

VII. Consideration and Adoption of Resolution 2.06

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RESOLUTION 2.06

Whereas the Texas Air Quality Study II was conducted in 2005 and 2006; and

Whereas significant additional data were collected during this study regarding ozone and its precursors and various other pollutants; and

Whereas after reviewing the data collected, TERC's Science Advisory Committee has developed and approved a set of priority research projects to fund to support future SIP development; and

Whereas the appropriate staff of the Texas Commission on Environmental Quality also has approved the completion of these studies.

Now, Therefore, Be It Resolved that the Board of Directors of the Texas Environmental Research Consortium hereby authorizes the Houston Advanced Research Center to:

- engage persons and entities to complete the following new studies:
 - H84 (Development of Databases and Characterization of Meteorological Conditions for the TexAQS II Intensive Period) for up to \$80,000;
 - H86 (TRAMP Data Analysis and Radical Chemistry Study) for up to \$80,000;
 - H87 (Multi-Resolution Simulation and Analysis of TexAQS II Air Pollution Events) for up to \$90,000; and
- delay or cancel the following projects if deemed necessary by the Science Advisory Committee to enhance other projects:
 - H66.SGU (Emissions Inventory Study on Small Electric Power Generating Units in the Houston Region); and
 - H77 (Comparison of the Carbon Bond and SAPRC Photochemical Mechanisms under Conditions Relevant to Southeast Texas).

Adopted and Approved this 15th day of March 2007

Kelly Frels, Chairman

NEW AIR QUALITY RESEARCH PROJECTS

The following project concepts have been approved by the Science Advisory Committee (SAC) for recommendation to the TERC Board of Directors:

Project Number: H84

Title: Development of Databases and Characterization of Meteorological Conditions for the TexAQS II Intensive Period

Duration: March 15, 2007 to August 31, 2007

Project Description:

The goal of this project is to lay the groundwork for accurate simulation of 2006 meteorological episodes for use in SIP modeling. This project will: 1) develop a comprehensive meteorological dataset for TexAQS II-2006 based on all available sources; 2) characterize the meteorological conditions prevailing during TexAQS II-2006, especially during days on which major TERC experiments were conducted; and 3) examine real-time meteorological and air quality forecasts made during the TexAQS II intensive period to determine successes and failures, and to develop strategies for better meteorological simulations of relevant ozone episodes.

Expected Benefits/Policy Relevance:

This project will assist the TCEQ in development of a 2006 model episode for the Houston-Galveston-Brazoria SIP.

Budget: \$80,000

Project Number: H86

Title: TRAMP Data Analysis and Radical Chemistry Study

Duration: March 15, 2007 to August 31, 2007

Project Description:

The goal of this project is to determine: 1) the main sources and sinks for radicals in Houston air, and 2) the processes determining the daytime and night-time radical budget. Special consideration will be given to contributions from formaldehyde, HONO, and ozone-olefin reactions. Using the complete suite of the data collected at Moody Tower, especially for VOCs, CO, and NO_x, OH reactivity will be calculated and compared to the observed OH reactivity to identify missing OH reactivity. Box model calculations using the Regional Atmospheric Chemistry Mechanism (RACM) will be performed to analyze radical sources and sinks (and production and loss rates).

Expected Benefits/Policy Relevance:

This project may help to improve Houston SIP model performance by increasing model ozone productivity and control strategy effectiveness. This may allow Houston to demonstrate attainment of the 8-hour ozone standard.

Budget: \$80,000

Project Number: H87

Title: Multi-resolution Simulation and Analysis of TexAQS II Air Pollution Events

Duration: March 15, 2007 to August 31, 2007

Project Description:

The objectives of this project are to: (1) perform source attribution of observed TexAQS II air pollution events using trajectory, HDDM sensitivity, and dynamic process analysis; (2) characterize the relative contributions of NO_x and VOC emissions to high ozone concentrations; (3) study the effects of model assumptions for vertical mixing; and (4) use process analysis to investigate radical sources, both at night and during the day, including formaldehyde, HONO, and products of ozone and olefin reactions. The project will conduct model assessments at 4-km and 1-km resolution based on meteorological forecasts for the TexAQS II intensive period and 2006 special inventory data from TCEQ, wherever possible. Simulated species contributions will be compared to routine measurements and TexAQS II data, as available, to identify successes and failures in the simulation. The results of the project will be used to identify the best days for which to conduct further analyses of TexAQS II data.

Expected Benefits/Policy Relevance:

This project will help to improve Houston SIP model performance by identifying the most promising periods for use in episode development and by increasing model ozone productivity and control strategy effectiveness. This may allow Houston to demonstrate attainment of the 8-hour ozone standard.

Budget: \$90,000

VIII. Consideration and Adoption of Resolution 2.07

TEXAS environmental improvement
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RESOLUTION 2.07

Whereas the legislature which authorized the Texas Emission Reduction Plan also established eligible uses of funds allocated to the New Technology Research and Development (NTRD) Program; and

Whereas air quality assessments and modeling are specifically listed as eligible uses of NTRD funds; and

Whereas the Texas Commission on Environmental Quality and the Texas Council on Environmental Technology allocated 10 – 15% of the NTRD Program’s funds for air quality assessments and modeling during their administration of the NTRD Program; and

Whereas it is imperative that the air quality studies prioritized by the Science Advisory Committee as a follow-up to Texas Air Quality Study II be completed as expeditiously as possible to support the development of future State Implementation Plans for Houston-Galveston and Dallas-Ft. Worth.

Now, Therefore, Be It Resolved that the Board of Directors of the Texas Environmental Research Consortium hereby authorizes its Executive Director and the Houston Advanced Research Center to use up to \$1.0 million of the NTRD Program’s funds to support air quality assessments and modeling, subject to the approval of the Texas Commission on Environmental Quality.

Adopted and Approved this 15th day of March 2007.

Kelly Frels, Chairman

PROJECTS PROPOSED FOR NTRD FUNDING

The following project concepts have not yet been reviewed by the SAC, nor have their associated cost estimates been finalized:

Emissions Verification of Solar Occultation Flux (SOF) Data (\$175,000)

The goal of this study is to improve Houston VOC emissions inventories (including the inference of direct formaldehyde emissions) based on TexAQS 2 mobile van (SOF) and aircraft measurements of VOCs, ozone, and aerosols. Aircraft measurements include those by the Baylor Aztec, and by the NOAA's P3 and Twin Otter. The project will use the TCEQ's 2006 special inventory as the base emissions, for which adjustments will be recommended based on the results of the analysis. A Lagrangian Reactive Plume Model (LRPM) equipped with the SAPRC chemical mechanism will be used to conduct data analysis of SOF, aircraft, and meteorological data, to characterize VOC emissions and explain ozone and secondary formaldehyde production in the measured pollution plumes. Formaldehyde data from both the P3 and Aztec will also be compared to establish the accuracy of the Aztec data.

Aerosol and VOC Source Apportionment Based on Data from the TexAQS II-2006 Houston Triangle Experiment (\$75,000)

Back trajectories and the Potential Source Contribution Function method will be used to provide a map for a variety of species (gas-phase and aerosol) showing the frequency with which each point over the selected domain is associated with a "high" event at a given receptor location (Deer Park, Bayland Park, or Aldine). Points associated with high values at a receptor are candidate source locations for the species of interest.

Development of Data Assimilation Schemes Leading to Improved Representation of Vertical Mixing in Models (\$40,000)

This project will employ an advanced method for incorporating observational data in models (data assimilation) to develop meteorological simulations for the TexAQS II intensive period. In particular, the Ensemble Kalman Filter (EnKF) method will be used to determine the optimal choice of parameterization schemes and parameter values for vertical mixing in an operational context. A previous TERC study has found that simultaneous incorporation of pollution and meteorological observations can improve model simulations of wind and transport. A carbon monoxide tracer model will therefore be used in conjunction with the MM5 meteorological model to enable observations of CO to be used in the EnKF data assimilation scheme.

Feasibility of a Computer Assisted Tomography-Automated Long Path Monitoring Network in the Houston Ship Channel (\$185,000)

This project will determine the feasibility of deploying long path instruments such as DOAS and OP-FTIR together with Computer Assisted Tomography in an automated monitoring network for measuring critical species in the Houston Ship Channel. Priority will be given to measurements of ozone, NO_x, HCHO, HONO, and HRVOCs. Other VOCs, such as aromatics, will be considered as well, depending on cost and technical feasibility. The network will be designed to provide better information for building emissions inventories, SIP modeling, and enforcement of air quality regulations.

Measurement of Flare-Emitted Species (TBD: \$225,000)

The goal of this project is to identify and measure the emission rates of chemical species released by flares for various types of industrial facilities, including olefin plants and refineries. Special consideration will be given to direct formaldehyde emissions. Ground-based and/or aircraft measurements will be made with instrumentation to be selected based on theoretical estimates of flare emissions. Possible measurement techniques may include Fourier Transform Infrared (FTIR) spectroscopy, Tunable Diode Laser Absorption Spectroscopy (TDLAS), and Hantzsch reaction fluorescence.

Feasibility of Advanced Burner Technology to Control Point Source Emissions of NO_x in Houston (TBD: \$100,000)

The most recent burner designs for new boilers and furnaces combined with Computational Fluid Dynamics (CFD) modeling has achieved flue gas NO_x concentrations of less than 10 ppm. This level of NO_x reductions can enable many new furnaces to attain the TCEQ's original goals of 90% NO_x reductions without having to install expensive Selective Catalytic Reduction (SCR) technology. On existing combustion devices, the reach and performance of the burner retrofits is limited by constraints associated with the existing facility design, construction, and operation. This project will identify possible existing point source sites that can benefit from the new burner and CFD technologies, the amount of NO_x emissions that can be avoided, and the associated costs. A key part of the study will be to assess the complete point source inventory in the Houston area and determine: a) current performance of installed combustion technology, and installed cost for industry, b) existing sources that may be retrofit with existing burners, and the estimated installed cost and NO_x benefits, and c) existing sources that may be retrofit with developing advanced burner technology, and the estimated installed cost and NO_x benefits.

Assessment of Barge Emissions of VOCs in the Houston Region (TBD: \$200,000)

During the past year the TCEQ employed a helicopter equipped with a GasFindIR (HAWK) camera and identified significant amounts of VOCs released from barges. Since the GasFindIR camera cannot quantify emissions, the impact of these releases on the emissions inventory is uncertain. This study would develop methods for quantifying the emissions from barges, both docked and in transit, using the best available methods and technologies. This project would estimate HGB area VOC emissions from barges using methods similar to TERC's H51C project that measured VOC emissions from oil and gas storage tank facilities. Measurements will include tagging bag samples to obtain concentrations of the contaminants and flow rates if emitting gases from relief valves, hatches and other areas where releases are suspected to occur.

X. Consideration and Adoption of Resolution 2.08

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RESOLUTION 2.08

Whereas the Houston Advanced Research Center published Request for Grant Assistance #7 in October 2007 with regard to the solicitation of technologies to reduce NOx in the marine sector; and

Whereas a set of eligible projects were received that have been evaluated by the Environmental Technology Advisory Council; and

Whereas the Environmental Technology Advisory Council and the NTRD Program Director are recommending that three of the ten technology projects received in response to RFGA #7 be funded.

Now, Therefore, Be It Resolved that the Board of Directors of the Texas Environmental Research Consortium hereby authorizes its Executive Director and the Houston Advanced Research Center to fund the following technology projects:

Applicant: Advanced Global Engineering/Miratech
Project title: Oxidation catalysts and modified fuel injectors
Grant award: \$226,427

Applicant: MJ Bradley
Project title: UREA Selective Catalytic Reduction (SCR)
Grant award: \$248,815

Applicant: ESW
Project title: Lean NOx catalyst system
Grant award: \$250,000

Adopted and Approved this 15th day of March 2007.

Kelly Frels, Chairman

Advanced Global Engineering and MIRATECH Corporation **Abstract**

This proposal presents an innovative solution that represents a cooperative combination of two complementary emission reduction technologies that provides a **50% NOx reduction** as well as **similar significant reductions in PM, THC and CO emissions levels**.

The US Inland and Coastal Waterway marine vessel operations that currently employ large medium speed diesel engines such as those manufactured by the Electro-Motive Diesels, (formerly the Electro-Motive Division of General Motors), and General Electric Transportation Systems, may have the unique opportunity to lower exhaust emissions by combining two technologies currently being developed for other applications that employ similar engines. These large medium speed diesel engines are also found in locomotives and stationary power generator sets for which various levels of emission reduction technologies have been developed to comply with the Federal standards. These regulations are responsible for spawning new and innovative ideas and products that offer alternative solutions to the OEM package.

The thrust of this proposal would be to incorporate two technologies into one emission reduction system, apply that system to a representative test engine and determine the feasibility of achieving the expected emission reductions for all major gaseous constituents. Prior test data is offered that demonstrates each product's ability to achieve significant emission reductions. Both technologies have the unique quality of being 100% retrofittable with current engine components. After the existing parts are removed, there are no special tools, adaptors or support structures and associated training required to apply both concepts to the existing engine. This advantage makes them both readily commercialized as a certifiable emissions reduction system that is easy to install and maintain.

ESW America, Inc. **Abstract**

ESW is proposing to further develop our XTRM Cat™ after treatment device for marine engines to exceed Tier 1, and provide near Tier 2 NOx emission requirements for marine diesel engines. This technology has undergone significant engineering design and testing to date to achieve approximately 30 percent NOx emission reductions as compared to the Tier 0 standard. Further engineering and refinement for durability and emission reduction optimization is required towards meeting the long term goal of obtaining EPA certification as a NOx emission reduction control device. Certification will provide incentive to manufacturers, parts suppliers and operators to incorporate this technology as a means of achieving significant NOx emission reductions. In addition, the technology offers the benefit of being able to use existing pre-Tier 0 injectors without engine modifications (e.g., timing). Over a five-year life, it is anticipated that the capital cost will be approximately equal to that of a Tier 0 rebuild kit, providing the operator with a cleaner than required engine and fuel savings for no additional cost, maximizing cost-effectiveness. The system is also backwards compatible with Tier 0 rebuild kits so that if ever necessary, the engine could be returned to Tier 0 compliance

M.J. Bradley & Associates, Inc.

Abstract

To meet ambient air quality standards in the Houston-Galveston area requires substantial reduction of the NO_x inventory. A major source of NO_x at the ports is due to operation of marine engines in tugs and towboats. Proposed is the design, development and demonstration of a stand-alone urea-SCR system that can be used reliably to produce over 50% reduction in NO_x from marine diesel engines. A major objective is that the system should not require electronic interfacing with the engine, to simplify engine retrofit, to avoid reliance on engine durability, and to accommodate retrofit of mechanically injected engines that are typical in marine applications. The program objectives are to prepare a robust, durable design that provides for NO_x mass measurement and NO_x abatement, while insuring that ammonia slip is eliminated, to select the best available technologies for inclusion in the design, and to configure a controller to receive sensor signals, manage the urea injection, and monitor the system for faults. The system will be designed and constructed, and then demonstrated using a diesel engine connected in a test cell. The proposers will also develop a strategy for scaling the system so that it can enjoy a wide variety of marine and off-road applications. The pathway to commercialization differs from one that would be used for on-road applications, because there are relatively few tugs and their designs differ. A detailed urea-SCR design will be prepared so that the system can be installed by an integrator.

The proposing team will be led by M.J. Bradley and Associates (MJB&A), with West Virginia University (WVU) as a subcontractor. MJB&A previously have led emissions reduction efforts for the Staten Island ferries, with WVU as a subcontractor, and WVU has a strong record in reduction and characterization of diesel engine emissions.

XII. Consideration and Adoption of Resolution 2.09

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RESOLUTION 2.09

Whereas Senate Bill 12 as proposed would require the Texas Environmental Research Consortium and its Research Management Organization, the Houston Advanced Research Center, to comply with the Open Meetings and Open Records Acts; and

Whereas Senate Bill 12 may be enacted with sufficient legislative support to have immediate effect; and

Whereas it is absolutely necessary for TERC and HARC to fully comply with these state laws if Senate Bill 12 is passed as proposed regarding them; and

Whereas the Board of Directors and TERC and HARC's staff need to be thoroughly briefed and trained on the relevant provisions of the Open Meetings and Open Records Acts to assure full compliance.

Now, Therefore, Be It Resolved that the Board of Directors of the Texas Environmental Research Consortium hereby authorizes its Executive Director and Research Management Organization to engage persons and/or entities for the purpose of training TERC and HARC's staffs on the relevant provisions of the Open Meetings and Open Records Acts.

Adopted and Approved this 15th day of March 2007.

Kelly Frels, Chairman

Executive Session

A. Consideration and Adoption of Resolution 2.10

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RESOLUTION 2.10

Whereas the Texas Environmental Research Consortium currently maintains banking accounts at Sterling Bank; and

Whereas it has become necessary for these banking accounts to be moved to another bank; and

Whereas comparable banking services may be achieved at another banking institution that more appropriately meets TERC's needs; and

Now, Therefore, Be It Resolved that the Board of Directors of the Texas Environmental Research Consortium hereby authorizes Chairman Frels to establish banking services for TERC at appropriate banking institutions.

Adopted and Approved this 15th day of March 2007

Kelly Frels, Chairman