

TERC Air Quality Research Overview

Jay Olaguer

Air Quality Program Manager

Houston Advanced Research Center

November 9, 2006

General Outline

- *Part I: Where have we been?*
 - TERC 2004-2007 Strategic Research Plan (SRP) as the basis for funding decisions
 - 12 main recommendations of SRP
 - Specific research accomplishments pertaining to each SRP recommendation
 - Regulatory impact of TERC research
- *Part II: Where are we going?*
 - Funding situation
 - New TERC Board priorities (HCHO)
 - Questions posed to the Science Advisory Committee (SAC)
 - Near-term research project identification
 - Longer-term research funding
 - Request for Qualifications
 - Air Toxics and PM2.5

Strategic Research Plan

Background Information

- Original SRP written in 2002 with major input from Dave Allen of UT-Austin.
- SRP revised in 2004 with input from Science Advisory Committee.
- Rationale for revision was the change from 1-hour to 8-hour ozone standard.

Strategic Research Plan

Recommendation 1

- *Adapt photochemical grid models to address the new 8-hour federal ozone standard.*
 - New 8-hr ozone conceptual model using PCA*
 - GOES, EnKF, 4DVar data assimilation capability*
 - Improved treatment of land use and land cover*
 - Transitioned from CB4 to SAPRC in AQ models*
 - Improved DFW SIP model performance by:
 - Increasing height of model top
 - Expanding model horizontal boundaries
 - Adding NO_x recycling reactions
 - Increasing vertical diffusivity
 - Changing PBL and Land Surface schemes
 - Developed two SIP-quality episodes for 2005 (June, Aug-Sep)

(*Asterisk denotes response to specific suggestions for research in SRP text.)

Strategic Research Plan

Recommendation 2

- *Improve emission inventories.*
 - Conducted top-down EI verification studies
 - Analyzed magnitude and timing of HRVOC emission events
 - Assessed uncertainties in emissions of Other VOCs (OVOCs)
 - Improved emissions estimates for solvents
 - Improved emissions estimates for oil and gas storage tanks
 - Improved representation of T and RH dependence of mobile source NO_x emissions
 - Projected diesel NO_x emissions to 2007, 2009, and 2012
 - Assessed NO_x emissions from:
 - Small electric generators
 - Oil and gas compressors
 - Boilers, process heaters, stationary engines, turbines, duct burners
 - Diesel construction equipment
 - Locomotives and marine vessels

Strategic Research Plan

Recommendation 3

- *Identify emission reductions that lead to the greatest reductions in ozone concentrations.*
 - Analyzed ozone impacts of HRVOC emission events
 - Evaluated benefits of HRVOC controls
 - Assessed ozone impacts of Other VOCs (OVOCs)
 - Evaluated potential controls on solvents
 - Evaluated control technologies for cement kilns
 - Evaluated regional control strategies in East Texas (NO_x from oil and gas compressors, EGUs)

Strategic Research Plan

Recommendation 4

- *Evaluate the impacts of ozone driven controls on fine particulate matter concentrations and on the ability of the region to meet the new ozone standard based on concentrations over 8 hours.*
 - Assessed Texas impacts of CAIR
 - Evaluated ozone impacts of 17 proposed new EGUs and voluntary TXU offsets
 - Analyzed effectiveness of TERP, LIRAP
 - Assessed 2012 impacts of federal motor vehicle standards on 8-hr ozone attainment in DFW and HGB

Strategic Research Plan

Recommendation 5

- *Assess the relative importance of regional transport and local emission reductions in meeting current and future air quality standards.*
 - Project H12.8HRA analyzed monitor data to separate local and background contributions to 8-hr ozone
 - Projects H27, H35, and H60 applied APCA to elucidate intra- and out-of-State transport contributions to DFW 8-hr ozone
 - Projects H59 and H60 Phase 2 applied new sensitivity techniques (4DVar, HDDM) to assess source culpability
 - Project H60 Phase 2 developed new source apportionment technique (KPASA) based on process analysis
 - Analysis of NETPS data in Project H61 used LRPM to quantify contributions to DFW O₃ of 1) local emissions, 2) Ellis County cement kilns, and 3) East Texas power plants

Strategic Research Plan

Recommendation 6

- *Assess the effects of uncertainties on model predictions used for policy assessments.*
 - Projects H24 and H45 applied sensitivity, ensemble, and EnKF methods to explore various uncertainties in meteorological and air quality models, including:
 - meteorological dynamics and tracer advection
 - OVOC emissions and chemical mechanism assumptions
 - Projects H12.8HRB and H60 Phase 2 identified major uncertainties in HGB SIP model, including:
 - Biogenic, HRVOC, NO_x, and HCHO emissions
 - Land use and land cover assumptions
 - Vertical mixing, sea breeze, and night-time transport
 - Radical budget and ozone productivity
 - RRFs due to choice of CB4 vs SAPRC

Strategic Research Plan

Recommendation 7

- *Evaluate and synthesize emerging information.*
 - Project H4 reports (O₃, PM) by David Allen
 - Project H30 report (Allen and Olaguer, 2004)
 - TERC Air Toxics Research Plan
 - TERC 2005 Science-Policy Synthesis
 - AWMA EM October 2006 Issue, pp. 26-30
 - E. Olaguer, H. Jeffries, G. Yarwood, and J. Pinto (2006), *Attaining the 8-hr Ozone Standard in East Texas: A Tale of Two Cities*

Strategic Research Plan

Recommendation 8

- *Participate in future air quality field programs.*
 - Southeast Texas Transport Study (2005)
 - Northeast Texas Plume Study (2005)
 - Houston Triangle Experiment (2006)
 - Solar Occultation Flux Experiment (2006)
 - TexAQS2 Radical Measurement Project (2006)
 - Baylor Aztec Flights (2006)
 - Real-time MM5 and CMAQ Forecasts in Support of TexAQS 2 Flight Planning (2005 and 2006)

Strategic Research Plan

Recommendations 9 and 10

- *Initiate human exposure research, coordinating with major air quality field studies.*
- *Coordinate human exposure research on HAPs with on-going analyses of benzene exposures in the Houston-Galveston area.*
 - Co-funding HEATS with Mickey Leland NUATRC
 - Conducting a study of children's exposure to DPM and other pollutants in school buses
 - Collaborating with UH in applying OLAP, data warehousing, data mining and GIS technology to analysis of air toxics as part of EPA-funded effort

Strategic Research Plan

Recommendations 11 and 12

- *Launch a permanent data and information exchange infrastructure.*
 - Developed prototype for an Air Research Information Infrastructure (ARII)
 - ARII combines OLAP, data warehousing, data mining and GIS technology
- *Develop methods for assessing progress in attaining federal pollution standards.*
 - Evaluated effectiveness of HSC monitor network in detecting HRVOC releases
 - Evaluated implementation of industrial HRVOC monitoring required by HGB SIP
 - Evaluated, developed, and deployed new monitoring techniques

Regulatory Impact of TERC Research

- Multiple citations of TERC research in HGB December 2004 1-hr SIP
- Implementation of HECT, short-term limit and industry monitoring of HRVOCs by TCEQ as a result of Project H13
- Expansion of DFW non-attainment area due to findings of Project H27
- TCEQ proposing oil and gas tank storage and degassing rule aided by results of Project H51C
- Public interest in proposed new EGU permits informed by Project H60

TERC Funding Outlook

- \$300K adjustment of FY2007 Board-approved projects to accommodate new short-term priorities
- TERC seeking permission to use NTRD funds for air quality research
- Likely availability of new CIAP funds by summer 2007 (\$15MM proposed)
- Legislative proposal to increase TERP funding will benefit air quality research

Formaldehyde

- *Preliminary Indications from Field Study and Project H60*
 - TexAQS 2 observations indicate large (20 ppb) transient concentrations at night, as well as daytime concentrations of more than 40 ppb
 - Primary vs secondary HCHO a major issue
 - H60 Phase 2 modeling indicates HCHO possibly from flares and diesel exhaust can have major ozone impacts
- *TERC Board Resolution 2.00*
 - Directs HARC to initiate \$1MM worth of research on HCHO, including:
 - Improvement of HCHO emission inventories
 - Modeling to assess HCHO impacts on ozone
 - Control strategy analyses
 - Subject to SAC approval on details

Questions Posed to SAC

- *Preliminary Scientific Findings*
 - What are the key findings of TexAQS II and related TERC projects?
- *Implications for the Texas SIP*
 - Is formaldehyde a missing ingredient in emission inventories and SIP control strategies?
 - What additional modeling and control strategy analyses would be useful in future SIP development?
- *Follow-up Research Needed*
 - What analyses of TexAQS II data are critical in the near term?

Near-Term Research Identification Process

- Private SAC deliberation on November 10
- Production of 2007 TERC Synthesis
 - Summary of TERC research results from TexAQS 2 and related modeling projects
 - Collaboration of HARC, SAC and TERC-funded PIs
 - Review by TCEQ and TERC stakeholders
 - Results provided to Rapid Science Synthesis Team
 - May include project concepts to be implemented by TERC Research Teams
 - Basis for near-term funding decisions

Longer-Term Research Request for Qualifications

- TERC is expanding the capabilities of its research teams by issuing two new RfQs: <http://www.tercairquality.org/RFQs/>
- Areas of expertise solicited:
 - AQR-RFQ-IIA (Deadline: November 30, 2006)
 - Assessment of Efficacy of Emission Control Measures
 - Air Quality Policy and Regulatory Analysis
 - AQR-RFQ-IIB (Deadline: December 31, 2006)
 - Emission Processes and Inventories for Point and Area Sources
 - Modeling and Assessment of Mobile Source Emissions
 - Urban, Regional, and Transportation Planning Related to Air Quality Issues
 - Atmospheric Chemistry of Ozone, PM, Regional Haze, and Air Toxics
 - Meteorology
 - Air Monitoring Research/Ambient Measurement
 - Air Quality Modeling Research
 - Human Exposure Research

Longer-Term Research

Air Toxics

- Major issue publicized by Houston Chronicle
- Mayor Bill White established Task Force on Reducing Air Quality Health Risks
- Task Force report identified:
 - 12 substances posing definite risks to human health including:
 - ozone, PM2.5, DPM, 1,3-butadiene, chromium VI, benzene, ethylene dibromide, acrylonitrile, formaldehyde, acrolein, chlorine, hexamethylene diisocyanate
 - 9 substances that are probable risks
 - 24 substances that are possible risks

Longer-Term Research

Fine Particulates

- Change in federal 24-hr PM_{2.5} standard from 65 $\mu\text{g}/\text{m}^3$ to 35 $\mu\text{g}/\text{m}^3$
- Annual mean standard unchanged at 15 $\mu\text{g}/\text{m}^3$
- Concern about monitoring trends in TX for both annual mean and 24-hr concentrations
- State recommendations to EPA by December 2007 based on 2004-2006 monitoring data
- EPA final designation by December 2009
- Designations effective April 2010
- SIPs due April 2013
- Attainment by April 2015 based on 2012-2014 monitoring data

Longer-Term Research

TERC Future Agenda

- SAC will evaluate RfQ responses and qualify new research teams
- SAC Meeting in May 2007 to discuss research agenda for air toxics and PM_{2.5}
- Projects may be funded through CIAP as well as TERP/TCEQ