

AIR QUALITY RESEARCH PROGRAM

**Texas Commission on Environmental Quality
Contract Number 582-10-94300
Awarded to The University of Texas at Austin**

Quarterly Report

December 1, 2012 through February 28, 2013

Submitted to

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March 4, 2013

Texas Air Quality Research Program

Quarterly Progress Report

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Overview

The goals of the State of Texas Air Quality Research Program (AQRP) are:

- (i) to support scientific research related to Texas air quality, in the areas of emissions inventory development, atmospheric chemistry, meteorology and air quality modeling,
- (ii) to integrate AQRP research with the work of other organizations, and
- (iii) to communicate the results of AQRP research to air quality decision-makers and stakeholders.

On April 30, 2010, the Texas Commission on Environmental Quality (TCEQ) contracted with the University of Texas at Austin to administer the AQRP. For the 2010-2011 biennium, the AQRP had approximately \$4.9 million in funding available. Following discussions with the TCEQ and an Independent Technical Advisory Committee (ITAC) concerning research priorities, the AQRP released its first request for proposals in May, 2010. Forty-five proposals, requesting \$12.9 million in research funding were received. These proposals were reviewed by the ITAC for technical merit, and by the TCEQ for relevancy to the State's air quality research needs. The results of these reviews were forwarded to the AQRP's Advisory Council, which made final funding decisions in late August, 2010. As of November 30, 2011, all projects have been completed. Final reports on all but one project have been posted to the AQRP website.

In June 2011, the TCEQ renewed the AQRP for the 2012-2013 biennium. Funding of \$1,000,000 for the FY 2012 period was awarded in February 2012. An additional \$1,000,000 for the FY 2013 period was awarded in June 2012. At the same time an additional \$160,000 was awarded for FY 2012, to support funding for two specific air quality projects recommended by the TCEQ. A call for proposals was released in May 2012. Thirty-two proposals, requesting \$5 million in research funding were received. The proposals were reviewed by the ITAC and the TCEQ. The Advisory Council selected 14 projects for funding. Contracts have been signed with each organization and work plans have been approved for all but one project. Task Orders are in place and work has begun on 10 of the 14 projects. Of the four projects that have not yet initiated work, three of the projects have Task Orders out for signature, and the last project is under development. This last project was purposefully delayed until other related projects had been approved.

BACKGROUND

Section 387.010 of HB 1796 (81st Legislative Session), directs the Texas Commission on Environmental Quality (TCEQ, Commission) to establish the Texas Air Quality Research Program (AQRP).

Sec. 387.010. AIR QUALITY RESEARCH. (a) The commission shall contract with a nonprofit organization or institution of higher education to establish and administer a program to support research related to air quality.

(b) The board of directors of a nonprofit organization establishing and administering the research program related to air quality under this section may not have more than 11 members, must include two persons with relevant scientific expertise to be nominated by the commission, and may not include more than four county judges selected from counties in the Houston-Galveston-Brazoria and Dallas-Fort Worth nonattainment areas. The two persons with relevant scientific expertise to be nominated by the commission may be employees or officers of the commission, provided that they do not participate in funding decisions affecting the granting of funds by the commission to a nonprofit organization on whose board they serve.

(c) The commission shall provide oversight as appropriate for grants provided under the program established under this section.

(d) A nonprofit organization or institution of higher education shall submit to the commission for approval a budget for the disposition of funds granted under the program established under this section.

(e) A nonprofit organization or institution of higher education shall be reimbursed for costs incurred in establishing and administering the research program related to air quality under this section. Reimbursable administrative costs of a nonprofit organization or institution of higher education may not exceed 10 percent of the program budget.

(f) A nonprofit organization that receives grants from the commission under this section is subject to Chapters 551 and 552, Government Code.

The University of Texas at Austin was selected by the TCEQ to administer the program. A contract for the administration of the AQRP was established between the TCEQ and the University of Texas at Austin on April 30, 2010 for the 2010-2011 biennium, and was renewed in June 2011 for the 2012-2013 biennium. Consistent with the provisions in HB 1796, up to 10% of the available funding is to be used for program administration; the remainder (90%) of the available funding is to be used for research projects, individual project management activities, and meeting expenses associated with an Independent Technical Advisory Committee (ITAC).

RESEARCH PROJECT CYCLE

The Research Program is being implemented through a 9 step cycle. The steps in the cycle are described from project concept generation to final project evaluation for a single project cycle.

- 1.) The project cycle is initiated by developing (in year 1) or updating (in subsequent years) the strategic research priorities. The AQRP Director, in consultation with the ITAC, and the TCEQ develop research priorities; the research priorities are released along with a Request for Proposals.
- 2.) Project proposals relevant to the research priorities are solicited. The Request for Proposals can be found at <http://aqrp.ceer.utexas.edu/>.
- 3.) The Independent Technical Advisory Committee (ITAC) performs a scientific and technical evaluation of the proposals.
- 4.) The project proposals and ITAC recommendations are forwarded to the TCEQ. The TCEQ evaluates the project recommendations from the ITAC and comments on the relevancy of the projects to the State's air quality research needs.
- 5.) The recommendations from the ITAC and the TCEQ are presented to the Council and the Council selects the proposals to be funded. The Council also provides comments on the strategic research priorities.
- 6.) All Investigators are notified of the status of their proposals, either funded, not funded, or not funded at this time, but being held for possible reconsideration if funding becomes available.
- 7.) Funded projects are assigned a Project Manager at UT-Austin and a Project Liaison at TCEQ. The project manager at UT-Austin is responsible for ensuring that project objectives are achieved in a timely manner and that effective communication is maintained among investigators involved in multi-institution projects. The Project Manager has responsibility for documenting progress toward project measures of success for each project. The Project Manager works with the researchers, and the TCEQ to create an approved work plan for the project. The Project Manager also works with the researchers, TCEQ and the Program's Quality Assurance officer to develop an approved Quality Assurance Project Plan (QAPP) for each project. The Project Manager reviews monthly, annual and final reports from the researchers and works with the researchers to address deficiencies.
- 8.) The AQRP Director and the Project Manager for each project describe progress on the project in the ITAC and Council meetings dedicated to on-going project review.
- 9.) The project findings are communicated through multiple mechanisms. Final reports are posted to the Program web site; research briefings are developed for the public and air quality decision makers; and a bi-annual research conference/data workshop is held.

Steps 1 – 9 have all been completed for the initial (2010-2011) biennium. Steps 1 – 6 have been completed for the 2012 – 2013 biennium, and steps 7 and 8 are in progress. A summary of the 2012-2013 activities is described below.

Activities during the current reporting period include completing the contracting with the Institutions where the research projects will be performed, working with the investigators to develop the project Work Plans, and working with projects that are active.

All but one of the projects has their Work Plans fully approved. (The Work Plan consists of the Project Plan, Budget and Justification, and Quality Assurance Project Plan (QAPP).) Ten of the projects are active and three projects have Task Orders issued, and will be active as soon as they are signed and returned. The final project was purposefully delayed until other related projects were approved.

Discover AQ

In the summer of 2013, the DISCOVER-AQ (Deriving Information on Surface Conditions from Column and Vertically Resolved Observations Relevant to Air Quality) program is planning to deploy NASA aircraft to make a series of flights with scientific instruments on board to measure gaseous and particulate pollution in the Houston, Texas area. The purpose, for NASA, of this campaign is to improve the use of satellites to monitor air quality for public health and environmental benefit.¹

To complement the NASA flight-based measurements, and to leverage the extensive measurements being funded by NASA to better understand factors that control air quality in Texas, ground-based air quality measurements will be made simultaneously by researchers from collaborating organizations, including research scientists and engineers funded wholly or in part by the AQRP and the TCEQ.

RESEARCH PROJECTS

Research Projects for FY 2010-2011 are now completed. All projects have submitted final invoices and those invoices have been paid. The Final Report for each project, with the exception of one, is posted on the AQRP website at <http://aqrp.ceer.utexas.edu/projects.cfm>.

A summary of the projects approved for funding for FY 2012-2013 follows.

Project 12-004

STATUS: Work Plan under Review

DISCOVER-AQ Ground Sites Infrastructure Support

University of Texas at Austin – Vincent Torres AQRP Project Manager – Dave Sullivan
TCEQ Project Liaison – Erik Gribbin

Funding Limited to: \$289,200

Executive Summary:

In the summer of 2013, the DISCOVER-AQ (Deriving Information on Surface Conditions from Column and Vertically Resolved Observations Relevant to Air Quality) program is planning to deploy NASA aircraft to make a series of flights with scientific instruments on board to measure gaseous and particulate pollution in the Houston, Texas area. The purpose of this campaign, for NASA, is to improve the use of satellites to monitor air quality for public health and environmental benefit.¹

To complement the NASA flight-based measurements, and to leverage the extensive measurements being funded by NASA to better understand factors that control air quality in Texas, ground-based air quality measurements will be made simultaneously by researchers from collaborating organizations, including research scientists and engineers funded wholly or in part by the AQRP and the TCEQ. It is anticipated that two or three ground sites will need to be expanded or established to accommodate the instrumentation that will be brought to Houston by research collaborators. This project will centralize and coordinate the site infrastructure preparation for the ground sites identified for expansion to support DISCOVER-AQ Houston 2013.

The scope of work for this project begins with meeting with and/or contacting appropriate DISCOVER-AQ and TCEQ personnel who will be determining how many and which ground sites will be used for the study. Once that is determined, assignment of instrumentation to each site would follow. Next, to accommodate the instrumentation and the associated support equipment and supplies that will be located at the selected ground sites, these sites will require site improvements to infrastructure in advance of the intensive measurement period of the campaign that includes obtaining the necessary site access/use agreements, ground (site pad) preparation, installation of utilities (electrical and communication) and security fencing, and

rental of temporary buildings to accommodate instrumentation that must be located in conditioned space. During the intensive measurements period of the campaign, some limited support may be required by the ground-based researchers should problems arise with the site accommodations. This support would also be provided as needed. At the end of the campaign, each of these sites must be decommissioned and restored to their original condition or a condition required by the property owner. This effort is also included in the scope of work proposed for this project.

Additional Information:

This Work Plan is currently under development. It was purposefully delayed until after all Discover-AQ projects were approved.

Quantification of industrial emissions of VOCs, NO₂ and SO₂ by SOF and mobile DOAS during DISCOVER AQ

Chalmers University – Johan Mellqvist
University of Houston – Barry Lefer

AQRP Project Manager – Dave Sullivan
TCEQ Project Liaison – John Jolly

Funding Amount: \$177,553
(\$129,047 Chalmers, \$48,506 UH)

Executive Summary:

Mobile remote sensing by SOF and mobile DOAS will be carried out in the Houston ship channel (HSC) area during September 2013. In this manner vertical columns will be obtained of VOCs (alkanes, alkenes), NH₃, NO₂, SO₂, HCHO and particles as inferred from aerosol optical depth. The optical remote data will be complemented by wind profile measurements. The data collected will have great value of its own to be applied for future ozone modeling since a good understanding of the emission variability and changes in the total emissions in the HSC will be obtained by comparison to similar studies in 2006, 2009 and 2011 [Mellqvist 2007; 2009; 2010 and Rivera 2010]. The emission data will be compared to available emission inventories and categorized in various industrial types.

Equally important, the measurements will complement the NASA Discover AQ campaign which will run in the HSC area during the targeted month. NASA will then fly a high altitude aircraft (B200) equipped with optical sensors measuring columns of SO₂, NO₂, HCHO and aerosol profiles (LIDAR). They will utilize a low flying airplane (P-3) that will make spirals in the vicinity of two ground stations in the HSC, to validate the high altitude measurements.

The spatial column data of NO₂, SO₂, and HCHO from the mobile DOAS will be directly comparable to the column data measured by the high altitude NASA aircraft, hence providing a validation data set across the whole ship channel. Secondly, by carrying out emission measurements of VOCs, NO₂, SO₂ and HCHO around the HSC, especially upwind the two sites, it will be possible to interpret the spiral measurements by the NASA P-3 and the high altitude measurements by the B200 in a better way. The combined airborne and ground based data set will be rather comprehensive and has large potential to be used for modeling of the ozone in the HSC area. This project will support the AQRP priority research area: Improving the understanding of ozone and PM formation and emission characteristics in the Houston area through supplementary measurements to the NASA Discover-AQ campaign September 2013.

Additional Information:

Fully executed contracts are in place with both Chalmers University and the University of Houston. The project Work Plan was approved on January 14, 2013 and the Task Orders have been signed. This project is now active.

Environmental chamber experiments and CMAQ modeling to improve mechanisms to model ozone formation from HRVOCs

University of California - Riverside – Gookyoung Heo
Texas A&M University – Qi Ying

AQRP Project Manager – Elena McDonald-Buller
TCEQ Project Liaison – Ron Thomas

Funding Amount: \$146,259
(\$101,765 UC-R, \$44,494 TAMU)

Executive Summary

Using reliable atmospheric chemical mechanisms in regulatory models is necessary to formulate effective air quality policies for controls of secondary air pollutants such as ozone (O₃). It is well known that alkenes are a major contributor to radical and O₃ formation in Southeast Texas due to their high emissions and their high reactivities. Particularly, in Harris County, Texas, seven alkenes (ethene, propene, 1,3-butadiene, 1-butene, isobutene, trans-2-butene, and cis-2-butene) are classified as Highly Reactive Volatile Organic Compounds (HRVOCs), and HRVOC emissions have been regulated by Texas Administrative Code, Title 30, Part 1, Chapter 115 (TCEQ, 2102). However, condensed chemical mechanisms commonly used for air quality modeling in the U.S. are designed to model O₃ formation from typical urban ambient volatile organic compound (VOC) mixtures but are not designed to model O₃ formation under atmospheric conditions significantly influenced by highly variable HRVOC emissions that are dominated by a small number of VOC species. Therefore, a chemical mechanism that can be used to simulate O₃ formation from both urban emissions and industrial HRVOC emissions needs to be developed to accurately assess the impact on O₃ formation of regular and episodic HRVOC emissions from industrial sources in Southeast Texas. However, lack of environmental chamber data useful for mechanism evaluation is a critical obstacle to developing reliable mechanisms for the HRVOCs. Among the 7 alkenes regulated as HRVOCs in Southeast Texas, robust chamber data for mechanism evaluation are available only for ethene and propene. The situation is even worse for the higher molecular weight non-HRVOC alkenes. Thus, this study will develop more robust chemical mechanisms for the HRVOCs and non-HRVOC alkenes that are better suited for use under atmospheric conditions influenced by HRVOC emissions, and evaluate and update the initially proposed mechanisms by designing and carrying out environmental chamber experiments for the HRVOCs and non-HRVOC alkenes for which existing data are inadequate. The effect of the mechanism modifications on air quality predictions in Southeast Texas will be evaluated by carrying out 3-dimensional air quality modeling with the Community Multiscale Air Quality modeling system (CMAQ), using both existing mechanisms and the updated and more explicit mechanisms developed in this work.

Additional Information:

Fully executed contracts are in place with both The University of California – Riverside and Texas A&M University/Engineering Extension Station. The Work Plan was approved on February 7, 2013 and the Task Orders have been signed. This project is now active.

Investigation of Global Modeling and Lightning NO_x Emissions as Sources of Regional Background Ozone in Texas

ENVIRON International – Chris Emery

AQRP Project Manager – Elena McDonald- Buller
TCEQ Project Liaison – Jim Smith**Funding Amount:** \$77,420**Executive Summary**

The production, transport, and fate of tropospheric ozone are highly dynamic processes with contributions from a multitude of anthropogenic and natural sources spanning spatial scales from local to global. The US Environmental Protection Agency (EPA) requires the use of regional photochemical models to demonstrate that local emission control plans will achieve the federal standard for ground-level ozone. As the ozone standard is lowered, sources contributing to uncontrollable “background” ozone become more significant and must be more accurately accounted. In response, regulatory modeling applications have employed continuously larger domains to explicitly include sources over broader portions of the continent. Regional models now include worldwide contributions by deriving boundary conditions from global models. As global models continue to emerge and improve, their contributions to background ozone as represented in regional models need to be evaluated.

The Texas Commission on Environmental Quality (TCEQ) uses the Comprehensive Air quality Model with extensions (CAMx) for research and regulatory photochemical modeling. Two popular global models have been routinely coupled to CAMx: the Goddard Earth Observing System - Chemistry model (GEOS-Chem), developed and distributed by Harvard University, and the Model for Ozone and Related chemical Tracers (MOZART), developed and distributed by the National Center for Atmospheric Research (NCAR). A newer global model called AM3, which is the atmospheric component of the CM3 global coupled atmosphere-oceans-land-sea ice model, is developed by Princeton University and the National Oceanic and Atmospheric Administration’s Geophysical Fluid Dynamics Laboratory (GFDL).

In this project, we will develop boundary condition inputs for CAMx utilizing output from all three global models (GEOS-Chem, MOZART, and AM3). The sensitivity of simulated ozone to regional boundary conditions will be investigated. We will develop quantitative comparisons of these global models with respect to their ability to provide accurate and reasonable boundary conditions for regional downscaling, particularly as it applies to regulatory ozone modeling.

Additional Information:

The contract with Environ is fully executed. The Work Plan was approved on January 16, 2013. This project is now active. They will be issuing a Purchase Order (PO) to Princeton for the AM3 data processing and simulation part of the project.

During this quarter, team members reviewed the Work Plan and QAPP, and coordinated procedures and data needs to begin the project tasks. The first priority of this work is to develop an interface program between the AM3 global model and the CAMx regional model. Princeton provided to ENVIRON a list of all chemical compounds carried by AM3 so that a mapping to CAMx compounds could be developed. From this mapping, ENVIRON informed Princeton on the minimum species list needed to be run in AM3 to support regional photochemical modeling. AM3 modeling for 2008 is expected to begin shortly.

Interactions Between Organic Aerosol and NO_x: Influence on Oxidant Production

University of Texas at Austin – Lea H. Ruiz
ENVIRON International – Greg Yarwood

AQRP Project Manager – Dave Sullivan
TCEQ Project Liaison – Mark Estes

Funding Amount: \$148,835
(\$79,461 UT Austin, \$69,374 Environ)

Executive Summary:

In rural areas where emission rates of NO_x (NO + NO₂) are relatively low, ozone formation can be sensitive to secondary NO_x sources such as decomposition of organic nitrates (R-ONO₂). AQRP project 10-042 provided experimental evidence for NO_x production when organic nitrates degrade by OH reaction and photolysis. Implementing NO_x production from OH reaction with organic nitrates causes regional ozone increases that are large enough to affect model agreement with ozone observations. This implies that organic nitrates are less available to NO_x recycling than previous experiments suggested. We are investigating the hypothesis that uptake of organic nitrates into secondary organic aerosol (SOA) reduces the amount of NO_x recycled by organic nitrate photolysis and OH reaction.

The first task in this project is to add the uptake of organic nitrates by SOA to the Comprehensive Air quality Model with extensions (CAMx). The conceptual model of Perraud et al. (2012) is followed, in which organic nitrate molecules stick to aerosol surfaces and become irreversibly buried by accretion of SOA. Results of this initial modeling work is then used to design laboratory chamber experiments in which organic nitrates are formed from the oxidation of VOCs in the presence of NO_x and the distribution of organic nitrates between the gas and particle phases is observed. New chemistries and mechanisms inferred from the experimental data are then tested by including them in a box model of the chamber experiments before they are implemented in CAMx. Finally, the partitioning of organic nitrates between the gas- and particle phase is observed in natural aerosol by conducting ambient measurements near Houston.

Additional Information:

The contract with Environ is fully executed. The work plan was approved on December 18, 2012. The UT Letter Agreement and Task Order have been signed. This project is active.

During this quarter the instruments, which will be used for the laboratory chamber experiments (Task 2) and ambient measurements (Task 4), were set up and calibrated. The PI purchased materials and supplies for the laboratory chamber experiments. Furthermore, a thorough literature review on atmospheric organic nitrates was started.

Work was started later than anticipated due to the contracting process. Work has now started and the delay did not cause major problems regarding the overall schedule of the project. However, the modeling work will not be completed by the end of February as originally suggested in the work plan.

Development of Transformation Rate of SO₂ to Sulfate for the Houston Ship Channel using the TexAQS 2006 Field Study Data

ENVIRON International – Ralph Morris

AQRP Project Manager – Elena McDonald - Buller
TCEQ Project Liaison – Jim Price**Funding Amount:** \$59,974**Executive Summary:**

On June 2, 2010, EPA promulgated a new 1-hour SO₂ primary NAAQS with a threshold of 75 ppb. The 1-hour SO₂ NAAQS is much more stringent and replaces the old 24-hour (140 ppb) and annual (30 ppb) SO₂ NAAQS. States are required to submit 1-hour SO₂ State Implementation Plans (SIPs) by February 2014 that demonstrates compliance with the NAAQS by August 2017. Preliminary modeling indicates that SO₂ emissions for numerous sources will result in near-by exceedances of the 1-hour SO₂ NAAQS. Fossil-fueled power plants (73%) and industrial facilities (20%) are the main sources of SO₂ emissions in the U.S. Photochemical oxidants will convert some SO₂ to sulfate thereby reducing SO₂ concentrations. However, the EPA-recommended model for near-source 1-hour SO₂ modeling is the AERMOD steady-state Gaussian plume model that does not treat photochemical oxidants and has a very simple treatment of chemistry (exponential decay). EPA recommends that AERMOD be run with no SO₂ conversion for addressing 1-hour SO₂ NAAQS issues. This assumption may be appropriate for fossil-fueled power plants where the high NO_x concentrations inhibit photochemistry and consequently SO₂ oxidation near the source, but it may not be appropriate for the Houston Ship Channel where the atmosphere can be very reactive (due to HRVOC emissions) resulting in faster SO₂ to sulfate conversion rates.

The goal of this project is to develop a representative SO₂ transformation rate for the Houston Ship Channel area using measurements from the NOAA P-3 aircraft collected during the 2006 Texas Air Quality Study (TexAQS) that can be used with the AERMOD model to simulate 1-hour SO₂ concentrations. The proposed approach uses a grid model to simulate first-order transformation of SO₂ to sulfate for sources in the Houston Ship Channel. The model results with varying transformation rate are evaluated against the 2006 TexAQS P-3 aircraft measurement data to find what transformation rate best fits the observations and to determine whether one hypothetical transformation rate results in statistically better model performance than the other rates used.

Additional Information:

The contract with Environ is fully executed. The Work Plan was approved on December 13, 2012. The Task Order has been signed. This project is Active.

ENVIRON has initiated Task 1 and acquired the NOAA P-3 flight measurement data for the 12 flights during the campaign that had been pre-selected based on their relevance to the Houston Ship Channel emissions. These were further analyzed to select the flight transects to be used for the grid model evaluation. Our focus is on the flight transects that pass the Houston Ship Channel plumes and have relatively small interferences from background and other local sources (e.g., Parish power plant). The project work was initiated in January 2013 due to a delay in the official Task Order. Therefore, the project schedule was revised accordingly while the project completion date remains the end of November 2013. All funds allocated to the project will be used upon the project completion.

Ozonesonde launches from the University of Houston and Smith Point, Texas in Support of DISCOVER AQ

Valparaiso University – Gary Morris
University of Houston – Barry Lefer

AQRP Project Manager – Gary McGaughey
TCEQ Project Liaison – Dave Westenbarger

Funding Amount: \$86,667
(\$66,821 Valparaiso, \$19,846 UH)

Executive Summary:

An intensive series of ozonesonde launches during DISCOVER AQ (September 2013) provides insight into the recirculation of ozone over Galveston and Trinity Bays. With potential operational launch sites at LaPorte, the University of Houston Main Campus, and Smith Point, the coordinated set of ozone profiles will permit us further insights into the importance of re-circulated ozone on exceedence events during the late Summer high ozone season in Houston, Texas.

Additional Information:

The contracts with Valparaiso University and the University of Houston are fully executed. The Work Plan was approved on November 19, 2012. The Task Order has been signed. This project is active.

Funding for this project is being split between FY11 funds (to be fully expended no later than April 2013) and FY 13 funds.

The project is attaining its goals on schedule to this point. The PI secured a price quote from the vendors for all equipment and expendable supplies needed for our project. In February, these items were ordered.

The Effects of Uncertainties in Fire Emissions Estimates on Predictions of Texas Air Quality

University of Texas at Austin – Elena McDonald-Buller
ENVIRON International – Chris Emery

AQRP Project Manager – Dave Sullivan
TCEQ Project Liaison – Clint Harper

Funding Amount: \$106,970
(\$85,282 UT Austin, \$21,688 Environ)

Executive Summary:

Wildland fires and open burning can be substantial sources of nitrogen oxides (NO_x), carbon monoxide (CO), and non-methane hydrocarbons (NMHCs), which are precursors to ozone formation, as well as particulate matter (PM), sulfur dioxide (SO₂), and ammonia (NH₃). Fire emissions are often transported over long distances and can contribute to exceedances of air quality standards at local and regional levels. Achieving attainment with the National Ambient Air Quality Standards (NAAQS) for ozone has been the primary focus of State Implementation Plans (SIPs) for Texas. Accurate characterization of fire events is necessary for understanding their influence on measured ambient concentrations, for providing a weight of evidence for exceptional event exclusions if necessary, and for conducting air quality modeling for planning and attainment demonstrations. In addition, if more stringent federal standards for ozone are considered in the future, emissions of its precursors from regional sources, such as fires in the Western U.S., Mexico, and Central America, that can contribute to background concentrations will become increasingly important for understanding the relative effectiveness of local and regional emissions control programs. This project examines the effects of uncertainties in fire emissions estimates on modeled ozone and particulate matter concentrations in Texas using the Fire INventory from NCAR (FINN) and the Comprehensive Air Quality Model with extensions (CAMx).

Additional Information:

The contract with Environ is fully executed. The Work Plan was approved on January 7, 2013. The Letter Agreement and Task Order have been signed. This project is active and in the kickoff phase.

The team is beginning work on four tasks: (1) development of a 10-year climatology of fires in Texas, its surrounding states, Mexico, and Central America; (2) a review of previous studies and relevant background literature to briefly describe current fire emissions estimation methods and input data sources, to examine applications of FINN emissions estimates in regional chemical transport models, and to identify new data resources and appropriate variations in input parameters for sensitivity analyses; (3) Base Case Fire Emissions Modeling; and (4) transfer of the CAMx Episode from ENVIRON to the University of Texas at Austin.

Surface Measurements of PM, VOCs, and Photochemically Relevant Gases in Support of DISCOVER-AQ

Rice University – Robert Griffin
University of Houston – Barry Lefer

AQRP Project Manager – Dave Sullivan
TCEQ Project Liaison – Jocelyn Mellberg

Funding Amount: \$206,815
(\$89,912 Rice, \$116,903 UH)

Executive Summary:

The City of Houston and Harris County have a long history of air quality issues because of their large population, extensive industrial activity, and sub-tropical climate. These issues predominantly have been manifested through ozone (O₃) mixing ratios that exceed the National Ambient Air Quality Standards (NAAQS) established by the United States Environmental Protection Agency (EPA). However, recent measurements indicate that Harris County levels for particulate matter (PM), specifically for particles with diameters less than or equal to 2.5 micrometers (PM_{2.5}), are very close to the relevant NAAQS.

In recent years, the National Aeronautics and Space Administration (NASA) has placed considerable emphasis on the use of satellite remote sensing in the measurement of species such as O₃ and PM that constitute air pollution. However, additional data are needed to aid in the development of methods to distinguish between low- and high-level pollution in these measurements. To that end, NASA has established a program titled Deriving Information on Surface Conditions from Column and Vertically Resolved Observations Relevant to Air Quality (DISCOVER-AQ). DISCOVER-AQ began in summer 2011 with work in the Mid-Atlantic Coast that featured satellite, airborne, and ground-based sampling. The DISCOVER-AQ program will conduct operations in and near Houston in September 2013.

During the Houston operations of DISCOVER-AQ, there will be a need for ground-based measurement support. This project will fill that need by providing quantitative measurements of sub-micron particle size and composition and mixing ratios of volatile organic compounds (VOCs) and other photochemically relevant gases such as O₃ and oxides of nitrogen (NO_x = nitric oxide (NO) plus nitrogen dioxide (NO₂)). The instrumentation for these measurements will be deployed using the University of Houston (UH) mobile laboratory.

The measurements made on the mobile laboratory generally will operate in two modes. First, during periods when DISCOVER-AQ flight patterns spiral over a given location, the mobile laboratory will operate at the ground surface beneath these spirals in a stationary mode in which surface air quality parameters are monitored continuously. Additional stationary mode measurements will be made at other locations of interest. When not in stationary mode, the

mobile laboratory will be deployed to perform Lagrangian studies of air quality within plumes from major sources of primary pollutants, as well as downwind of the major metropolitan area, to characterize secondary processes at surface level.

Additional Information:

Fully executed contracts are in place with both Rice University and the University of Houston. The project Work Plan was approved on January 28, 2013. The Task Orders have been signed. This project is active.

The primary investigators have had several in-person meetings to determine likely instrument layout within the mobile laboratory, inlet positioning, and deployment/calibration schedule. Additional meetings are scheduled for late February and early March to continue with selection of stationary deployment locations and begin requests for infrastructure support at those locations.

Surface Measurement of Trace Gases in Support of DISCOVER-AQ in Houston in Summer 2013

University of Maryland – Xinrong Ren

AQRP Project Manager – Dave Sullivan
TCEQ Project Liaison – Erik Gribbin**Funding Amount:** \$90,444**Executive Summary:**

The link between ozone (O_3) and NO_x ($= NO + NO_2$) photochemistry has been extensively studied for decades, yet new discoveries have revealed the need to improve scientific understanding of ozone formation chemistry. In order to improve the interpretation of aircraft and satellite observations to diagnose near-surface conditions relating to air quality, high-quality surface observations of ozone and particulate matter (PM) precursors are needed, especially in urban environments like Houston. To support the NASA DISCOVER-AQ study in Houston in summer 2013, we propose to make surface measurements of trace gases, including O_3 , $NO/NO_2/NO_y$, and SO_2 . Research-grade instrumentation to measure these trace gases will be deployed at two of the science sites identified by TCEQ/AQRP. These measurements will be compared to concurrent aircraft measurements for the periods when the NASA P-3B aircraft conducts spiral profiles over the sites. Vertical distributions of these gases will be observed and compared with surface observations with the aim of improving the capability of transport models for air quality simulations. Data collected in the field study will be analyzed with regard to the source regions and emission profiles, reactive nitrogen budget, and relationship between NO_x and O_3 . Results from this project will be presented to AQRP/TCEQ and published in peer-reviewed journals. These activities will not only meet the program goals of DISCOVER-AQ, but will also strengthen our understanding of O_3 and PM formation in Houston, which is essential to meet the primary and secondary National Ambient Air Quality Standards for ozone and PM.

Additional Information:

The contract with the University of Maryland was fully executed on February 20, 2013. Because the work plan for this project was approved on December 17, 2012, its start date will be February 20, 2012. The Task Order has been submitted for signature.

Implementation and evaluation of new HONO mechanisms in a 3-D Chemical Transport Model for Spring 2009 in Houston

University of Houston – Barry Lefer
UCLA – Jochen Stutz
Environ – Greg Yarwood
UNC at Chapel Hill – Will Vizuette

AQRP Project Manager – Elena McDonald-Buller
TCEQ Project Liaison – Doug Boyer

Funding Amount: \$117,269
(\$19,599 UH, \$17,944 UCLA, \$44,496 Environ, \$35,230 UNC)

Executive Summary:

Although portions of the chemistry that lead to the formation of ozone have been understood for decades, new discoveries have revealed the need to improve scientific understanding of ozone formation chemistry. Radical production in Houston and other urban areas appear to be underestimated by chemical mechanisms. The roles of some radical precursors such as HONO, HCHO, and reactive VOCs in ozone formation in Houston and other Texas cities have not been well understood. Research based on both modeling and field measurements by the University of Houston, ENVIRON, University of California – Los Angeles, and the University of North Carolina – Chapel Hill has shown that nitrous acid (HONO) significantly affects the HO_x budget in urban environments like Houston. These chemical processes connect surface emissions, both anthropogenic and natural, to local and regional air quality.

From April 15th to May 30th, 2009, a team of more than 40 scientists representing more than 15 different institutions collected a relatively complete suite of atmospheric measurements, including NO, NO₂, NO_y, HONO, HNO₃, O₃, CO, SO₂, HCHO, HOOH, OH, HO₂, OVOCs, VOCs, actinic flux, PBL height, O₃ production rates, and vertical profiles (nominally 40m, 150m, 300m) of NO₂, HONO, O₃, SO₂, and HCHO, during the Study of Houston Atmospheric Radical Precursor (SHARP). The SHARP dataset provides us a unique opportunity to examine and improve our understanding of atmospheric HONO formation processes and how they may be implemented into the Comprehensive Air quality Model with extensions (CAMx) 3-D chemical transport model commonly used for SIP evaluations. The objective of the study is to develop, implement, and evaluate missing pathways for HONO formation in a photochemical model, CAMx, that is used routinely for regulatory applications in Texas and other areas. This model update is expected to improve the model's ability to simulate ozone concentrations, because HONO is a potential daytime source of the hydroxyl radical, OH, which plays an important role in the ozone formation cycle. Measurements during the SHARP study in Houston showed that radical production in the early morning was dominated by HONO photolysis.

The modeling strategy is to take advantage of the SHARP data analysis in a previous AQRP project (Project 10-032) to develop parameterizations, based on current understanding of the important processes governing HONO formation, and implement and refine these parameterizations in CAMx using existing modeling databases for the Houston area during the SHARP period. Model performance evaluation will make use of process analysis tools to evaluate how HONO formation pathways influence radical budgets and ozone formation within CAMx simulations.

Additional Information:

The contract with each university is fully negotiated. The project work plan was approved on January 28, 2013. Task Orders have been signed and returned by all project parties, except UNC-Chapel Hill. This project is active for all parties except UNC-Chapel Hill. They are expected to return the Task Order within the week.

During the month of February, the science team has been examining and evaluating various HONO parameterizations to identify which may be suitable for incorporation into the CAMx 3-D photochemical transport model.

Collect, Analyze, and Archive Filters at two DISCOVER-AQ Houston Focus Areas: Initial Characterization of PM Formation and Emission Environmental Chamber Experiments to Evaluate NO_x Sinks and Recycling in Atmospheric Chemical Mechanisms

Baylor University – Rebecca Sheesley

AQRP Project Manager – Dave Sullivan
TCEQ Project Liaison – Fernando Mercado

Funding Amount: \$45,972

Executive Summary:

DISCOVER-AQ (Deriving Information on Surface conditions from Column and Vertically Resolved Observations Relevant to Air Quality) is a multi-year air quality research study set to focus on Houston, TX in September 2013. NASA's P-3B and B200 aircraft will be deployed to sample vertical profiles over specific focus areas using a spiraling vertical profile flight plans for selected days during the one month sampling campaign. In this study, we propose to measure elemental carbon (EC), organic carbon (OC), and optical black carbon (BC) at two of these vertical spiral sites during the DISCOVER-AQ mission. Baylor University's research group will collect, analyze, and archive particulate filters collected concurrently with DISCOVER-AQ 2013 Houston-based sampling campaign. Specifically, we will continuously measure OC, EC and (BC at two surface sites on each day of the month that the NASA aircraft will be deployed. Collection will occur at two field stations located directly below aircraft focus areas (i.e. vertical profile sites). Results from the carbon measurements taken during the campaign will be disseminated to DISCOVER-AQ investigators and other external research groups. We will also archive particulate filters for future research opportunity. Access to these archived filters will be provided to DISCOVER-AQ investigators and external research groups.

Specific goals of this project are to:

- 1) Characterize OC and EC concentrations using fine particulate matter (PM_{2.5}) and total suspended particulate (TSP) air filter samples collected at two of DISCOVER-AQ Houston's focus areas.
 - a. Focus areas include ground stations near Katy and H-NET Jones Forest.
 - b. Archive filters for two years at -10°C for future research opportunities.
 - c. Provide access of filters to DISCOVER-AQ project leadership and external research groups and collaborators.
- 2) Measure optical BC using a seven channel aethalometer at the H-NET Jones Forest ground station.
- 3) Compare ground-based OC, EC, and optical BC with other aerosol measurements made directly over focus areas on NASA's P-3B and B200 aircraft (i.e. water soluble organic carbon and BC).

Additional Information:

The contract with the Baylor University is fully negotiated. The project Work Plan was approved on January 24, 2013 and the Task Order has been signed. This project is active.

Due to the early stages of the project, the project activities has been limited to field sampling preparation. Progress towards goals:

- Have acquired a freezer for the preservation and archival of filter samples.
- Have acquired a mobile trailer for sampling at one of the DISCOVER-AQ Houston Focus Areas. The trailer is in the process of being outfitted for a portable aethalometer, URG medium-volume air sampler, and a Tisch high-volume air sampler.

Investigation of surface layer parameterization of the WRF model and its impact on the observed nocturnal wind speed biasUniversity of Maryland – Daniel Tong
Pius LeeAQRP Project Manager – Gary McGaughey
TCEQ Project Liaison – Bright Dornblaser**Funding Amount:** \$64,994**Executive Summary:**

This study investigates surface layer parameterizations in the Weather Research and Forecasting (WRF) model. The parameterization of energy fluxes from the surface layer significantly impacts the modeled near-surface winds. The WRF model tends to over-predict the surface wind speeds in eastern Texas in the evening hours, especially in coastal regions. This project examines the various similarity theories that parameterize the momentum fluxes of the surface layer used in the WRF meteorological model.

The investigation and possible remedy recommendation for rectifying the high wind-speed-bias is carried out in multiple steps: (A) Understand the sensitivities of the different surface layer schemes, (B) Examine the sensitivity of the flux-profile relationships with regards to synoptic and atmospheric stability conditions, and (C) Investigate the universal flux profile functions and the range of parameter values used by the functions to suggest potential modifications for improvement – especially for the stable regimes. These details of the surface layer schemes are important as they govern the correct timing of the decoupling of near-surface and surface phenomena which are critical in the redistribution of kinetic energy from the residual layer to the surface. The rate of transfer of energy affects the evolution of wind speeds in the lowest layers.

A series of sensitivity runs of the WRF model is devised and conducted with possible recommendation on adjusted values for several of the tunable constants in the surface layer similarity theory parameterizations. Although the runs will focus on an early summer period for the Houston-Galveston-Brazoria area, they should provide insight on the rate and strength of the coupling and decoupling between the surface layer and the lowest model level in a large range of land-use and meteorological conditions.

Additional Information:

The contract with the University of Maryland was fully executed on February 20, 2013. The work plan was approved on the same day. The Task Order has been submitted for signature. Once it is returned the project start date will be February 21, 2013.

Development of IDL-based geospatial data processing framework for meteorology and air quality modeling

University of Maryland – Daniel Tong
HyunCheol Kim

AQRP Project Manager – Gary McGaughey
TCEQ Project Liaison – Bright Dornblaser

Funding Amount: \$69,985

Executive Summary:

This project investigates basic computational algorithms to handle Geographic Information System (GIS) data and satellite data, which are essential in regional meteorological and chemical modeling. It develops a set of generalized libraries within a geospatial data processing framework aiming to process geospatial data more efficiently and accurately. The tool can process GIS data both in vector format (e.g., ESRI shapefiles) and raster format (e.g., GEOTIFF and IMG) for any given domain. Processing speeds will be improved through selective usages of polygon-clipping routines and other algorithms optimized for specific applications. The raster tool will be developed utilizing a histogram reverse-indexing method that enables easy access of grouped pixels. It generates statistics of pixel values within each grid cell with improved speed and enhanced control of memory usage. Spatial allocating tools that use polygon clipping algorithms require huge computational power to calculate fractional weighting between GIS polygons (and/or polylines) and gridded cells. To overcome the speed and computational accuracy deterioration issues, an efficient polygon/polyline clipping algorithm is crucial. A key for faster spatial allocation is to optimize computational iterations in both polygon clipping and map projection calculations.

The project has the following specific objectives: (A) To develop an optimized geospatial data processing tool that can handle raster data format and vector data format with enhanced processing time and accuracy, for any given target domain. (B) To collect and to process sample GIS and satellite data. Applications will include a spatial regridding method for emissions and satellite data, such as the Moderate Resolution Imaging Spectroradiometer (MODIS) Aerosol Optical Depth (AOD), the Ozone Monitoring Instrument (OMI), and the Global Ozone Monitoring Experiment (GOME)-2 NO₂ column data. (C) To perform an engineering test with processed fine resolution LULC data.

Additional Information:

The contract with the University of Maryland was fully executed on February 20, 2013. The work plan was approved on the same day. The Task Order has been submitted for signature. Once it is returned the project start date will be February 21, 2013.

FINANCIAL STATUS REPORT

Initial funding for fiscal year 2010 was established at \$2,732,071.00. In late May 2010 an amendment was issued increasing the budget by \$40,000. Funding for fiscal year 2011 was established at \$2,106,071, for a total award of \$4,878,142 for the FY 2010/2011 biennium. As of February 28, 2013, \$21,176.99 remains unspent. Of these funds, \$20,168.90 are contractual/research funds and will be used to partially support Project 13-016. It is expected that these funds will be fully expended in the next quarter on the purchase of expendable supplies. What remains will be used to purchase supplies for the Project Managers and will be fully expended by the end of April 2013.

In February 2012, funding of \$1,000,000 was awarded for FY 2012. In June 2012, an additional \$160,000 was awarded in FY 2012 funds and \$1,000,000 was awarded in FY 2013 funds, for a total of \$2,160,000 in funding for the FY 2012/2013 biennium.

All of these funds were distributed across several different reporting categories as required under the contract with TCEQ. The reporting categories are:

Program Administration – limited to 10% of the overall funding (per Fiscal Year)

This category includes all staffing, materials and supplies, and equipment needed to administer the overall AQRP. It also includes the costs for the Council meetings.

ITAC

These funds are to cover the costs, largely travel expenses, for the ITAC meetings.

Project Management – limited to 8.5% of the funds allocated for Research Projects

Each research project will be assigned a Project Manager to ensure that project objectives are achieved in a timely manner and that effective communication is maintained among investigators in multi-institution projects. These funds are to support the staffing and performance of project management.

Research Projects / Contractual

These are the funds available to support the research projects that are selected for funding.

Program Administration

Program Administration includes salaries and fringe benefits for those overseeing the program as a whole, as well as, materials and supplies, travel, equipment, and other expenses. This category allows indirect costs in the amount of 10% of salaries and wages.

During the reporting period six staff members were involved, part time, in the administration of the AQRP. Dr. David Allen, Principal Investigator and AQRP Director, is responsible for the overall administration of the AQRP. James Thomas, AQRP Manager, is responsible for assisting Dr. Allen in the program administration. Maria Stanzione, AQRP Grant Manager, with assistance from Rachael Bushn and Melanie Allbritton assisted with program organization and financial management. This included assisting with the contracting process. Denzil Smith is responsible for the AQRP Web Page development and for data management.

Table 1: AQRP Administration Budget

**Administration Budget (includes Council Expenses)
FY 2010/2011**

Budget Category	FY10 Budget	FY11 Budget	Total	Expenses	Pending Expenses	Remaining Balance
Personnel/Salary	\$202,816.67	\$163,120.24	\$365,936.91	\$365,936.91	\$0	\$0
Fringe Benefits	\$38,665.65	\$31,173.03	\$69,838.68	\$69,838.68	\$0	\$0
Travel	\$346.85	\$0	\$346.85	\$346.85		\$0
Supplies	\$15,096.14	\$4.51	\$15,100.65	\$15,100.65		\$0
Equipment	\$0	\$0	\$0			\$0
Total Direct Costs	\$256,925.31	\$194,297.78	\$451,223.09	\$451,223.09	\$0	\$0
Authorized Indirect Costs	\$20,281.69	\$16,310.22	\$36,591.91	\$36,591.91		\$0
10% of Salaries and Wages						
Total Costs	\$277,207	\$210,608	\$487,815	\$487,815.00	\$0	\$0
Fringe Rate	22%	22%		19%		

**Administration Budget (includes Council Expenses)
FY 2012/2013**

Budget Category	FY12 Budget	FY13 Budget	Total	Expenses	Pending Expenses	Remaining Balance
Personnel/Salary	\$80,440	\$70,040	\$150,480	\$55,496.97	\$1,634.00	\$93,349.03
Fringe Benefits	\$14,666	\$12,606	\$27,272	\$13,027.48	\$589.94	\$13,654.58
Travel	\$350	\$350	\$700	\$0		\$700.00
Supplies	\$10,000	\$10,000	\$20,000	\$1,375.21	\$30.30	\$18,594.49
Equipment	\$0	\$0	\$0			\$0
Total Direct Costs	\$105,456	\$92,996	\$198,452	\$69,899.66	\$2,254.24	\$126,298.10
Authorized Indirect Costs	\$8,044	\$7,004	\$15,048	\$5,549.70	\$163.40	\$9,334.90
10% of Salaries and Wages						
Total Costs	\$113,500	\$100,000	\$213,500	\$75,449.36	\$2,417.64	\$135,633.00
Fringe Rate	22%	22%		17%		

Fringe benefits for the administration of the AQRP were initially budgeted to be 22% of salaries and wages across the term of the project. It should be noted that this was an estimate, and actual fringe benefit expenses have been reported for each month. The fringe benefit amount and percentage fluctuate each month depending on the individuals being paid from the account, their salary, their FTE percentage, the selected benefit package, and other variables. For example, the amount of fringe benefits are greater for a person with family medical insurance versus a person with individual medical insurance. At the end of the project, the overall total of fringe benefit expensed is expected to be at or below 22% of the total salaries and wages. Actual fringe benefit expenses for the quarter are included in the spreadsheets above.

As discussed in previous Quarterly Reports, the AQRP Administration requested and received permission to utilize funds in future fiscal years. This is for all classes of funds including Administration, ITAC, Project Management, and Contractual. As of the writing of this report, the FY 10 funds have been fully expended. The intent is to fully expend the FY 11 funds, by April 2013. This same procedure will be followed for the FY 12 funds.

In June 2011, UT-Austin received a Contract Extension for the AQRP. This extension will continue the program through the end of the 2012/2013 biennium.

ITAC

No ITAC activities occurred in the quarter being reported. Remaining FY11 ITAC funds were rebudgeted into FY11 Project Management and FY11 Contractual/Research funds.

Table 2: ITAC Budget

**ITAC Budget
FY 2010/2011**

Budget Category	FY10 Budget	FY11 Budget	Total Budget	Expenses	Pending Expenses	Remaining Balance
Personnel/Salary						
Fringe Benefits						
Travel	\$16,378.86	\$6,292.97	\$22,671.83	\$22,671.83	\$0.00	\$0
Supplies	\$1,039.95	\$284.67	\$1,324.62	\$1,324.62	\$0.00	0
Total Direct Costs	\$17,418.81	\$6,577.64	\$23,996.45	\$23,996.45	\$0.00	\$0
Authorized Indirect Costs						
10% of Salaries and Wages						
Total Costs	\$17,418.81	\$6,577.64	\$23,996.45	\$23,996.45	\$0.00	\$0

**ITAC Budget
FY 2012/2013**

Budget Category	FY12 Budget	FY13 Budget	Total Budget	Expenses	Pending Expenses	Remaining Balance
Personnel/Salary						
Fringe Benefits						
Travel	\$10,000	\$0	\$10,000	\$0	\$0	\$10,000
Supplies	\$500	\$0	\$500	\$0		\$500
Total Direct Costs	\$10,500	\$0	\$10,500	\$0	\$0	\$10,500
Authorized Indirect Costs						
10% of Salaries and Wages						
Total Costs	\$10,500	\$0	\$10,500	\$0	\$0	\$10,500

Project Management

In August 2012, Project Managers were assigned to the FY 2012-2013 Research Projects. During the quarter ending February 28, 2013, Project Managers continued to work with Investigators to develop and finalize the Project Work Plans (Scope of Work, Budget, and QAPP). As projects transitioned into Active status, they made sure Investigators had all reporting templates and met reporting deadlines.

Table 3: Project Management Budget

Project Management Budget FY 2010/2011

Budget Category	FY10 Budget	FY11 Budget	Total Budget	Expenses	Pending Expenses	Remaining Balance
Personnel/Salary	\$145,337.70	\$117,328.78	\$262,666.48	\$262,656.84	\$0	\$9.64
Fringe Benefits	\$28,967.49	\$22,142.56	\$51,110.05	\$51,219.41	\$0	(\$109.36)
Travel	\$0	\$0	\$0	\$0		\$0
Supplies	\$778.30	\$260.00	\$1,038.30	\$911.98		\$126.32
Total Direct Costs	\$175,083.49	\$139,731.34	\$314,814.38	\$314,668.23	\$0	\$26.60
Authorized Indirect Costs	\$14,533.77	\$12,713.40	\$27,247.17	\$26,265.68	\$0	\$981.49
10% of Salaries and Wages						
Total Costs	\$189,617.26	\$152,444.74	\$342,062.00	\$340,933.91	\$0	\$1,008.09

Project Management Budget FY 2012/2013

Budget Category	FY12 Budget	FY13 Budget	Total Budget	Expenses	Pending Expenses	Remaining Balance
Personnel/Salary	\$60,700	\$46,000	\$106,700	\$10,827.47	\$22,643.40	\$73,229.13
Fringe Benefits	\$11,230	\$8,400	\$19,630	\$2,170.72	\$4,519.27	\$12,940.01
Travel	\$500	\$0	\$500	\$0		\$500
Supplies	\$7,500	\$6,000	\$13,500	\$0.03		\$13,499.97
Total Direct Costs	\$79,930	\$60,400	\$140,330	\$12,998.22	\$27,162.67	\$100,169.11
Authorized Indirect Costs	\$6,070	\$4,600	\$10,670	\$1,082.75	\$2,264.34	\$7,322.91
10% of Salaries and Wages						
Total Costs	\$86,000	\$65,000	\$151,000	\$14,080.97	\$29,427.01	\$107,492.02

Research Projects

Table 4 on the following 2 pages illustrates the 2010-2011 Research Projects, including the funding awarded to each project and the total expenses reported on each project as of February 28, 2013.

As of the end of February there was \$20,168.90 of FY 2011 funding available in Research Projects. This funding has been allocated to project 13-016 Valparaiso. These funds are expected to be fully expended by April 2013. Valparaiso will utilize these funds to purchase supplies in preparation for their summer research activities.

The FY 10 Research/Contractual budget was originally funded at \$2,286,000. After all transfers, it has been increased by \$1,827.93. The FY 11 Research/Contractual budget was originally funded at \$1,736,063. After all transfers, it has been increased by \$377.62. This is an overall net increase of \$2,205.55 to the Research/Contractual funds (and net reduction in Project Management/ITAC funds).

Table 5 illustrates the 2012-2013 Research Projects, including the funding awarded to each project and the total expenses reported on each project as of February 28, 2013.

Table 4: 2010/2011 Contractual Expenses

Contractual Expenses				
FY 10 Contractual Funding		\$2,286,000		
FY 10 Contractual Funding Transfers		\$1,827.93		
FY 10 Total Contractual Funding		\$2,287,827.93		
Project Number		Amount Awarded (Budget)	Cumulative Expenditures	Remaining Balance
10-008	Rice University	\$128,851	\$126,622.32	\$2,228.68
10-008	Environ International	\$49,945	\$49,944.78	\$0.22
10-009	UT-Austin	\$591,332	\$591,306.66	\$25.34
10-021	UT-Austin	\$248,786	\$248,786.41	-\$0.41
10-022	Lamar University	\$150,000	\$132,790.80	\$17,209.20
10-032	University of Houston	\$176,314	\$176,314	\$0
10-032	University of New Hampshire	\$23,054	\$18,850.65	\$4,203.35
10-032	UCLA	\$49,284	\$47,171.32	\$2,112.68
10-034	University of Houston	\$195,054	\$186,657.54	\$8,396.46
10-042	Environ International	\$237,481	\$237,479.31	\$1.69
10-045	UCLA	\$149,773	\$142,930.28	\$6,842.72
10-045	UNC - Chapel Hill	\$33,281	\$33,281	\$0
10-045	Aerodyne Research Inc.	\$164,988	\$164,988.10	-\$0.10
10-045	Washington State University	\$50,000	\$50,000	\$0
10-DFW	UT-Austin	\$37,857	\$37,689.42	\$167.58
FY 10 Total Contractual Funding Awarded		\$2,286,000		
FY 10 Contractual Funding Expended (Init. Projects)			\$2,244,812.59	
FY 10 Contractual Funds Remaining Unspent after Project Completion				\$41,187.41
FY 10 Additional Projects				
	Data Storage	\$7,015.34	\$7,015.34	\$0
10-SOS	State of the Science	\$36,000.00	\$36,000.00	\$0
FY 10 Contractual Funds Expended to Date*			\$2,287,827.93	
FY 10 Contractual Funds Remaining to be Spent				\$0

Project Number		Amount Awarded (Budget)	Cumulative Expenditures	Remaining Balance
10-006	Chalmers University of Tech	\$262,179	\$262,179	\$0
10-006	University of Houston	\$222,483	\$217,949.11	\$4,533.89
10-015	Environ International	\$201,280	\$201,278.63	\$1.37
10-020	Environ International	\$202,498	\$202,493.48	\$4.52
10-024	Rice University	\$225,662	\$223,769.99	\$1,892.01
10-024	University of New Hampshire	\$70,747	\$70,719.78	\$27.22
10-024	University of Michigan	\$64,414	\$60,597.51	\$3,816.49
10-024	University of Houston	\$98,134	\$88,914.46	\$9,219.54
10-029	Texas A&M University	\$80,108	\$78,276.97	\$1,831.03
10-044	University of Houston	\$279,642	\$277,846.38	\$1,795.62
11-DFW	UT-Austin	\$50,952	\$29,261.75	\$21,690.25
FY 11 Total Contractual Funding Awarded		\$1,758,099		
FY 11 Contractual Funds Expended (Init. Projects)			\$1,713,287.06	
FY 11 Contractual Funds Remaining Unspent after Project Completion				\$44,811.94
FY 11 Additional Projects				
	Data Storage	\$2,984.66	\$2,984.66	\$0.00
	12-016 Valparaiso	\$20,168.90	\$0.00	\$20,168.90
FY 11 Contractual Funds Expended to Date*			\$1,716,271.72	
FY 11 Contractual Funds Remaining to be Spent				\$20,168.90
Total Contractual Funding		\$4,022,063.00		
Total Contractual Funding Transfers		\$2,205.55		
Total Contractual Funding Available		\$4,024,268.55		
Total Contractual Funds Expended to Date*			\$4,004,099.65	
Total Contractual Funds Remaining				\$20,168.90

*(Expenditures Reported as of November 30, 2012.)

Table 5. 2012/2013 Contractual Expenses

Contractual Expenses

FY 12 Contractual Funding

\$950,000

Project Number		Amount Awarded (Budget)	Cumulative Expenditures	Remaining Balance
12-004	UT-Austin (Torres)			
12-006	UC-Riverside			\$0.00
12-006	TAMU/TEES	\$44,494		\$44,494.00
12-011	Environ International	\$77,420		\$77,420.00
12-012	UT-Austin (Hildebrandt)	\$79,463	\$9,144.46	\$70,318.54
12-012	Environ International	\$69,374		\$69,374.00
12-013	Environ International	\$59,974		\$59,974.00
12-018	UT-Austin (McDonald-Buller)	\$85,282		\$85,282.00
12-018	Environ International	\$21,688		\$21,688.00
12-028	University of Houston	\$19,599		\$19,599.00
12-028	UCLA	\$17,944		\$17,944.00
12-028	Environ International	\$44,496		\$44,496.00
12-028	UNC - Chapel Hill			\$0.00
12-032	Baylor	\$45,972		\$45,972.00
12-TN1	Maryland			\$0.00
12-TN2	Maryland			\$0.00
FY 12 Total Contractual Funding Awarded		<u>\$565,706</u>		
FY 12 Contractual Funds Remaining to be Awarded		\$384,294		
FY 12 Contractual Funds Expended to Date			<u>\$9,144</u>	
FY 10 Contractual Funds Remaining to be Spent				\$940,856

FY 11 Contractual Funding		\$835,000		
Project Number		Amount Awarded (Budget)	Cumulative Expenditures	Remaining Balance
13-004	UT-Austin (Torres)			\$0.00
13-005	Chalmers University of Tech	\$129,047		\$129,047.00
13-005	University of Houston	\$48,506		\$48,506.00
13-016	Valparaiso	\$46,652		\$46,652.10
13-016	University of Houston	\$19,846		\$19,846.00
13-022	Rice University	\$89,912		\$89,912.00
13-022	University of Houston	\$116,903		\$116,903.00
13-024	Maryland			\$0.00
FY 13 Total Contractual Funding Awarded		<u>\$450,866</u>		
FY 13 Contractual Funding Remaining to be Awarded		\$384,134		
FY 13 Contractual Funds Expended to Date			<u>\$0</u>	
FY 13 Contractual Funds Remaining to be Spent				\$835,000
Total Contractual Funding		\$1,785,000		
Total Contractual Funding Awarded		\$1,016,572		
Total Contractual Funding Remaining to be Awarded		\$768,428		
Total Contractual Funds Expended to Date			\$9,144	
Total Contractual Funds Remaining to be Spent				\$1,775,856

Conclusion

The Project Management FY 2011 budget has approximately \$1000 remaining after all February expenses. These funds will be used to cover Project Management expenses until the funds are fully expended in April 2013.

The Research/Contractual category has \$20,168.90 remaining. These funds will be used to fund project 13-016 Valparaiso (they should be fully expended by April 30, 2013). It should be noted that all FY 10-11 Research funds were allocated to projects, and an additional \$22,036 was moved from Project Management to Research to cover additional expenses related to the DFW Field Study. Several projects returned funds to the AGRP when they concluded, thus the remaining balance. As these funds were committed to Research projects until the projects ended, the AGRP was unable to utilize the funds for any other purpose.

In summary, the remaining FY 2011 funds of approximately \$21,000 are expected to be fully expended by April 30, 2013.

Each 2012-2013 Research Project will be funded from a specific fiscal year. Once all budgets have been approved and assignments made, the program managers will assess whether any Research Project funds remain available, and will contact the ITAC, TCEQ, and Council to determine how to proceed in the allocation of those funds.

Appendix A

Financial Reports by Fiscal Year

FY 10 and 11

(Expenditures reported as of February 28, 2013.)

Administration Budget (includes Council Expenses)

FY 2010

Budget Category	FY10 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary	\$202,816.67	\$202,816.67		\$0
Fringe Benefits	\$38,665.65	\$38,665.65		\$0
Travel	\$346.85	\$346.85		\$0
Supplies	\$15,096.14	\$15,096.14		\$0
Equipment	\$0			\$0
Other				
Contractual				
Total Direct Costs	\$256,925.31	\$256,925.31		\$0
Authorized Indirect Costs	\$20,281.69	\$20,281.69		\$0
10% of Salaries and Wages				
Total Costs	\$277,207	\$277,207.00	\$0	\$0

Administration Budget (includes Council Expenses)

FY 2011

Budget Category	FY11 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary	\$163,120.24	\$163,120.24	\$0	\$0
Fringe Benefits	\$31,173.03	\$31,173.03	\$0	\$0
Travel	\$0			\$0
Supplies	\$4.51	\$4.51		\$0
Equipment				
Other	\$0			\$0
Contractual				
Total Direct Costs	\$194,297.78	\$194,297.78	\$0	\$0
Authorized Indirect Costs	\$16,310.22	\$16,310.22		\$0
10% of Salaries and Wages				
Total Costs	\$210,608	\$210,608.00	\$0	\$0

**ITAC Budget
FY 2010**

Budget Category	FY10 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary				
Fringe Benefits				
Travel	\$16,378.86	\$16,378.86	\$0	\$0
Supplies	\$1039.95	\$1,039.95		\$0
Equipment				
Other				
Total Direct Costs	\$17,418.81	\$17,418.81	\$0	\$0
Authorized Indirect Costs				
10% of Salaries and Wages				
Total Costs	\$17,418.81	\$17,418.81	\$0	\$0

**ITAC Budget
FY 2011**

Budget Category	FY11 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary				
Fringe Benefits				
Travel	\$6,292.97	\$6,292.97	\$0.00	\$0
Supplies	\$284.67	\$284.67	\$0.00	\$0
Equipment				
Other				
Total Direct Costs	\$6,577.64	\$6,577.64	\$0.00	\$0
Authorized Indirect Costs				
10% of Salaries and Wages				
Total Costs	\$6,577.64	\$6,577.64	\$0.00	\$0

**Project Management Budget
FY 2010**

Budget Category	FY10 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary	\$145,337.70	\$145,337.70		\$0
Fringe Benefits	\$28,967.49	\$28,967.49		\$0
Travel	\$0	\$0		\$0
Supplies	\$778.30	\$778.30		\$0
Equipment				
Other				
Total Direct Costs	\$175,083.49	\$175,083.49	\$0	\$0
Authorized Indirect Costs	\$14,533.77	\$14,533.77		\$0
10% of Salaries and Wages				
Total Costs	\$189,617.26	\$189,617.26	\$0	\$0

**Project Management Budget
FY 2011**

Budget Category	FY11 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary	\$117,328.78	\$117,319.14	\$0	\$9.64
Fringe Benefits	\$22,142.56	\$22,251.92	\$0	(\$109.36)
Travel	\$0			\$0
Supplies	\$260.00	\$133.68		\$126.32
Equipment				
Other				
Total Direct Costs	\$139,731.34	\$139,704.74	\$0	\$26.60
Authorized Indirect Costs	\$12,713.40	\$11,731.91	\$0	\$981.49
10% of Salaries and Wages				
Total Costs	\$152,444.74	\$151,436.65	\$0	\$1,008.09

AQRP Budget

FY 2010

Budget Category	FY10 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary	\$202,816.67	\$202,816.67	\$0.00	\$0.00
Fringe Benefits	\$38,665.65	\$38,665.65	\$0.00	\$0.00
Travel	\$346.85	\$346.85	\$0.00	\$0.00
Supplies	\$15,096.14	\$15,096.14	\$0.00	\$0.00
Equipment	\$0	\$0.00	\$0.00	\$0.00
Other	\$0	\$0.00	\$0.00	\$0.00
Contractual	\$2,287,827.93	\$2,287,827.93	\$0.00	\$0.00
ITAC	\$17,418.81	\$17,418.81	\$0.00	\$0.00
Project Management	\$189,617.26	\$189,617.26	\$0.00	\$0.00
Total Direct Costs	\$2,751,789.31	\$2,751,789.31	\$0.00	\$0.00
Authorized Indirect Costs	\$20,281.69	\$20,281.69	\$0.00	\$0.00
10% of Salaries and Wages				
Total Costs	\$2,772,071.00	\$2,772,071.00	\$0.00	\$0.00

AQRP Budget

FY 2011

Budget Category	FY11 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary	\$163,120.24	\$163,120.24	\$0.00	\$0.00
Fringe Benefits	\$31,173.03	\$31,173.03	\$0.00	\$0.00
Travel	\$0	\$0.00	\$0.00	\$0.00
Supplies	\$4.51	\$4.51	\$0.00	\$0.00
Equipment	\$0	\$0.00	\$0.00	\$0.00
Other	\$0	\$0.00	\$0.00	\$0.00
Contractual	\$1,736,440.62	\$1,716,271.72	\$0.00	\$20,168.90
ITAC	\$6,577.64	\$6,577.64	\$0.00	\$0.00
Project Management	\$152,444.74	\$151,436.65	\$0.00	\$1,008.09
Total Direct Costs	\$2,089,760.78	\$2,068,583.79	\$0.00	\$21,176.99
Authorized Indirect Costs	\$16,310.22	\$16,310.22	\$0.00	\$0.00
10% of Salaries and Wages				
Total Costs	\$2,106,071.00	\$2,084,894.01	\$0.00	\$21,176.99

Appendix B

Financial Reports by Fiscal Year

FY 12 and 13

(Expenditures reported as of February 28, 2013.)

Administration Budget (includes Council Expenses)

FY 2012

Budget Category	FY12 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary	\$80,440.00	\$55,496.97	\$1,634.00	\$23,309.03
Fringe Benefits	\$14,666.00	\$13,027.48	\$589.94	\$1,048.58
Travel	\$350.00	\$0.00		\$350.00
Supplies	\$10,000.00	\$1,298.88	\$30.30	\$8,670.82
Equipment	\$0.00			\$0.00
Other				
Contractual				
Total Direct Costs	\$105,456.00	\$69,823.33	\$2,254.24	\$33,378.43
Authorized Indirect Costs	\$8,044.00	\$5,549.70	\$163.40	\$2,330.90
10% of Salaries and Wages				
Total Costs	\$113,500.00	\$75,373.03	\$2,417.64	\$35,709.33

Administration Budget (includes Council Expenses)

FY 2013

Budget Category	FY13 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary	\$70,040.00	\$0.00		\$70,040.00
Fringe Benefits	\$12,606.00	\$0.00		\$12,606.00
Travel	\$350.00	\$0.00		\$350.00
Supplies	\$10,000.00	\$76.33		\$9,923.67
Equipment				
Other	\$0.00	\$0.00		\$0.00
Contractual				
Total Direct Costs	\$92,996.00	\$76.33	\$0.00	\$92,919.67
Authorized Indirect Costs	\$7,004.00	\$0.00		\$7,004.00
10% of Salaries and Wages				
Total Costs	\$100,000.00	\$76.33	\$0.00	\$99,923.67

ITAC Budget

FY 2012

Budget Category	FY12 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary				
Fringe Benefits				
Travel	\$10,000.00			\$10,000.00
Supplies	\$500.00			\$500.00
Equipment				
Other				
Contractual				
Total Direct Costs	\$10,500.00	\$0.00	\$0.00	\$10,500.00
Authorized Indirect Costs				
10% of Salaries and Wages				
Total Costs	\$10,500.00	0.00	\$0.00	\$10,500.00

ITAC Budget

FY 2013

Budget Category	FY13 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary				
Fringe Benefits				
Travel	\$0.00	\$0.00		\$0.00
Supplies	\$0.00	\$0.00		\$0.00
Equipment				
Other				
Contractual				
Total Direct Costs	\$0.00	\$0.00	\$0.00	\$0.00
Authorized Indirect Costs				
10% of Salaries and Wages				
Total Costs	\$0.00	\$0.00	\$0.00	\$0.00

Project Management Budget

FY 2012

Budget Category	FY12 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary	\$60,700.00	\$10,827.47	\$22,643.40	\$27,229.13
Fringe Benefits	\$11,230.00	\$2,170.72	\$4,519.27	\$4,540.01
Travel	\$500.00			\$500.00
Supplies	\$7,500.00	\$0.03		\$7,499.97
Equipment				
Other				
Contractual				
Total Direct Costs	\$79,930.00	\$12,998.22	\$27,162.67	\$39,769.11
Authorized Indirect Costs	\$6,070.00	\$1,082.75	\$2,264.34	\$2,722.91
10% of Salaries and Wages				
Total Costs	\$86,000.00	\$14,080.97	\$29,427.01	\$42,492.01

Project Management Budget

FY 2013

Budget Category	FY13 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary	\$46,000.00			\$46,000.00
Fringe Benefits	\$8,400.00			\$8,400.00
Travel	\$0.00			\$0.00
Supplies	\$6,000.00			\$6,000.00
Equipment				
Other				
Contractual				
Total Direct Costs	\$60,400.00	\$0.00	\$0	\$60,400.00
Authorized Indirect Costs	\$4,600.00			\$4,600.00
10% of Salaries and Wages				
Total Costs	\$65,000.00	0.00	\$0.00	\$65,000.00

**AQRP Budget
FY 2012**

Budget Category		FY12 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary		\$80,440.00	\$55,496.97	\$1,634.00	\$23,309.03
Fringe Benefits		\$14,666.00	\$13,027.48	\$589.94	\$1,048.58
Travel		\$350.00	\$0.00	\$0.00	\$350.00
Supplies		\$10,000.00	\$1,298.88	\$30.30	\$8,670.82
Equipment		\$0.00	\$0.00	\$0.00	\$0.00
Other		\$0.00	\$0.00	\$0.00	\$0.00
Contractual		\$950,000.00	\$9,144.46	\$0.00	\$940,855.54
ITAC		\$10,500.00	\$0.00	\$0.00	\$10,500.00
Project Management		\$86,000.00	\$14,080.97	\$29,427.01	\$42,492.02
Total Direct Costs		\$1,151,956.00	\$93,048.76	\$31,681.25	\$1,027,225.99
Authorized Indirect Costs		\$8,044.00	\$5,549.70	\$163.40	\$2,330.90
10% of Salaries and Wages					
Total Costs		\$1,160,000.00	\$98,598.46	\$31,844.65	\$1,029,556.89

**AQRP Budget
FY 2013**

Budget Category		FY13 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary		\$70,040.00	\$0.00	\$0.00	\$70,040.00
Fringe Benefits		\$12,606.00	\$0.00	\$0.00	\$12,606.00
Travel		\$350.00	\$0.00	\$0.00	\$350.00
Supplies		\$10,000.00	\$76.33	\$0.00	\$9,923.67
Equipment		\$0.00	\$0.00	\$0.00	\$0.00
Other		\$0.00	\$0.00	\$0.00	\$0.00
Contractual		\$835,000.00	\$0.00	\$0.00	\$835,000.00
ITAC		\$0.00	\$0.00	\$0.00	\$0.00
Project Management		\$65,000.00	\$0.00	\$0.00	\$65,000.00
Total Direct Costs		\$992,996.00	\$76.33	\$0.00	\$992,919.67
Authorized Indirect Costs		\$7,004.00	\$0.00	\$0.00	\$7,004.00
10% of Salaries and Wages					
Total Costs		\$1,000,000.00	\$76.33	\$0.00	\$999,923.67