

## **SOUTHEAST TEXAS PHOTOCHEMICAL MODELING TECHNICAL COMMITTEE**

Meeting Summary  
August 23, 2012

H-GAC Offices  
3555 Timmons Avenue  
Houston, Texas

### **Members and Guests Present:**

Dan Baker, Marise Textor, Graciela Lubertino, Alex Cuclis, Judy Bigon, Bernhard Rappenglueck, Ziyuan Wang, Jian Zhang, Dan Chen, Rohit Sharma, Erik Snyder, Doug Boyer, Jim Smith and Dick Karp, and via telephone, Brad Flower, Steve Smith, Dennis McNally, Greg Stella, Jim Wilkinson, and Lola Brown

At the beginning of the meeting, Dick introduced Doug Boyer (TCEQ), who will be taking over the role as facilitator of the SETPMTC, as Dick plans to retire the end of January 2013.

All presentations are available on the SETPMTC Web site,  
[http://www.tceq.state.tx.us/implementation/air/airmod/committee/pmtc\\_set.html](http://www.tceq.state.tx.us/implementation/air/airmod/committee/pmtc_set.html).

### **SIP Planning and Implementation Update – Lola Brown (TCEQ)**

Lola gave an update, which included the following:

- No comments were received on the Commission approved (7/27/12) proposed BPA SIP revision to update the motor vehicle emissions budget (MVEB) using the MOVES EPA on-road mobile emissions factor model, which is scheduled for adoption at the November 14, 2012, Agenda meeting,
- The HGB SIP revision to update the MVEB using the MOVES EPA on-road mobile emissions factor model is scheduled for proposal at the October 17, 2012, Agenda meeting, with SIP documents publically available on September 28, 2012,
- The Commission approved (8/22/12) a proposed Infrastructure and Transport SIP revision for the 2008 Ozone NAAQS, for which a public hearing is scheduled on September 25, 2012, at the TCEQ offices in Austin, with comment closing September 28, 2012, and
- The FCAA, \$185 fee rulemaking is scheduled for proposal at the October 31, 2012, Agenda meeting.

Lola also gave a presentation, entitled, “2008 Eight-Hour Ozone Standard for the HGB Nonattainment Area.” The presentation addressed the elements and timeline for the HGB marginal attainment SIP.

Meeting participants asked about the emission statement, which is one of the required elements of a SIP for a marginal classified area. In particular, they asked what comprised the emission statement. Lola responded that she wasn't sure but would find out. Following up on this question, FCAA (182(a)(3)(B) and ozone implementation rules require the state to have a rule under which owner/operators of point sources of VOC and/or NO<sub>x</sub> certify their emissions. The reporting requirements from 30 TAC Section 101.10 require a certification statement to accompany each emission inventory, which appears to satisfy the required SIP element for a marginal classified area.

Lola was also asked whether the TCEQ was contemplating having the Governor request a bump-up to higher classification prior to December 31, 2015, when HGB, as a marginal area, needs to have attained the 75 ppb standard. Lola responded that as far as she knew, there has been no activity in that regard.

For questions or more information, please contact Lola at [lola.brown@tceq.texas.gov](mailto:lola.brown@tceq.texas.gov).

### **H-GAC Air Quality Issues – Graciela Lubertino, Ph.D. (H-GAC)**

Graciela gave a verbal update of H-GAC air quality activities including continued work on conformity analyses associated with revisions to the 2011-2014 and 2013-2016 Transportation Improvement Projects (TIPs). Graciela also mentioned that she recently presented a paper at the annual EPA EI conference entitled, "Emissions of Radical Precursors and Related Species from Traffic in Houston, Texas – Implications for Air Quality Modeling," which compares MOVES estimated on-road mobile source emissions with the ambient air quality measurements collected along roadways in Houston as part of the SHARP study in 2009. The comparison suggests that MOVES over-predicts emissions of CO from light-duty vehicles and under-predicts NO<sub>x</sub> emissions (and associated HONO) from heavy-duty diesel vehicles.

Graciela was asked how she was able to determine the portion of the ambient measurements contributed by emissions from the various vehicle types. Graciela responded that she used the MOVES model, which determines emissions for the various vehicle types. Graciela also agreed to give her presentation at an upcoming SETPMTC meeting, which will explain the procedure in more detail.

For questions or more information, please contact Graciela at [graciela.lubertino@h-gac.com](mailto:graciela.lubertino@h-gac.com).

### **EPA SIP-Related Update – Erik Snyder (EPA Region VI)**

Erik gave a verbal update on several SIP-related issues. In particular, EPA has been waiting to take action on the 2010 HGB AD and RFP SIPs until the TCEQ submits the HGB MOVES MVEB SIP revision. However, the EPA is now under a court decree to issue proposed approval/disapproval rulings on the 2010 SIP submittals by May 2013 and final rulings by December 2013.

Regarding the designations and classifications for the 2008 ozone NAAQS, Erik indicated the EPA has received petitions to use the 2009 through 2011 ozone data

instead of the 2008 through 2010 data, which resulted in notably fewer designations and lower classifications. As Erik pointed out, the 2011 ozone data was certified shortly after the proposed designation/classifications were made, and in at least one case (i.e., Chicago), the EPA did allow for the use of the 2009 through 2011 data for determining the nonattainment classification.

During this portion of the discussion, Erik was asked how monitored attainment was determined given the large influence meteorology plays. The 2009 through 2011 period was put forth as an example where the HGB ozone design value for both 2009 and 2010 was 84 ppb but rose to 89 ppb in 2011, which was a year of extreme drought and record-setting high temperatures. Erik explained that monitored attainment is based upon the average of three consecutive years' fourth high concentrations being less than or equal to the NAAQS.

Erik responded to another question regarding designations for new areas using the 2009 through 2011 or the 2010 through 2012 data but indicated there were no discussions about another round of designations for the 2008 NAAQS, and further indicated that their workload made it unlikely that they would do so.

Erik briefly discussed the recent court decision vacating CSAPR. Erik was asked about one of the issues the court found objectionable, the imposition of FIPs on states and not providing opportunity for states to submit their own SIPs. Erik explained that the EPA was under a court order to find a timely replacement for CAIR, which EPA did not feel would allow for the normal SIP process. The other issue with CSAPR is that the level of each state's reduction requirement was not directly related to that state's significant impact. Erik was asked what EPA might do next and said that an appeal was being considered.

For questions or more information, please contact Erik at [snyder.erik@epamail.epa.gov](mailto:snyder.erik@epamail.epa.gov).

### **Initial Base Case Model Performance for 2008, 2009 and 2010 – Eight-Hour Coalition (Jim Wilkinson, Dennis McNally, Greg Stella, Alpine Geophysics)**

Jim led the presentation, which focused on performance of the base case modeling conducted for the April 13 through October 18 period for the years 2008, 2009 and 2010. The base case modeling was conducted using two meteorological models (MM5 and WRF) and two biogenic emissions models (MEGAN and GloBIES). For statistical evaluations (e.g., MNB, MNGE), which were based on the comparison of modeled and measured ozone concentrations at 25 regulatory monitors, multiple ozone threshold values (60 ppb, 70 ppb and 80 ppb) were used. Jim's presentation also included some case studies comparing modeled and measured ozone concentrations for specific days at specific monitors.

During Jim's presentation, he was asked about performance differences between the two biogenic emission models (MEGAN v GloBEIS) and Jim, Dennis, and Greg responded that there are differences but they do not appear to be consistent and not as significant as those associated with the meteorology. Jim was also asked about the

model performance at rural sites, and responded that, as yet, they have not made those evaluations.

Jim was also asked about the meteorological model performance, and Dennis responded that in general both models (MM5 and WRF) meet the recommended level of comparability between modeled and measured parameters (e.g., temperature, wind speed and direction), although WRF typically provides better results. A follow on question was whether the meteorological model parameters were used as input to the biogenic and mobile source emission models, and Jim and Dennis responded that in order to use a consistent set of inputs exclusive of the meteorological model, they used a single set of meteorological inputs for the biogenic and mobile source emission models, those derived from the MM5 meteorological model.

Additionally, Jim was asked about diagnostic model performance evaluations, in particular, weekday versus weekend analysis and back casting (i.e., retrospective modeling). Jim agreed that the weekday versus weekend analysis would provide a good test of the model's ability to appropriately respond to the change in emissions from weekdays to weekends. However, Dennis questioned what meteorology would be appropriate for the back cast analysis. For example, if the back cast analysis was to use 2006 as the projection year, which meteorology (i.e., 2008, 2009 or 2010) should be used?

For questions or more information, please contact Jim at [jgw@alpinegeophysics.com](mailto:jgw@alpinegeophysics.com).

**Quantification of Industrial Emissions of VOCs, NO<sub>2</sub> and SO<sub>2</sub> by SOF and Mobile DOAS (AQRP-11-006) – Bernhard Rappenglueck, Ph.D. (University of Houston)**

As Bernhard indicated in the presentation, this was a collaborative project between researchers from the University of Houston and Chalmers University of Technology, Gothenburg, Sweden. The project (AQRP-11-006) involved the measurement of plumes of VOCs, NO<sub>2</sub>, and SO<sub>2</sub> emitted from industrial facilities in various locations (e.g., Houston Ship Channel, Mont Belvieu, Texas City, Beaumont-Port Arthur, Longview) using several monitoring platforms (e.g., SOF, DOAS, MeFTIR). In addition to these industrial locations, ambient measurements were taken in the Barnett shale region of active oil and gas exploration and production west of Fort Worth.

As Bernhard explained, combining these ambient concentration measurements with associated measurements of wind speed and direction, the plume flux was determined, which is directly comparable to the industrial facility's emissions. In general the project results indicate that the plume flux measurements are notably larger than the comparable industry reported emissions. These differences are especially large for VOCs (e.g., alkanes), with smaller differences for NO<sub>2</sub> and SO<sub>2</sub>.

During the presentation Bernhard was asked about the large alkane flux measurement made along Farm to Market Road (FM) 1220 downwind of an oil and gas compressor and storage tank facility in the Barnett shale region west of Fort Worth. Bernhard responded that it was most likely due to flashing emissions, which can occur when oil

and/or condensate under high pressure is allowed to equilibrate to lower atmospheric pressure.

For questions or more information, please contact Bernhard at [brappenglueck@uh.edu](mailto:brappenglueck@uh.edu).

### **Development of Speciated Industrial Flare Emission Inventories for Air Quality Modeling in Texas (AQRP-11-022), Daniel Chen, Ph.D. (Lamar University)**

Daniel presented the results of the AQRP-11-022 project as well as SEP project 2009-009, a companion project to estimate flare efficiency (i.e., combustion efficiency (CE) and destruction removal efficiency (DRE)) and plume speciation (i.e., NO<sub>x</sub> and VOCs). In particular, the objective of the AQRP-11-022 project was to replicate the TCEQ 2010 Flare Study results using a computational fluid dynamic (CFD) model with a combustion chemistry mechanism.

As Daniel explained, modeling the complexity of flaring operations (e.g. vent gas composition, flow rates, assist types, ambient meteorology) is best done using CFD models. The CFD model used is a composite of Chemkin and Fluent, and the combustion mechanism was a combination of the GRE and USC mechanisms reduced to 50 species and updated to include NO<sub>2</sub> and HONO formation.

The Fluent/Chemkin CFD model was validated using test data from laboratory burners (McKenna, Sandia National Laboratory Flame D). Then the validated model was applied to determine the sensitivity of the DRE and the CE to various operating and meteorological conditions, as well as 2010 TCEQ Flare Study data. In addition, the flare operating parameters and resulting plume constituent concentrations were used to develop easy-to-use correlations and neural networks, in part to estimate aldehydes/HO<sub>x</sub>/NO<sub>x</sub> emissions.

As Daniel explained, an added feature necessary to simulate industrial flares is the effect of turbulence on the chemistry. Two turbulence-chemistry models were considered; one based on the eddy dissipation concept (EDC) and the other based on an assumed probability distribution function (PDF) of the interaction of turbulence and chemistry. Unfortunately the PDF model, which is more computationally efficient, is only valid for higher temperature ( $T > 2100$  K) combustion, which was not achieved at the relatively low heating values tested in the TCEQ 2010 Flare Study. Using the PDF model resulted in nearly complete combustion in nearly all cases, which was not physically realistic in these cases. Therefore, only the EDC model simulated results were compared to the TCEQ 2010 Flare Study.

As Daniel presented, the CFD results of flare efficiencies (i.e., DRE and CE), using the EDC turbulence-chemistry routine, were generally lower than the TCEQ 2010 Flare Study measured efficiencies for both the air-assisted and steam-assisted flare tests. Daniel indicated that CFD modeling using the EDC turbulent-chemistry has been successfully applied to industrial flares, but in those cases the flare was operating at higher heating values and exit velocities.

Daniel discussed the results of the SEP project 2009-009 project, which focused on the impact of cross wind on flare efficiency (i.e., CE and DRE) and plume speciation (i.e., HO<sub>x</sub>, NO<sub>x</sub> and VOCs), and generally showed that at high cross winds (i.e., wind speed >> exit velocity), the efficiency decreased and some plume constituents (e.g., VOCs) increased in concentration. The results indicated a monotonic reduction in efficiencies with higher cross winds. However, at both the lowest and highest cross-wind velocities tested, efficiencies were more sensitive to cross-winds, indicating flares have an optimal exit velocity range.

### **Modeling Update: HGB MOVES SIP Revision – Dick Karp (TCEQ)**

Dick presented an update of the modeling and corroborative analyses for the HGB MOVES MVEB SIP revision. As Dick explained, the purpose of this SIP revision is to replace the 2018 MVEB developed using the EPA MOBILE model with a 2018 MVEB developed using the new EPA MOVES model. Starting in March 2013, mobile source emission conformity analyses conducted to show that new transportation projects will not result in an increase in emissions above the 2018 MVEB must use the EPA MOVES model. Therefore, to avoid transportation conformity problems, a new 2018 MVEB needs to be developed using MOVES. The modeling activities and technical analyses for this SIP revision focused on updating the on-road mobile source emissions used in the HGB 2010 eight-hour ozone SIP attainment demonstration.

Dick presented the results of the model performance evaluation using the revised MOVES-developed on-road mobile source emissions. For the operational evaluations (i.e., modeled versus monitored statistical and graphical comparisons), the results show a general improvement in the model performance. For the diagnostic evaluations, including the retrospective modeling of the year 2000 and the observational modeling of weekday versus weekend, both of which compare the modeled and monitored ozone response to emission changes, the model still significantly under-predicts the observed reduction in ozone associated with reductions in emissions, particularly NO<sub>x</sub> emissions.

During the presentation of the model performance, Dick was asked about the retrospective modeling for the year 2000, and whether an emissions reconciliation was included. Dick responded that the PSCF was used in the 2006 base year modeling, but he would have to check to see what was used in the 2000 projection year. JimSmith indicated that the 2000 modeling used the older HRVOC-to-NO<sub>x</sub> adjustment used in SIPs using the 2000 episode. Subsequent to the meeting, Dick found that this adjustment (used in the December 13, 2002 HGB attainment demonstration SIP) was included in the modeling for the year 2000, with a much larger amount of HRVOC emissions than the PSCF-based adjustment used in the 2006 base year modeling.

Dick presented the results of the revised 2018 attainment year modeling and the projected design values. Similar to the 2018 attainment year modeling used in the HGB 2010 eight-hour ozone SIP attainment demonstration, the revised 2018 attainment year modeling indicates ozone is much more responsive to NO<sub>x</sub> than VOC emission reductions. In addition, modeling with MOVES shifts the 2018 design value setting monitor from Deer Park (DRPK) to Bayland Park (BAYP) with a 2018 project ozone

design value of 87 ppb. This is consistent with on-road mobile source NO<sub>x</sub> emissions being the major change, which would be expected to affect BAYP more than DRPK.

During the presentation of the revised 2018 attainment year modeling and the projected design values, Dick was asked about the OSAT/APCA source apportionment modeling, in particular, whether the source apportionment modeling had been conducted for other episodes. Dick responded that although only the June 2006 episode was presented, the OSAT/APCA modeling for the other episodes is available and generally shows the same emission source culpabilities with low-level local emission sources, including non-road mobile, area, on-road mobile, and low-level points, contributing the majority of ozone at BAYP and the contribution from elevated HBG HECT and MECT sources being noticeably more prevalent at DRPK than BAYP.

Also during the presentation of the unmonitored area analysis, Erik Snyder commented that the relative response of ozone at the DRPK and Wallisville (WALV) should be considered in the analysis to add support to the argument that the unmonitored area is expected to be in attainment by 2018.

For questions or more information, contact Dick Karp at [dick.karp@tceq.texas.gov](mailto:dick.karp@tceq.texas.gov).

### **Future Meeting Schedules and Agenda Topics**

The meeting participants discussed setting a date for a meeting in October, during which it was mentioned that there were known conflicts for the week of October 15-19, 2012. Dick indicated he and Doug would work with Graciela to identify candidate days for an October 2012 meeting. Once candidate days are identified, members will be polled to see if there is a preferred date.

During the discussion several agenda topics were mentioned, including ozone monitoring summaries for the 2012 season, analysis of exceptional events, and presentations of other AQRP projects.

The meeting was adjourned.