

TERC Research Priorities 2006-2007

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Funding Outline

- TX Legislature earmark from TERP funds may yield \$3M (unloaded) for FY 2006-2007
- \$500K of FY 2005 excess TERP funds reserved for FY 2006 projects
- **Total of \$3.5M for FY 2006-2007 AQ research**
- Additional funds possible from other sources (e.g., TCEQ SEP program)
- TERC will partner with TCEQ, NUATRC and others in funding air toxics research

Research Categories

- **TexAQS 2006 Intensive Study**
 - Take advantage of concurrent research by national labs and others to address major scientific issues
- **State Implementation Plan**
 - Provide critical input to 8-hr ozone SIPs for DFW and HGB before submission deadline of June 15, 2007
 - Anticipate possible Mid Course Review
- **Air Toxics Exposure**
 - Major attention due to Houston Chronicle articles focusing on Houston Ship Channel neighborhoods

SAC Approved Projects

- ***STEM 4DVar Chemical Data Assimilation***
(University of Iowa, \$200K, 2 yrs)
 - Inverse modeling of East Texas emissions using satellite data for CO (AIRS, MOPITT), NO₂ and CH₂O (SCHIAMACHY) plus other TexAQS measurements. Possible real-time adaptive observation planning.
- ***Solar Occultation Flux (SOF)***
(Chalmers University, \$170K, 1 yr)
 - Mobile SOF + SODAR measurements of VOC emission fluxes from industrial facilities and dockside marine vessels in the Houston Ship Channel.
- ***Solvents Project*** *(up to \$150K, 2 yrs)*

TexAQS 2006

Basic Commitments

- **East Texas Air Quality Forecasting**
(TEX-MET-5, \$240K, 1 yr)
- **Real-time Meteorological Forecasts**
(TEX-MET-6, \$240K, 1 yr)
- **NE TX Plume Study (NETPS) and SE TX Transport Study (SETTS) Data Analysis**
(TEX-MET-15, \$180K, 1.5 yrs)

TexAQS 2006

Night-time Issues

- **Rationale:** *Nocturnal jet, PBL height, vertical mixing major issues in SIP modeling. Night-time O₃ chemistry and transport not well understood.*
- **Nocturnal BL** (*TEX-MET-4, \$110K, 1 yr*)
 - Use of tethered sondes balloons to vertically profile winds, T, RH, and O₃ in nocturnal boundary layer
- **Smart Balloons** (*TEX-CHM-10, \$500K, 2 yrs*)
 - Use of tethered balloons and chase aircraft to characterize night-time O₃ chemistry (including aerosols) and transport (follow-up of Summer 2005 project)

TexAQS 2006

Daytime Radical Chemistry

- **Rationale:** *Houston SIP model has low O₃ productivity despite high VOC and NO_x levels.*
- **HONO Project** (*TEX-CHM-2, \$70K, 1 yr*)
 - Measure daylight-average HONO (annular denuders) and do AQ modeling to see if heterogeneous HONO formation on buildings can boost O₃ productivity
- **TRAMP Project** (*TEX-CHM-3, \$400K, 1 yr*)
 - Tower photolysis and concentration measurements (HONO, CH₂O, H₂O₂, MHP, carbonyls, other VOCs, plus O₃, NO_x, PAN, CO) and evaluation of radical concentrations, sources and sinks using box model

TexAQS 2006

Meteorology Data Assimilation

- **Rationale:** *SIP model wind and PBL height biases affect O_3 and precursor concentrations. Need to constrain MM5 model with observations.*
- **GOES Satellite Data** (*TEX-MET-14, \$45K, 1 yr*)
 - Improve GOES satellite data assimilation (DA)
 - Enhance meteorology component of STEM 4DVar DA and inverse modeling project
- **Ensemble Kalman Filter (EnKF)**
 - Radar EnKF (*TEX-MET-9, \$160K, 2 yrs*)
 - Land Surface and Vertical Mixing EnKF (*TEX-MET-10, \$200K, 2 yrs*)

TexAQS 2006

Nitrogen Reservoirs

- **Rationale:** *NO_z influences local O₃ productivity and may be transported remotely as part of NO_y.*
- **Ion-Drift Chemical Ionization Mass Spec**
(*TEX-CHM-5, \$150K, 1 yr*)
 - Deploy ID-CIMS instrument in a trailer or on a tower to measure night-time HONO, N₂O₅, and HNO₃
- **Downwind Aging of Houston Plume**
(*TEX-CHM-6, \$120K, 2 yrs*)
 - Build portable, speciated NO_y flux system based on fast-response NO₂ (luminol) analyzers and perform rural tower measurements during Summer 2006

TexAQS 2006

Transport Mechanisms

- **Rationale:** *Dead zones and transport via the Free Troposphere (FT) may lead to high ozone.*
- **Frontal Dead Zones**
(*TEX-MET-12, \$200K, 1 yr*)
 - Fly aircraft & run models to examine role of stationary fronts and moist convection in producing high ozone in PBL and/or FT
- **Lightning NO_x and Regional Ozone**
(*TEX-MET-16, \$200K, 2 yrs*)
 - Modeling to assess impacts of lightning NO_x and PBL-FT exchange on regional O₃
- **Summertime Transport Climatology**
(*TEX-MET-17, \$240K, 2 yrs*)
 - Modeling to assess relative importance of transport vs. local ozone production in Houston and DFW

DFW SIP

NO_x and Biogenic Emissions

- EGU Emission Forecasts Using ENERGY 2020 Model (SIP-2)
- 2010 Land Use / Land Cover (SIP-4)
- Heavy Duty Truck Idling Estimates (SIP-5)
- Mobile Source NO_x Correction (SIP-6)
- Biogenics in SIP Modeling (SIP-17)
- Compressor Engine NO_x Emission Factors (SIP-21)

Houston SIP

HRVOC Emissions and Impacts

- VOC Emission Stack Parameters (SIP-1)
- HRVOC Emission Trading and Event Tracking (SIP-14, SIP-15)
- HRVOC Stochastic Inventory and Rule Effectiveness, THOE Forecasting (SIP-18, SIP-19, SIP-20)

State Implementation Plan

Other VOCs

- **Assess OVOC Control Strategies (SIP-13)**
 - Use higher-order DDM and SAPRC chemical mechanism to map ozone response curves
 - Assess economic cost and ozone benefits of OVOC controls
- **Wastewater Emissions (SIP-22)**
 - Use HAWK camera and traditional tests to identify VOC emissions from wastewater / process sewers
- **Storage Tank Emissions (SIP-23)**
 - Use HAWK camera to identify leaking storage tanks
 - Determine emission rates and compare to AP-42

State Implementation Plan

New Ozone Standard

- New ozone design value (DV) = 3 yr avg of 4th highest daily 8-hr max at each monitor
- 8-hr ozone DV now determined by multiple episodes in different years and/or seasons
- May need to consider new episodes for SIP modeling (SIP-3) consistent with new conceptual model (H12.8HRA) and new EPA guidance
- Regulatory timetable constrains what new science can be adopted in 2007 SIP
- Need to consider Mid Course Review SIP

Air Toxics Exposure

- Complement RIOPA study by assessing near-source human exposure in Houston Ship Channel
- Personal Exposure Monitoring (PEM) study should coincide with TexAQS 2006 (*ATE-1, \$300K, 1 yr*)
- Couple a neighborhood-scale dispersion model to a human exposure model such as APEX and use it to evaluate PEM study data (*ATE-2, \$150K, 1 yr*)
- Develop toxics chemical mechanism and use AQ model to evaluate TRI emissions (*ATE-3, \$200K, 1-2 yrs*)
- Determine importance of emission events to acute and chronic exposure (*ATE-5, \$100K, 1 yr*)

Summary of Major Issues

- **TexAQS 2006**
 - Night-time vertical mixing, chemistry, and transport
 - Radical and reactive nitrogen chemistry
 - Data assimilation to improve meteorology models
 - Dead zones, transport involving PBL-FT coupling
- **State Implementation Plan**
 - NO_x, biogenic, HRVOC and OVOC emissions
 - Change in modeling practice for 8-hour ozone should take precedence over control strategy evaluation
- **Air Toxics Exposure**
 - Assessment of near-source personal exposure in Houston Ship Channel neighborhoods