTC members as they proceed to develop estimates.

For questions or more information, please contact Marvin at marvin.jones@tceq.texas.gov.

Highlights of CMAS Annual Conference - Jim Smith, Ph.D. (TCEQ)

Jim commented that over the years, this conference has evolved into a forum for the entire regulatory air quality modeling community, including users of CAMx and other photochemical models, as well as CMAQ. One of the reasons to attend CMAS is to learn about recent enhancements to CMAQ that may be incorporated into CAMx. Both

CMAQ and CAMx are considered to be state-of-the-science models, with each incorporating advances made in the other (as well as other less-used models). For example, CAMx source apportionment capabilities are still superior to CMAQ. Therefore in the foreseeable future, the TCEQ intends to continue using CAMx for SIP modeling.

Jim reported on a couple of presentations concerning background ozone, “Regional/Global Modeling of PRB Ozone,” by Chris Emery, et al., Environ, and “Background Air Quality in the United States Under Current and Future Emissions Scenarios,” by Zac Adelman, UNC Chapel Hill. During this discussion, Jim was asked about the background conditions (BCs) used in our recent modeling and explained that we developed the BCs using the results of global models (e.g., GEOS-Chem and MOZART) run for the 2006 baseline and 2018 future year. These BCs are temporally and spatially varying. Jim was also asked about the ozone increase due to future growth in BCs and responded that the global modeling did show some increase in the ozone concentration for the 2018 future case (see: http://www.tceq.state.tx.us/assets/public/implementation/air/am/committees/pmt_s et/20110629/20110629-summary_bc_transport.pdf).

Jim also reported on a presentation entitled, “Overview of the Two-way Coupled WRF-CMAQ Modeling System,” by Rohit Mathur, et al., U.S. EPA. In particular, the presentation considered the application of the coupled modeling system to a California wildfire event that occurred during June 2008, which had very high aerosol loadings. Jim was asked about one of the findings of the application, which was the effect of fire plumes in lowering the PBL and thus increasing simulated ozone concentrations. Jim responded that with the coupled modeling system, the feedback between the meteorological and photochemical models improves the simulation of the vertical extent of the boundary layer affected by the wildfire plumes. Jim was also asked about the effect of wildfire plumes on photolysis. Jim responded that apparently the effect of wildfire plumes on photolysis is similarly modeled in both the uncoupled and coupled systems.

For questions or more information, please contact Jim at jim.smith@tceq.texas.gov.

SHARP Study Final Results – Barry Lefer, Ph.D., Bernard Rappenglueck, Ph.D, (University of Houston)

Barry led off the presentation showing ozone trends and distribution of the seasonal (monthly) number of ozone exceedance days (> 75 ppb) over the period from 2000 to 2011.

A principal objective of the study focused on HO_x (OH and HO₂) chemistry. Barry showed a time series of the HO_x measurements and the “box-model” predicted concentrations averaged from five different chemical mechanisms (e.g., CB05, SAPRC07). During this part of the presentation Barry was asked about the instrument calibration, presumably because of the high reactivity of HO_x. Barry explained that the HO_x instrument is calibrated using a calibration system that photolyzes water vapor (H₂O) into OH and HO₂ of standard concentrations.

Barry presented the results of box-modeling with each of the five chemical mechanisms in comparison to the hourly distribution of measured HO_x concentrations. These results indicated that during the night, the box-model simulations for all the chemical mechanisms under-predicted both the OH and HO₂ average measured concentrations, while during the middle of the day the box-model simulations for all the chemical mechanisms over-predicted the average measured OH concentrations, and slightly under-predicted the HO₂ average measured concentrations. In response to a question about the variability of the chemical mechanism, Barry indicated the most variable feature is the level of detail in representing the myriad of chemical reactions. The master chemical mechanism (MCM) is the most detailed and the Langley Research Center (LaRC) mechanism used by NASA is the least. The CBO5 model predicted the closest total HO_x of all five mechanisms.

Barry also presented results of:

- an investigation of the degree of ozone production sensitivity to clouds and aerosol, which appears to be quite significant;
- comparisons of the ozone production measurements using the Measurement of Ozone Production Sensor (MOPS) with box-model predictions, which showed similar peak values, but the box-model peaks were generally too early in the day;
- an investigation of the sensitivity of ozone production to the relative concentrations of NO_x and VOCs, which suggests that NO_x emission reductions (TexAQS2000, TRAPM2006, SHARP2009) have extended the afternoon period of NO_x-sensitive ozone production; and
- a proposed new surface source of HONO to account for the existence of appreciable measured concentrations during the afternoon.

Bernhard continued with the presentation, focusing on meteorological (WRF) and photochemical (CMAQ) modeling of the SHARP study period (May 4 to June 6, 2009). Bernhard indicated the need for including objective analysis (nudging) in the WRF modeling to replicate the typical clockwise rotational wind shift. Notably, Bernhard showed that WRF was able to stimulate the planetary boundary layer (PBL) height quite satisfactorily as compared with continuous ceilometer measurements during SHARP. The CMAQ model was implemented with the SAPRC99 chemical mechanism.

Bernhard showed time series of modeled versus monitored comparisons for a number of photochemical constituents, including oxides of nitrogen and HO_x species for both the Moody Tower (elevation ~70 m) and the Clinton Drive (CAMS 403) surface site. Overall, the results were quite good. There has been significant improvement in HONO modeling. Model results for HONO coincide nicely for most of the days. Remaining mismatches are due to mismatches in modeling NO₂. Of particular note is the tendency of the model to over-predict the termination product of organic peroxides (e.g., H₂O₂ and CH₃COOH) and under-predict the termination product of nitrogen oxides (e.g., HNO₃).

Bernhard also presented a case study for May 20, 2009. Winds on May 20, 2009 were consistently from the east-northeast throughout most of the day and the highest ozone concentration was measured at the Manvel Croix (CAMS 84) site (maximum eight-hour ozone = 92 ppb). The case study included:

- a series of modeled hourly ozone, CO, and HCHO concentrations overlaid with the monitored hourly ozone, CO, and HCHO concentrations;
- hourly HO_x production by photolysis of O₃, HONO, HCHO and H₂O₂, split into layer 1 and the entire PBL, showing that HONO contribution occurs foremost in the early morning and is altitude dependent; and
- time-series of modeled versus monitored ethene, propene and HCHO, with and without extra ethene and OLE1 added to layer 3.

During Bernhard's presentation, he was asked about the imputation of the modeling emissions and whether the need for imputing the emissions should diminish in the future, as the emission inventories submitted improve. Bernhard responded that the extra ethene and propene were added for the May 20, 2009, case to check for improvement of HCHO simulation, which did not improve very much. Overall, apart from some excursions, the model simulated ethene well for the Moody Tower site during SHARP, and in some cases even over-predicted ethene. As for the improvement of future emission inventories, Bernhard indicated he was hopeful.

For questions or more information, contact Barry Lefer at blefer@uh.edu or Bernhard Rappenglueck at brappenglueck@uh.edu.

Eight-Hour Coalition Update – Jim Wilkinson, Ph.D. (Alpine Geophysics)

Jim gave an update on the modeling activities being conducted for the 8-Hour Coalition, including

- meteorological modeling summary;
- emissions modeling summary;
- air quality modeling summary;
- bias adjustment summary; and
- attainment demonstration summary.

Jim indicated they are focusing on 2008, 2009 and 2010 for base case and baseline modeling, and they plan to run at least three different meteorology, emissions and air quality modeling configurations:

- MM5/SMOKE_{MEGAN}/CAMX;

- WRF/ SMOKE_{MEGAN}/CAMx; and
- WRF/ SMOKE_{MEGAN}/CMAQ.

During Jim's presentation, TCEQ staff mentioned that updated modeling files (meteorology, emissions and air quality) for the extended June 2006 episode are available on the TCEQ AMDA web site (<ftp://amdaftp.tceq.texas.gov/pub/Rider8/>).

Jim also briefly discussed the various techniques they are considering for applying bias adjustments to the base case and baseline modeling, as well as multiple attainment testing techniques being considered, including:

- Direct design value estimate using the average of the fourth highest eight-hour ozone concentrations predicted for 2020-2022;
- EPA attainment test guidance using RRFs for 2008-2020, 2009-2021 and 2010-2022; and
- Probabilistic attainment test using ensemble modeling.

For questions or more information, contact Jim Wilkinson at jgw@alpinegeophysics.com.

Meeting Schedule and Agenda Topics 2012

Dick indicated that for now we will continue with bi-monthly meetings during 2012, with a plan to have two or three presentations of the results of the HGB-related AQRP-2011 projects. Dick indicated he would work with Graciela to identify candidate days for an April 2012 meeting.

The meeting was adjourned.