

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

Meeting Summary  
December 16, 2010

H-GAC Offices  
3555 Timmons Avenue  
Houston, Texas

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

Dan Baker, Steve Smith, Graciela Lubertino, Thomas Ho, Jian Zhang, Qiang Xu, Marise Textor, Dan Cohan, Jim MacKay, Jim Smith, and Dick Karp, and via telephone Russell Nettles, Lola Brown, Angela Kissel, Tom Tesche, Jim Wilkinson, Jed Anderson, Lilly Wells and Liz Hendler.

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).

### **Flare Study Update – Russ Nettles (TCEQ)**

Russ gave a verbal update via the conference telephone on the flare study conducted at the John Zink facility in Oklahoma during September and October 2010. The study design can be found in the final QAPP on the TCEQ web site:

([http://www.tceq.state.tx.us/assets/public/implementation/air/rules/Flare/Flare\\_Research\\_Final\\_QAPP.pdf](http://www.tceq.state.tx.us/assets/public/implementation/air/rules/Flare/Flare_Research_Final_QAPP.pdf)). The primary study objectives were:

- Assessing the potential impact of waste gas flow rate turndown on flare destruction/removal efficiency (DRE) and overall control efficiency (CE).
- Assessing the potential impact of steam- and air-assist on flare DRE and CE at various operating conditions, focusing exclusively on low flow rate conditions.
- Assessing whether flares operating over the range of requirements stated in 40 Code of Federal Regulations (CFR) § 60.18 achieve the assumed hydrocarbon DRE of 98% at varying flow rate turndown and assist ratios as well as variable waste gas heat content.
- Identifying and quantifying the hydrocarbon species in flare flue gas currently visualized with passive infrared technology.

The study was initially funded at \$1.6 million, with an additional \$0.5 million from the Air Quality Research Project (AQRP) funds to extend the number of sampling days. Two flares were used in the study; a 24 inch diameter air assist and a 36 inch diameter steam assist. Each flare was tested at two flow rates, with two heat content levels, with two assist levels. The input flare gas composition was approximately 20% methane and 80% propene. Nitrogen (N<sub>2</sub>) was added to achieve the different heating content. In addition, a few tests were run using propane instead of propene.

The sampling device consisted of a 30 foot, 18 inch diameter pipe with a 90 degree fitting at one end with a 20 inch diameter flange opening. The other end was equipped with a vacuum pump (4000 cubic feet per minute) to draw in the flare flue gas. Discrete sampling ports were located along the pipe toward the downstream end. The sampling device was suspended horizontally by a crane and was positioned using three cameras (one an infrared) focused on the flare and temperature sensors inside the pipe just downstream from the flange opening. This way the device could be positioned in close proximity to the flare flame but outside the combustion zone. A control room was equipped with monitors for the cameras and measurement devices for the flare flue gas. The measurement devices included auto-GC, PTR-MS, FTIR. The contractors have reported that the measurements were very repeatable.

The preliminary data are to be presented to TCEQ in mid December 2010, the draft report is due February 23, 2011 and the final report will be available March 31, 2011.

Russ was asked about the range of cross wind speeds included in the testing, and he responded that the ambient air conditions, i.e., temperature, humidity, wind speed and wind direction were not controlled. Therefore the range of wind speed varied with the selected days, which Russ indicated ranged from days with calm winds to notably windy.

Russ was also asked about measurements of radiant heat loss, since this quantity is used in modeling flares. Russ indicated that he did not think radiant heat loss was measured.

For other questions or more information, please contact Russ at [rnettles@tceq.state.tx.us](mailto:rnettles@tceq.state.tx.us).

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

Lola gave a verbal report via the conference telephone. Lola reported that based on EPA's recent action to delay the ozone NAAQS revision to July 2011, the TCEQ has indefinitely extended the deadline for receipt of comments on the potential nonattainment boundaries.

Lola indicated that at the November 18, 2010, commissioners' agenda, the staff recommendation for 2010 primary one-hour nitrogen dioxide (NO<sub>2</sub>) standard designation was approved. All counties with NO<sub>2</sub> monitoring are currently measuring concentrations below the standard and will be designated attainment; all other counties are to be designated as unclassifiable/attainment.

Lola also reported on two recent stakeholder group meetings. On December 1, 2010, the Control Techniques Guidelines (CTG) Stakeholder group met to solicit inputs on the Chapter 115 Volatile Organic Compounds (VOC) Reasonably Available Control Technology (RACT) Rule Revisin Project. Comments will be accepted until January 5, 2011. The Title V stakeholder group met on December 10, 2010, to discuss pending rule-making for air emission fees, 30 TAC Section 101.27. The air emissions fee rule is in the process of being revised to ensure adequate funds are generated to support the Title V program.

For other questions or more information, please contact Lola at [lbrown@tceq.state.tx.us](mailto:lbrown@tceq.state.tx.us).

### **NASA ROSES Project Update – Dan Cohan, Ph.D., Rice**

Dan gave an update on the NASA Research Opportunities in Space and Earth Sciences (ROSES) project being conducted collaboratively by Rice University and the University of Alabama at Huntsville. At the June 22, 2010, SETPMTTC meeting, Dan first briefed members about the project, which has the goal of applying satellite observations to air quality management planning in the Gulf of Mexico region. In particular, the project objectives are:

- Applying GOES satellite cloud data to improve photolysis rates;
- Applying Ozone Monitoring Instrument (OMI) satellite NO<sub>2</sub> column data to develop a top-down NO<sub>x</sub> emissions inventory; and
- Applying the HDDM sensitivity analysis option with CAMx to assess how satellite-derived inputs influence ozone precursor response.

Progress to date includes:

- Obtaining the TCEQ modeling files for the August and September 2006 HGB and June 2006 DFW base case modeling;
- Validating the TCEQ CAMx results on the Rice computer system;
- Obtaining the DOMINO-GC OMI NO<sub>2</sub> data; and
- Obtaining the lightning detection network data.

Dan was asked if the GOES data would be used to adjust other meteorological parameters besides the clouds. Dan explained that only the photolysis rates would be altered.

Dan was also asked about the spatial and temporal resolution of the OMI satellite NO<sub>2</sub> column data. Dan responded that the satellite collects one set of NO<sub>2</sub> column data per day at 1345 hours local time, at a grid resolution of 13 km by 24 km.

Dan responded to a question about the change in the boundary layer NO<sub>x</sub> concentrations between CB05 and CB6, indicating that CB6 should reduce the amount of NO<sub>x</sub> removed through termination reactions

### **List of Current TCEQ Air Quality Projects - Dick Karp, TCEQ**

Dick provided an update to the list of 2010 and 2011 air quality monitoring, emissions and modeling projects the TCEQ plans to incorporate into the next HGB SIP. The updated list includes the AQRP administered by UT-Austin, as well as projects funded under the FY2011 Air Modeling, Emissions Inventory and Other Technical Support umbrella contract. The monitoring projects are expected to provide enhanced data for model performance evaluation, the emission projects are expected to provide improved updates to the modeling emissions, and the modeling projects are expected to provide enhancements to WRF and CAMx.

As Dick indicated, some of the projects concluded in FY2010 have been presented at previous SETPMTC meetings, such as TCEQ-2010-36 (Aerometric Data Collection and Analysis at the UH Moody Tower), TCEQ-2010-33 (Estimated HRVOC Emissions Loss from Pipelines), and TCEQ-2010-26 (Alternative Plume-rise Algorithm in CAMx).

Dick was asked about the schedule for the various projects investigating inter- and intra-state transport (e.g., TCEQ-2010-22, TCEQ-2010-66, TCEQ-2011-19, TCEQ-2011-36) and responded that the FY2011 projects are to be completed by August 31, 2011 and the FY2010 projects have been extended into FY2011, but generally should be completed before August 31, 2011.

In response to a request at the previous SETPMTC meeting, Dick presented the timeline of modeling, control strategy testing and rule development activities for the next HGB SIP. Dick indicated this timeline has not been adjusted to reflect the July 2011 date of the new ozone NAAQS, which will likely extend the SIP submission date past December 2013. In turn, the date at which the modeling activities need to be completed will also likely be extended past December 2012.

### **Community Modeling and Analysis System (CMAS) 2010 Conference Update – Jim Smith, Ph.D., TCEQ**

Jim gave a synopsis of the 2010 CMAS conference he and Ron Thomas (TCEQ) attended in October 2010. In particular, Jim presented a brief description of a few of the noteworthy papers.

One of the papers of interest investigated temporal source apportionment using the CMAQ-Adjoint sensitivity analysis comparing modeled ozone concentrations to emissions as a function of time. This sensitivity analysis indicates that the maximum daily eight-hour ozone concentration is most sensitive to the emissions around 0600 hours. Jim mentioned that sensitivity modeling conducted by TCEQ in previous one-hour ozone SIPs, with the temporal distribution of construction equipment emissions shifted to later in the day, showed similar results.

A couple of other papers of interest addressed the issue of adequately simulating cloud location and timing. One of the papers investigated parameterization of clouds within CMAQ and the other paper investigated the use of incorporating satellite observations within WRF.

Another paper compared the hourly projected planetary boundary layer (PBL) depths in east Texas using MM5 with the Eta scheme and WRF with the ACM2 scheme. WRF with the ACM2 PBL scheme appears to simulate more accurate PBL depths at inland sites, which is problematic for MM5 with the Eta scheme. Both models appear to produce comparable results along the gulf coast. The TCEQ used the MM5 with Eta for the recent HGB SIP modeling, although for the next round of SIP modeling, the TCEQ is planning to use WRF and will test the ACM2 PBL scheme.

Another paper of interest used CMAQ with process analysis modeling of the TexAQS II episodes to investigate night-time formaldehyde (HCHO) formation, particularly from

ozone + alkene reactions. Process analysis results indicated that up to 5 ppb of HCHO was created over night, primarily from the ozone + alkene reaction, although the NO + methylperoxy (CH<sub>3</sub>O<sub>2</sub>) reaction also contributes to the formation of HCHO.

### **Update of Marine Emissions Estimates – Jim MacKay, TCEQ**

Jim presented the results of an emissions improvement project conducted by Environ to incorporate the recent Port of Houston Authority (POHA) emissions inventory and harmonize it with the remaining HGB eight-county shipping emissions for the TCEQ SIP modeling. This project also included improved delineation of shipping lanes using GPS, trip-based spatial distribution, and realistic plume rise.

As Jim explained, for the most part, the ships were modeled as elevated links using a new EPS module (PSTSHIP) also developed by Environ. The harmonizing involved combining emissions without overlap from several inventories, including the POHA (2007), Starcrest (2000) ship movements for BPA, the EPA near-port inventory, and the Ship Traffic, Energy, and Environmental Model (STEEM) EI developed by the University of Delaware.

For the HGB eight-county area, the updated 2006 marine emissions estimate is 30.03 tpd of NO<sub>x</sub>, which is about 5 tpd less than the 35.10 tpd used in the recent (April 2010) SIP submission. As Jim indicated, the comparability of these emission estimates suggests we have a good handle on marine emissions.

Jim was asked about NO<sub>x</sub> emission reductions due to requiring lower sulfur content fuels while in port and responded that the NO<sub>x</sub> emission reductions associated with lower sulfur fuel is attributable to the improved performance of a catalytic converter, which most ships do not employ.

### **8-Hour Coalition Update – Jim Wilkinson, Ph.D., Alpine Geophysics**

Jim presented a status report on the 8-Hour Coalition modeling activities, including protocol development and technical refinements. The draft protocol has been shared with the TCEQ (11/9/10) and EPA-ORD (12/8/10) and was accompanied by a request for comments. Modeling inputs for 2009 ensemble modeling have also been developed.

A significant aspect of the 8-Hour Coalition modeling approach is to split ozone exceedance days into those days that the current model formulation can adequately replicate (i.e., category I days) and those days that cannot be adequately replicated (i.e., category II days). The TCEQ commented and the Coalition has agreed that the separation of exceedance days should occur after model performance has been completed. In addition, the Coalition's approach is to only use the category I days in the modeled control strategy and ozone attainment testing. After a control strategy is developed which indicates attainment would be achieved for the category I days, an analysis of the category II days would be conducted to determine whether the control strategy developed based on the category I days would or would not provide sufficient ozone reductions on the category II days.

The Coalition's meteorological inputs for the 2009 ensemble modeling, which are derived from the WRF model, use different physics options than the TCEQ is currently planning to use. The Coalition has agreed to run the WRF model using the TCEQ physics options for deriving the meteorological inputs. The Coalition is also running MM5 for 2008 and when asked why MM5 and not WRF, Jim responded that MM5 was actually performing better for 2008.

The Coalition plans to use a series of emissions inputs for the ensemble modeling that spans the likely variability in emission estimates, guided by the observed ranges in the VOC-to-NO<sub>x</sub> ratios. In light of the dichotomy between the observed VOC-to-NO<sub>x</sub> ratios and those determined from the reported emissions inventories, Jim was asked if the emissions inputs used in the ensemble modeling would require adjusting the reported emissions inventories, and if so, which emissions would be adjusted. Jim indicated that the exact approach to developing the series of emissions inputs for the ensemble modeling has yet to be finalized.

After meeting with the TCEQ in early November 2010, the Coalition revised its modeling plan to focus on providing the bulk of recommendations by December 2012. However, now that EPA has delayed the promulgation of the new ozone NAAQS to July 2011, the Coalition may reconsider its current revisions.

#### **Next Meeting Schedule and Agenda– Dick Karp, TCEQ**

Dick indicated that the next meeting is scheduled for February 24, 2011, and that he will line up presenters for various air quality monitoring, emissions and modeling projects to be used in the next HGB SIP modeling. In particular, Dick indicated that he has talked with Barry Lefer at University of Houston about presenting a summary of the 2010 ozone monitoring from the perimeter counties (i.e., CAMS 696, 697, 698 and 699).

Since February 24, 2011 is a Thursday, Dick asked if we should consider a different day of the week for the April 2011 meeting to accommodate members who may have scheduling conflicts on Thursdays. Some of the participants indicated that they preferred a more constant schedule, such as the third Thursday of every other month. Subsequent to the meeting, it was determined that no conference rooms were available on April 21, 2011, the third Thursday, and in addition that is a state holiday. Dick worked with Graciela to reserve a conference room for the April 2011 meeting on Wednesday the thirteenth