AIR QUALITY RESEARCH PROGRAM

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

Annual Report

September 1, 2011 through August 31, 2012

Submitted to

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Texas Air Quality Research Program

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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 a call for proposals in May, 2010. Forty-five proposals, requesting $12.9 million in research funding were received by the due date of June 25, 2010. 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. Projects commenced shortly thereafter, and 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 additional 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. Investigators have been notified of their funding status and the contracting process has commenced.

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. (More information on the ITAC is provided below.)

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. (More information on the TCEQ relevancy review is provided below.)

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. (More information on the Council is provided below.)

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 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.

Independent Technical Advisory Committee (ITAC)

The AQRP funding is used primarily for research projects, and one of three groups responsible for selecting the projects is the Independent Technical Advisory Committee (ITAC). The ITAC, composed of up to 15 individuals and an alternate with scientific expertise relevant to the Program, is charged with recommending technical approaches, and establishing research priorities. Initially, the ITAC was to meet at least twice per year at locations rotating between Austin, Dallas and Houston. As the Program proceeded, it was more efficient for the ITAC to meet once in Austin and as needed via conference call/webinar. Generally, the meetings in Austin are dedicated to new project review, reviewing progress on funded projects, and reviewing the Program's strategic plan.

Members of the ITAC consist of the TCEQ Project Director (or designee), representatives with air quality expertise from research institutions with extensive expertise in air quality research in Texas. The members of the ITAC are drawn from Texas universities active in air quality research, national laboratories that have participated in air quality studies in Texas, and institutions that have expertise not available in Texas and that have participated in air quality studies in Texas. The members of the ITAC are listed in Table 1.

As the ITAC membership is intentionally drawn from air quality researchers who have experience in Texas; these researchers and their colleagues will likely have interest in responding to the requests for research proposals issued by the AQRP. This raises potential confidentiality and conflict of interest issues, and the contract between TCEQ and the University of Texas requires that the AQRP shall maintain and implement an appropriate written policy on conflict of interest. Specifically for the ITAC, all members are required to certify:

> *Confidentiality:* As a member of ITAC I understand that I will have access to proposals submitted to the Air Quality Research Program. Subject to any legal requirements, I agree to keep the information in these proposals confidential until the selection process is completed and it is appropriate to release information to the public. I understand that there may be certain information that comes to me in my role as a member of ITAC that retains its confidential nature even after the process is concluded. I also understand that I will review said proposals and may have access to the reviews made by other ITAC members. I agree to keep these reviews and the identity of the reviewers confidential until such time as this information is released to the public. (NOTE: For the reviews and reviewers, this information may never be released.)
>
> *Conflict of Interest:* As a member of ITAC, I agree that I will not evaluate, comment on, or vote on proposals in which I or my home institution is involved, including but not limited to, any financial interest, or in which I have another form of conflict of interest. I understand that ITAC members with conflicts of interest must leave the meeting room or the conference line when a proposal with which they have a conflict is discussed, voted on or otherwise being considered. I understand that I must recuse myself from participating in or attempting to influence at any time the ITAC's or the AQRP Council's consideration or decision concerning such proposals. I agree to bring any issues concerning a possible conflict of interest to the attention of the Director of the Air Quality Research Program or the TCEQ Project Director. If there is a question of interpretation regarding whether a conflict of interest exists, I agree that the decision regarding whether a conflict of interest exists will be made by the Director of the Air Quality Research Program or the TCEQ Project Director.

All members of the ITAC agreed to abide by these conflict of interest and confidentiality provisions prior to participating in the review of proposals.

Table 1: Members of the Independent Technical Advisory Committee

Name	**Title**	**Organization**
David Allen	Gertz Regents Professor in Chemical Engineering	The University of Texas at Austin
Peter Daum	Head, Atmospheric Science Division	Brookhaven National Lab
Mark Estes	Senior Air Quality Scientist Air Modeling and Data Analysis Section	Texas Commission on Environmental Quality
Fred Fehsenfeld	Senior Scientist, Cooperative Institute for Research in Environmental Sciences	University of Colorado - Boulder
Sarwar Golam	Research Physical Scientist, Atmospheric Modeling and Analysis Division, Office of Research and Development	U.S. Environmental Protection Agency
Robert Griffin	Associate Professor, Civil and Environmental Engineering	Rice University
Tho (Thomas) Ching Ho	Chairman, Dan F. Smith Dept. of Chemical Engineering	Lamar University
Kuruvilla John	Professor of Mechanical and Energy Engineering Associate Dean for Research and Graduate Studies	University of North Texas
Barry Lefer	Associate Professor, Department of Earth and Atmospheric Sciences	The University of Houston
John Nielsen-Gammon	Professor and Texas State Climatologist Center for Atmospheric Chemistry and the Environment	Texas A&M University
David Parrish	Program Lead, Tropospheric Chemistry, NOAA/ESRL/Chemical Sciences Division	National Oceanic and Atmospheric Administration
Jay Turner	Associate Professor of Energy, Environmental and Chemical Engineering	Washington University in St. Louis
William Vizuete	Associate Professor, Gillings School of Global Public Health	The University of North Carolina at Chapel Hill
Christine Wiedinmyer	Scientist II, Atmospheric Chemistry Division	Nation Center for Atmospheric Research
Greg Yarwood	Principal	Environ
Dan Cohan (Alternate)	Assistant Professor, Civil and Environmental Engineering	Rice University

TCEQ Relevancy Review

Once the ITAC has reviewed and ranked research project proposals according to technical merit, they are submitted to the TCEQ for a relevancy review. The TCEQ reviews proposals for relevancy to the State's air quality research needs. TCEQ approval is required for a project to receive funding from the Program.

Advisory Council

The final group responsible for selecting AQRP research projects is the Advisory Council. The Council serves as a Board of Directors for the Program and consists of up to 11 members, all residents of the State of Texas. Two Council members with relevant scientific expertise are nominated by the TCEQ. As defined in the AQRP contract, up to four members of the Council can be county judges from the Houston-Galveston-Brazoria (HGB) and Dallas-Fort Worth (DFW) non-attainment counties. Additional members include government officials from Texas Near-Non-Attainment Areas active in air quality management. The purpose of the Council is to give final approval to projects recommended by the ITAC and TCEQ, and to provide guidance on the Strategic Plan. At least one meeting in Austin is dedicated to new project selection. Additional meetings, either in person or via webinar, and email updates are dedicated to providing summaries of on-going projects and review of the strategic plan.

Table 2: Members of the Advisory Council

Name	Title	Organization
Ramon Alvarez	Senior Scientist	Environmental Defense Fund
Daniel Baker	Senior Consultant in Air Quality	Shell Global Solutions
Sam Biscoe	County Judge	Travis County
Jeff Branick	County Judge	Jefferson County
Edward M. Emmett	County Judge	Harris County
Ralph B. Marquez	Former TCEQ Commissioner	Environmental Strategies and Policy
Keith Self	County Judge	Collin County
Kim Herndon	Assistant Director Air Quality Division	Texas Commission on Environmental Quality
TCEQ 2	Pending appointment by TCEQ	

PROJECT TIMELINE

This section will discuss the activities that took place in support of the AQRP. In the period covered by this report, four primary activities took place:

- FY 2010 – 2011 Projects completed
- Data Workshop
- State of the Science – Strategic planning document completed
- New funding for FY 2012 – 2013 – decisions on new projects

September – November 2011

The primary activities during the first quarter of FY 2011 – 2012 were the completion of the remaining research projects and the Data Workshop.

On September 27 and 28, 2011, the AQRP hosted a Data Workshop and ITAC meeting at The University of Texas at Austin's Pickle Research Campus. During the first day and a half, a representative from each project presented a report on project results and recommendations. The ITAC meeting was held during the last half of the second day. Topics of discussion included the upcoming NASA Discovery AQ project, procedures for possible future requests for proposals (RFPs), and the development of a State of the Science document to provide background information for establishing future research priorities.

All of the FY 2010 - 2011 Research Projects initially had an end date of August 30, 2011; however, eight Principal Investigators requested a 90 day contract extension. Project Managers reviewed final reports for those projects that were completed on August 30, and worked with the PIs of the extended Projects to ensure their timely completion. As of November 30, 2012, all Projects were completed, and draft final reports were submitted to the Project Managers and TCEQ Liaisons for review.

Program Administration during this period focused on the payment of monthly invoices for projects, reporting activities, and the planning and execution of the Data Workshop.

Table 3 on the following page, is a list of all FY 2010-2011 Research Projects, the amount they were funded, the amount they expended, and the amount they returned to the AQRP.

Table 3: FY 2010-2011 Funded Research Projects

AQRP Project Number	Title	Start Date	End Date	Total Project Funding Awarded	Total Project Expenditures	Funding Returned to AQRP
	Institution (*Institution = Lead Institution and PI)	Principal Investigator		Project Funding Awarded to Institution	Institution Project Expenditures	Institution Funding Returned to AQRP
10-006	**Quantification of Industrial Emissions of VOCs, NO_2 and SO_2 by SOF and Mobile DOAS**	**2/16/2011**	**11/30/2011**	**$484,662.00**	**$480,128.11**	**$4,533.89**
	*Chalmers University of Technology	Johan Mellqvist		$262,179.00	$262,179.00	$0.00
	University of Houston	Bernhard Rappenglüeck		$222,483.00	$217,949.11	$4,533.89
10-008	**Factors Influencing Ozone-Precursor Response in Texas Attainment Modeling**	**10/21/2010**	**9/30/2011**	**$178,796.00**	**$176,567.10**	**$2,228.90**
	*Rice University	Daniel Cohan		$128,851.00	$126,622.32	$2,228.68
	ENVIRON International	Greg Yarwood		$49,945.00	$49,944.78	$0.00
10-009	**Additional Flare Test Days for TCEQ Comprehensive Flare Study**	**9/8/2010**	**11/30/2011**	**$591,332.00**	**$591,306.66**	**$25.34**
	*The University of Texas at Austin	Vincent Torres				
10-015	**An Assessment of Nitryl Chloride Formation Chemistry and its Importance in Ozone Non-attainment areas in Texas**	**3/4/2011**	**11/30/2011**	**$201,280.00**	**$201,278.63**	**$1.37**
	*ENVIRON International	Greg Yarwood				
10-020	**NO_x Reactions and Transport in Nighttime Plumes and Impact on Next-Day Ozone**	**3/5/2011**	**11/30/2011**	**$202,498.00**	**$202,493.48**	**$4.52**
	*ENVIRON International	Greg Yarwood				
10-021	**Dry Deposition of Ozone to Built Environment Surfaces**	**10/11/2010**	**8/31/2011**	**$248,786.00**	**$248,786.41**	**($0.41)**

	*The University of Texas at Austin	Richard Corsi				
10-022	**Development of Speciated Industrial Flare Emission Inventories for Air Quality Modeling in Texas**	**2/16/2011**	**11/30/2011**	**$150,000.00**	**$132,790.80**	**$17,209.20**
	*Lamar University	Daniel Chen				
10-024	**Surface Measurements and One-Dimensional Modeling Related to Ozone Formation in the Suburban Dallas-Fort Worth Area**	**2/16/2011**	**9/30/2011**	**$458,957.00**	**$444,001.74**	**$14,955.26**
	*Rice University	Robert Griffin		$225,662.00	$223,769.99	$1,892.01
	University of Houston	Barry Lefer		$98,134.00	$88,914.46	$9,219.54
	University of New Hampshire	Jack Dibb		$70,747.00	$70,719.78	$27.22
	University of Michigan	Allison Steiner		$64,414.00	$60,597.51	$3,816.49
10-029	**Wind Modeling Improvements with the Ensemble Kalman Filter**	**12/1/2010**	**11/30/2011**	**$80,108.00**	**$78,276.97**	**$1,831.03**
	*Texas A & M University	John Neilson-Gammon				
10-032	**SHARP Data Analysis: Radical Budget and Ozone Production**	**2/9/2011**	**11/30/2011**	**$248,652.00**	**$242,335.97**	**$6,316.03**
	*University of Houston	Barry Lefer		$176,314.00	$176,314.00	$0.00
	University of California - Los Angeles	Jochen Stutz		$23,054.00	$18,850.65	$4,203.35
	University of New Hampshire	Jack Dibb		$49,284.00	$47,171.32	$2,112.68
10-034	**Dallas Measurements of Ozone Production**	**2/2/2011**	**11/30/2011**	**$195,054.00**	**$186,657.54**	**$8,396.46**
	*University of Houston	Barry Lefer				
10-042	**Environmental Chamber Experiments to Evaluate NOx Sinks and Recycling in Atmospheric Chemical Mechanisms**	**10/8/2010**	**11/30/2011**	**$237,481.00**	**$237,479.31**	**$1.69**
	*ENVIRON International	Greg Yarwood				

10-044	**Airborne Measurements to Investigate Ozone Production and Transport in the Dallas/Fort Worth (DFW) Area During the 2011 Ozone Season**	**3/25/2011**	**11/30/2011**	**$279,642.00**	**$277,846.38**	**$1,795.62**
	*University of Houston	Maxwell Shauck				
10-045	**Quantification of Hydrocarbon, NOx, and SO2 emissions from Petrochemical Facilities in Houston: Interpretation of the 2009 FLAIR dataset**	**1/22/2011**	**9/30/2011**	**$398,042.00**	**$391,199.38**	**$6,842.62**
	*University of California - Los Angeles	Jochen Stutz		$149,773.00	$142,930.28	$6,842.72
	University of North Carolina - Chapel Hill	William Vizeute		$33,281.00	$33,281.00	$0.00
	Aerodyne Research Inc.	Scott Herndon		$164,988.00	$164,988.10	($0.10)
	Washington State University	George Mount		$50,000.00	$50,000.00	$0.00
10-DFW	**Dallas - Fort Worth Field Study**	**2/1/2011**	**8/31/2011**	**$37,857.00**	**$37,689.42**	**$167.58**
	*The University of Texas at Austin	Vincent Torres				
11-DFW	**Dallas - Fort Worth Field Study**	**2/1/2011**	**8/31/2011**	**$50,952.00**	**$29,261.75**	**$21,690.25**
	*The University of Texas at Austin	Vincent Torres				
11-SOS	**State of the Science**	**2/8/2012**	**4/30/2012**	**$36,000.00**	**$36,000.00**	**$0.00**
	*The University of Texas at Austin	David Allen				
Notes:	The State of the Science project was funded from monies returned from the completed research projects. The Dallas - Fort Worth Field Study project was partially funded by a transfer of monies from the Project Management budget ($22,036). The full amount was returned to the Project Management budget at the conclusion of the Research Projects.					

December 2011 – Feb 2012

During the second quarter of FY 2011-2012, Program Administration focused on the close-out and final payment of invoices for projects, as well as the completion of reporting activities. Project Managers and TCEQ Liaisons completed the review of the Final Reports.

Once all reviews were completed, the Final Report for each project was posted on the AQRP website at http://aqrp.ceer.utexas.edu/projects.cfm. All Final Reports, with the exception of one have been posted to the website.

Principal Investigators notified Project Managers and TCEQ Liaisons of impending publications developed from the AQRP Projects. A reference list of the publications for each project can be found in Appendix C.

The State of the Science project was initiated in February to help determine the high priority scientific and technical issues to be addressed in the 2012-2013 biennium.

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.

March 2012 – May 2012

State of the Science Assessment

The State of the Science project was completed in April. The primary product of the project was a State of the Science Assessment that was released and posted on the AQRP website (http://aqrp.ceer.utexas.edu). The Assessment provided an overview of the current understanding of key scientific and technical issues, relevant to Texas, in emissions inventory development, atmospheric chemistry, meteorology and air quality modeling. The Assessment also summarized key findings from AQRP research projects and defined the research priorities for the 2012-2013 biennium.

The findings from the fourteen (14) research projects, organized by research topic, are briefly described below:

Emissions:
Despite improvements in inventory estimates over the past decade, significant discrepancies are still observed between annual average reported emissions and instantaneous emission estimates inferred from observed concentrations. Some of these discrepancies can be resolved through refinement of the temporal resolution of emissions; other discrepancies may be due to missing or under-estimated sources.

The AQRP projects related to industrial flaring have provided information about both temporal variability and potential underestimation of emissions. The studies of flares under controlled operating conditions demonstrated that at low flow rates, and with low heating value gases, standard emission estimation methods may understate emissions if excess steam or air-assist is used. Subsequent air quality modeling demonstrated that these emissions, coupled with the temporal variability in the emissions, can lead to additional ozone formation both locally and

over large spatial scales. Field observations in the FLAIR project support these findings. Specifically:

- Field tests in a semi-controlled environment indicate that the most efficient industrial flare operation, as measured by the destruction and removal efficiency and combustion efficiency, are achieved at or near the incipient smoke point. Minimum levels of steam or air assist that comply with the flare manufacturer's recommendations should be used when possible.
- Further development of remote sensing technologies, such as Passive and Active Fourier Transform Infrared Spectroscopy, and modeling techniques, such as Multivariate Image Analysis, may offer approaches for improving the detection, monitoring, and evaluation of flare operational conditions in the future.

A variety of additional studies have involved field measurements to resolve emission inventories. A particular focus has been on alkenes and aldehydes.

- Remote sensing measurements in the Houston Ship Channel and Texas City indicated that alkane and ethene emissions were similar in 2006, 2009, and 2011, while propene emissions decreased. Formaldehyde emissions in the Houston Ship Channel and Texas City were similar between 2009 and 2011, and many sources were associated with industries also emitting alkenes. In the Houston Ship Channel, Beaumont/Port Arthur, and Longview areas, comparison of the 2011 measurements with the 2009 TCEQ inventory showed primarily good agreement for NO_x and SO_2 but large discrepancies in VOC with observations at certain locations, such as Mont Belvieu, exceeding reported emissions by 400-1500% for alkanes, 300-1500% for ethene, and 170-800% for alkenes.
- The strength of industrial emissions sources of formaldehyde and olefins were assessed in Texas City and the Houston Ship Channel region during the 2009 FLAIR study. Consistent with previous studies, computed ethene, propene, benzene, and 1,3-butadiene emission rates significantly exceeded levels reported in emissions inventories (by more than 2 orders of magnitude in some cases). Ignited flares emitted formaldehyde at the tip at rates between 0.3-2.5 kg/h. Combustion efficiencies were found to vary from 0 (unlit) to 0.7 (steaming) to 0.999. A large source of primary formaldehyde emissions was identified in a Texas City refinery complex with a strength of 18 ± 5 kg/h, which may be associated with a FCCU regeneration unit.

Chemistry:

Atmospheric chemistry in Texas has a number of unique features. The combinations of industrial and urban emissions, and forested and coastal environments lead certain chemical pathways to become more significant in Texas than in other regions. Specific findings arising from the AQRP program that address ozone and radical formation under Texas conditions include:

- Nitryl chloride can affect tropospheric oxidation capacity and ozone formation in coastal and inland regions. Representation of the chemistry of nitryl chloride formation in CAMx has been implemented and chlorine/chloride sources have been characterized for Texas emissions inventories.

- Volatile organic compounds can remove NO_x by forming NO_x sink compounds that reduce the availability of NO_x for ozone formation. These NO_x sink species may eventually react to return NO_x back to the atmosphere, known as NO_x recycling, potentially causing additional ozone production in NO_x-limited regions. Novel experimental data, describing the NO_x sinks for aromatics and isoprene and NO_x-recycling from photolysis of alkyl nitrates and nitrocresols, have been obtained and used to develop a revised version of the Carbon Bond mechanism (CB6) known as CB6r1.
- Calculated HO_x production during the SHARP campaign in Houston was dominated by the photolysis of HONO in the early morning and by photolysis of O_3 in the midday; at night, OH production occurred mainly via O_3 reactions with alkenes. On average, the daily HO_x production rate was 23.8 ppbv day^{-1} in the region, of which 31% was from O_3 photolysis, 23% from HONO photolysis, 12% from HCHO photolysis, and 14% from O_3 reactions with alkenes.
- Recent measurements have indicated that daytime observed HONO mixing ratios are often far larger than the expected photostationary state with OH and NO in Houston and other locations throughout the world. Statistically significant vertical gradients of HONO throughout the day, with smaller mixing ratios aloft, have suggested that a likely source of daytime HONO could be photocatalytic conversion of NO_2 on the ground in Houston. Although daytime mechanisms for HONO formation have been a subject of exploration, it is evident that uncertainty remains and further studies are needed. As further progress is made, incorporation into air quality models will be important.

Transport/Modeling:
One of the ways in which air quality models are improved is by collecting detailed field measurements that can be used to evaluate the performance of the air quality models. Previous field measurement campaigns in the state were primarily focused on southeast Texas. In 2010-2012, a field measurement program in the Dallas-Fort Worth area was funded by AQRP. The measurements led to a number of significant findings and future comparisons with modeling results are expected to lead to additional insights.

- Aircraft measurements downwind of the Dallas-Fort Worth area indicated enhancements in maximum ozone concentrations by factors ranging from 1.5-2.5 relative to upwind concentrations. Downwind concentrations of NO, NO_2, and reactive alkenes were modest indicating a photochemically aged air mass.
- Aircraft flights over portions of the Barnett Shale did not find enhancements in ozone concentrations clearly associated with oil and gas emissions, but persistent southerly winds (~10 mph) may not have favored mixing of urban DFW and Barnett Shale emissions that would change the VOC/NOx ratio towards a regime favoring ozone production. On some occasions, elevated concentrations of reactive alkenes (up to 10 ppbv) and formaldehyde (4-6 ppbv compared to background concentrations of 2-3 ppbv) were measured over the Barnett Shale, such as immediately downwind of a large compressor station in the Eagle Mountain Lake area.
- Preliminary results from deployment of the Measurement of Ozone Production Sensor (MOPS) during August – October 2011 at the Meacham site near Dallas-Fort Worth showed that ozone production on sunny days peaked at 40-60 ppbv/h in the mid-mornings, which suggested that Meacham may be an ozone source region. Preliminary

ozone production rates at Eagle Mountain Lake were generally lower, with peak ozone productivities of 40 ppbv/h in the late mornings on only a few days.

- Preliminary analyses of surface measurements during May 30 – June 30, 2011 indicated that Eagle Mountain Lake was most often affected by aged and processed air from the Dallas-Fort Worth metropolitan area and intermittently by emissions from nearby oil and gas operations in the Barnett Shale.
- The largest sources of methane and other hydrocarbon species at oil and gas locations near Fort Worth were gas treatment facilities combined with large compressor stations. Emissions were an order of magnitude lower from smaller compressor stations and well pads; however, flashing emissions on one occasion from a condensate tank were estimated at 140 kg/h methane and 10 kg/h ethane (and other species) suggesting further study for this potentially important intermittent source.

In addition to the field measurement program, AQRP projects also included data analysis of previously conducted field programs. Among these were flights examining the long range transport, overnight, of urban, industrial and power plant plumes. Results from laboratory and field studies of pollutant loss mechanisms (dry deposition) were also incorporated into air quality models.

- Overnight transport of plumes from urban, petrochemical, and coal-fired power plant plumes can affect regional air quality the following day. Aircraft flights in the Houston area have shown NO_3 to be 3 to 5 times more important than O_3 as a nighttime oxidant of VOCs. Net NO_3 radical productions rates can be large (1–2 ppbv h^{-1}) within NO_x-containing plumes of industrial origin from Houston. Nighttime NO_x loss through N_2O_5 heterogeneous uptake is modest, but should be an area of continued study.
- Analysis of nighttime aircraft intercepts from two different Texas power plants resulted in improvements to the plume-in-grid formulation in CAMx version 5.40, released in October 2011. Plume-in-grid puff growth rates were modified to ignore growth contributions from horizontal and vertical shear during stable/nighttime conditions. Shear effects remain during neutral/unstable/daytime conditions. Minimum limits on vertical diffusivity, turbulent flux moments, and nighttime planetary boundary layer depths were reduced. With these improvements, plume-in-grid puff behavior will change potentially significantly at night and above the boundary layer, usually leading to longer lifetime.
- The heterogeneity of the urban environment is typically not represented in the dry deposition algorithms used for photochemical modeling. Refined characterization of the urban built environment on the dry deposition of ozone in Austin, Texas resulted in decreases in predicted daily maximum 8-hour average ozone concentrations of 0.2 to 1.3 ppb. The results were primarily attributed to deposition to urban vegetation and highlighted the importance of characterizing Texas urban landscapes undergoing rapid development.

Investigators planning to respond to AQRP requests for proposals during the 2012-2013 biennium were directed to the Assessment for guidance in identifying research areas in which proposals are sought.

For the 2012-2013 biennium, the targeted areas for AQRP research are:

- Analysis of data collected in the Dallas-Fort Worth (Barnett Shale) field campaign
- Analysis of flare operating regimes that provide both high combustion efficiency and minimal smoke formation
- Deployment of supplementary measurements in a large field measurement campaign planned by NASA for the summer of 2013
- Analysis of prior Texas field study data and modeling tools to investigate transformation of gas-phase pollutants to aerosol phase
- Investigation of how the temporal resolution of meso-scale meteorology and photochemical grid models must be altered for high spatial resolution modeling; investigation of mesoscale modeling of cloud formation and the effects of clouds upon ozone and PM chemistry;
- Analysis of radical chemistry in Texas cities, especially HONO formation, ozone removal and production by halogen chemistry, and atmospheric chemistry within industrial plumes.
- Analysis of the impact of global and regional transport of air pollutants on Texas.

RFP Released

In May 2012, a Request for Proposals (RFP) for 2012-2013 funding was released. Potential responders were notified via email and the RFP was posted on the AQRP website, along with instructions for applying. The submission deadline for proposals was June 15, 2012 at 5pm Central Time.

June 2012

The AQRP received thirty-two (32) proposal submissions, requesting $5 million in funding, by the due date of June 15, 2012. The ITAC conducted the scientific and technical review of the proposals via a conference call on June 26, 2012 and in a meeting held in Austin, Texas, on June 29, 2012. Ten proposals were highly recommended for funding; five proposals were recommended for funding; and seventeen proposals were not recommended for funding.

July 2012

On July 4, 2012, the project proposals and ITAC recommendations were forwarded to TCEQ. The TCEQ evaluated the project recommendations from the ITAC and provided comment on the relevancy of the projects to the State's air quality research needs. The TCEQ recommended for funding twelve (12) of the fifteen (15) proposals that the ITAC recommended.

Several of the highly recommended and recommended proposals were projects associated with the NASA DISCOVER-AQ field campaign. Dr. James Crawford of NASA provided additional input on whether any of the proposed projects were duplicative of projects already funded. His assessment determined that none of the projects recommended for funding would be duplicative of NASA-funded activities.

Prior to the issuance of the RFP, two proposals were submitted to the AQRP for consideration in the FY 2012-2013 funding cycle. The TCEQ supported these proposals and indicated they would provide additional funding to the AQRP to support these proposals. Because these proposals were not a direct response to the RFP, and were not competing for the same funding, they were not included in the proposals discussed above. They were, however, reviewed independently by the ITAC and the TCEQ, both of which recommended the proposals be funded.

August 2012

On August 2, 2012, the recommendations from the ITAC and the TCEQ were presented to the Advisory Council, as well as an overview of the strategic research priorities developed as part of the State of the Science project. The Council members expressed concern about the large number of projects associated with the DISCOVER-AQ field campaign and the geographic distribution of the funding, however, they also recognized that the DISCOVER-AQ campaign offered an opportunity to make measurements of great interest to the State at a time when many complementary measurements would be made, thus leveraging the State's investments in research. They felt that the highly recommended and recommended projects represented good science, but recommended considering additional projects that address mobile source (vehicular) emissions, and that address air quality issues relevant to regions that have not been as extensively studied as southeast Texas (e.g. central Texas).

The Council recommended that the twelve (12) proposals recommended by both the ITAC and the TCEQ be funded, as well as the two (2) additional proposals. They also recommended that a targeted RFP be published for the distribution of any remaining 2012-2013 funding. The Council members agreed to solicit and provide input regarding high priority needs for various areas within the state of Texas. This process is currently ongoing.

At this time, all principal investigators have been notified of the status of their proposals. Those that were selected for funding have been assigned an AQRP Project Manager and a TCEQ Liaison. The contracting process has begun. An amended Master Agreement will be issued to those entities which had projects funded in FY 2010-2011. A new Master Agreement will be issued to those entities newly funded by the AQRP

The proposals that were recommended for funded are listed in Table 4.

Table 4: FY 2012-3012 AQRP Proposals Selected for Funding

Proposal Number		Proposal Title	PI	Lead Institution	Collaborating Institutions	Funding Awarded by Council
12-004		DISCOVER-AQ Ground Sites Infrastructure Support	Vincent Torres	The University of Texas at Austin	None	$289,200
12-005		Quantification of industrial emissions of VOCs, NO2 and SO2 by SOF and mobile DOAS during DISCOVER AQ	Johan Mellqvist	Chalmers University of Technology	University of Houston	$177,652
12-006		Environmental chamber experiments and CMAQ modeling to improve mechanisms to model ozone formation from HRVOCs	Gookyoung Heo	University of California, Riverside	TAMU	$146,259
12-011		Investigation of Global Modeling and Lightning NOx Emissions as Sources of Regional Background Ozone in Texas	Chris Emery	Environ	Princeton University	$72,856
12-012		Interactions Between Organic Aerosol and Noy: Influence on Oxidant Production	Lea Hildebrandt	The University of Texas at Austin	Environ	$148,837
12-013		Development of Transformation Rate of SO2 to Sulfate for the Houston Ship Channel using the TexAQS 2006 Field Study Data	Ralph Morris	Environ	None	$59,974
12-016		Ozonesonde launches from the University of Houston and Smith Point, Texas in Support of DISCOVER AQ	Gary Morris	Valparaiso University	University of Houston	$86,666

12-018		The Effects of Uncertainties in Fire Emissions Estimates on Predictions of Texas Air Quality	Elena McDonald-Buller	The University of Texas at Austin	ENVIRON	$112,864
12-022		Surface Measurements of PM, VOCs, and Photochemically Relevant Gases in Support of DISCOVER-AQ	Robert Griffin	Rice University	University of Houston	$206,815
12-024		Surface Measurement of Trace Gases in Support of DISCOVER-AQ in Houston in Summer 2013	Xinrong Ren	University of Maryland	NOAA	$90,444
12-028		Implementation and evaluation of new HONO mechanisms in a 3-D Chemical Transport Model for Spring 2009 in Houston	Barry Lefer	University of Houston	University of California - Los Angeles, ENVIRON, University of North Carolina - Chapel Hill	$117,446
12-032		Collect, Analyze, and Archive Filters at two DISCOVER-AQ Houston Focus Areas: Initial Characterization of PM Formation and Emission	Rebecca Sheesley	Baylor University	None	$45,972
12-TN1		Investigation of surface layer parameterization of the WRF model and its impact on the observed nocturnal wind speed bias	Pius Lee	NOAA	None	$65,000
12-TN2		Development of IDL-based geospatial data processing framework for meteorology and air quality modeling	HyunCheol Kim	NOAA	None	$70,000

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 August 31, 2012, $59,410.76 remains unspent. These funds will be used in conjunction with the FY 2012 and 2013 funds and will be fully expended by March 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 issuance of the RFP, the proposal review process, the contracting process, invoice review and payment, and other invoicing functions. Denzil Smith is responsible for the AQRP Web Page development and for data management.

Table 2: 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	$15,096.14		$4.51
Equipment		$0	$0	$0			$0
Total Direct Costs		$256,925.31	$194,297.78	$451,223.09	$451,218.58	$0	$4.51
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**	**$487,810.49**	**$0**	**$4.51**
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	$28,220.55	$0	122,259.45
Fringe Benefits		$14,666	$12,606	$27,272	$6,182.19	$0	$21,089.81
Travel		$350	$350	$700	$0		$700.00
Supplies		$10,000	$10,000	$20,000	$275.10		$19,724.90
Equipment		$0	$0	$0			$0
Total Direct Costs		$105,456	$92,996	$198,452	$34,677.84	$0	$163,774.16
Authorized Indirect Costs		$8,044	$7,004	$15,048	$2822.05		$12,225.95
10% of Salaries and Wages							
Total Costs		**$113,500**	**$100,000**	**$213,500**	**$37,499.89**	**$0**	**$176,000.11**
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. 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 through July 2012 are included in the spreadsheets above. The amount for August is estimated.

Actual indirect costs for the months through July 2012 are included in Table 2. The amount for August is estimated. The accounting records for the month of August do not close until after the due date of this report, thereby requiring the estimate.

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 March 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

The ITAC had two meetings in Austin and one conference call during this reporting period.

A half-day meeting was held following the Data Workshop on September 28, 2011. The purpose of the meeting was to discuss the upcoming NASA Discovery AQ project, procedures for possible future requests for proposals (RFPs), and the development of a State of the Science document to provide background information for establishing future research priorities. ITAC expenses incurred included lodging and travel to Austin for those ITAC members who did not have active research projects.

The ITAC met in Austin, Texas, on June 29, 2012, to complete their review and ranking of the proposals. ITAC expenses incurred include lodging and travel costs for members to travel to Austin, Texas, for the meeting. As the meeting was a full day meeting, a working lunch was provided to the meeting participants.

Table 3: 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	$16,714.53	$33,093.39	$22,312.76	$1,759.00	$9,021.63
Supplies		$1,039.95	$4,130.66	$5,170.61	$1,324.62		$3,845.99
Total Direct Costs		$17,418.81	$20,845.19	$38,264	$23,637.38	$1,759.00	$12,867.62
Authorized Indirect Costs							
10% of Salaries and Wages							
Total Costs		**$17,418.81**	**$20,845.19**	**$38,264**	**$23,637.38**	**$1,759.00**	**$12,867.62**

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

Project management activities from September through January focused on the completion of the research projects, the review and approvals of the final reports, and the reviews of any publications. From February through July, there were minimal project management activities other than for the State of the Science project. In August 2012, Project Managers were assigned to the FY 2012-2013 Research Projects and they began working with the PIs to begin the Work Plans.

A transfer of funds from the FY 11 Project Management account to the FY 11 Contractual account was approved and processed in February 2011 in order to fully fund the DFW Field Study Logistics project (FY 11). Once all expenses had posted for that project, there were enough funds remaining to return the full amount of the transferred funds to the Project Management account. During the grant period ending May 31, 2012, $345.75 of the FY 11 Contractual funds were returned to the FY 11 Project Management account. The remaining $21,690.25 was returned in June 2012.

Table 4: 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	$106,907.22	$252,244.92	$233,254.14		$18,990.78
Fringe Benefits		$28,967.49	$22,142.56	$51,110.05	$45,692.19		$5,417.86
Travel		$0	$0	$0	$0		$0
Supplies		$778.30	$260.00	$1,038.30	$911.98		$126.32
Total Direct Costs		$175,083.49	$129,309.78	$304,393.27	$279,858.31	$0.00	$24,534.96
Authorized Indirect Costs		$14,533.77	$10,690.22	$25,223.99	$23,325.41		$1,898.58
10% of Salaries and Wages							
Total Costs		**$189,617.26**	**$140,000.00**	**$329,617.26**	**$303,183.72**	**$0.00**	**$26,433.54**

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	$0		$106,700
Fringe Benefits		$11,230	$8,400	$19,630	$0		$19,630
Travel		$500	$0	$500	$0		$500
Supplies		$7,500	$6,000	$13,500	$0		$13,500
Total Direct Costs		$79,930	$60,400	$140,330	$0	$0	$140,330
Authorized Indirect Costs		$6,070	$4,600	$10,670	$0		$10,670
10% of Salaries and Wages							
Total Costs		**$86,000**	**$65,000**	**$151,000**	**$0**	**$0**	**$151,000**

Research Projects

Table 5 on the following 2 pages lists the 2010-2011 Research Projects, including the funding awarded to each project and the total expenses reported on each project as of August 31, 2012.

As of the end of August there was $18,346.09 of FY 2011 funding available in Research Projects. 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 decreased by $1,445,19 (the amount transferred to Project Management). This is an overall net increase of $382.74 to the Research/Contractual funds (and an equal net reduction in Project Management funds).

The remaining FY 2011 Research/Contractual funds will be awarded to one of the 2012-2013 Research Projects, and will be fully expended by March 2013.

A spreadsheet is not included in this report for FY 2012 and 2013 funds, as the projects have not yet been assigned to a particular fiscal year of funding (this happens later in the contracting process), and no expenditures have yet occurred. FY 2012 funds in the amount of $950,000 and FY 2013 funds in the amount of $835,000 are budgeted for Research Projects.

Table 5: 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

FY 11 Contractual Funding		**$1,736,063**		
FY 11 Contractual Funding Transfers		-$1,445.19		
FY 11 Total Contractual Funding		$1,734,617.81		
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
FY 11 Contractual Funds Expended to Date*			$1,716,271.72	
FY 11 Contractual Funds Remaining to be Spent				$18,346.09
Total Contractual Funding		$4,022,063.00		
Total Contractual Funding Transfers		$382.74		
Total Contractual Funding Available		$4,022,445.74		
Total Contractual Funds Expended to Date*			$4,004,099.65	
Total Contractual Funds Remaining				$18,346.09

*(Expenditures Reported as of August 31, 2012.)

Conclusion

The ITAC FY 2011 budget has $12,867.62 remaining. These funds will be utilized for the remaining ITAC expenses for the meeting held in June 2012. It is anticipated that some or all of the remaining funds may be moved to support research projects in the 2012-2013 biennium. The amount will be determined during the next quarter.

The Project Management FY 2011 budget has $26,433.54 remaining after all August expenses are posted. These funds will be used to cover Project Management expenses until the funds are fully expended. Use of these funds may allow the release of FY 12 Project Management funds to be used for Research projects. This will be assessed during the next quarter.

The Research/Contractual category has $18,346.09 remaining. These funds will be used to fund research projects in the FY 2012-13 biennium (though they will be fully expended by March 31, 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 AQRP when they concluded, thus the remaining balance. As these funds were committed to Research projects until the projects ended, the AQRP was unable to utilize the funds for any other purpose.

In summary, the remaining FY 2011 funds of $57,651.76 are expected to be fully expensed by March 31, 2013.

Each 2012-2013 Research Project will be funded from a specific fiscal year. The assignments will be made during the next quarter. 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 August 31, 2012.)

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
Equipment					
Other		$0			$0
Contractual					
Total Direct Costs		$194,297.78	$194,293.27	$0	$4.51
Authorized Indirect Costs		$16,310.22	$16,310.22		$0
10% of Salaries and Wages					
Total Costs		**$210,608**	**$210,603.49**	**$0**	**$4.51**

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		$16,714.53	$5,933.90	$1,759.00	$9,021.63
Supplies		$4,130.66	$284.67		$3,845.99
Equipment					
Other					
Total Direct Costs		$20,845.19	$6,218.57	$1,759.00	$12,867.62
Authorized Indirect Costs					
10% of Salaries and Wages					
Total Costs		**$20,845.19**	**$6,218.57**	**$1,759.00**	**$12,867.62**

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		$106,907.22	$87,916.44	$0	$18,990.78
Fringe Benefits		$22,142.56	$16,724.70	$0	$5,417.86
Travel		$0			$0
Supplies		$260.00	$133.68		$126.32
Equipment					
Other					
Total Direct Costs		$129,309.78	$104,774.82	$0	$24,534.96
Authorized Indirect Costs		$10,690.22	$8,719.64		$1,898.58
10% of Salaries and Wages					
Total Costs		**$140,000.00**	**$113,566.46**	**$0**	**$26,433.54**

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	$0.00	$0.00	$4.51
Equipment		$0	$0.00	$0.00	$0.00
Other		$0	$0.00	$0.00	$0.00
Contractual		$1,734,617.81	$1,716,271.72	$0.00	$18,346.09
ITAC		$20,845.19	$6,218.57	1,759.00	$12,867.62
Project Management		$140,000.00	$113,566.46	$0.00	$26,433.54
Total Direct Costs		$2,089,760.78	$2,030,350.02	$1,759.00	$57,651.76
Authorized Indirect Costs		$16,310.22	$16,310.22	$0.00	$0.00
10% of Salaries and Wages					
Total Costs		**$2,106,071.00**	**$2,046,660.24**	**$1,759.00**	**$57,651.76**

Appendix B

Financial Reports by Fiscal Year

FY 12 and 13

(Expenditures reported as of August 31, 2012.)

Administration Budget (includes Council Expenses)

FY 2012

Budget Category		FY12 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary		$80,440.00	$28,220.55	$0	$52,219.45
Fringe Benefits		$14,666.00	$6,182.19	$0	$8,483.81
Travel		$350.00	$0.00		$350.00
Supplies		$10,000.00	$275.10	$0	$9,724.90
Equipment		$0.00			$0.00
Other					
Contractual					
Total Direct Costs		$105,456.00	$34,677.84	$0	$70,778.16
Authorized Indirect Costs		$8,044.00	$2,822.05		$5,221.95
10% of Salaries and Wages					
Total Costs		**$113,500.00**	**$37,499.89**	**$0**	**$76,000.11**

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	$0.00		$10,000.00
Equipment					
Other		$0.00	$0.00		$0.00
Contractual					
Total Direct Costs		$92,996.00	$0.00	$0.00	$92,996.00
Authorized Indirect Costs		$7,004.00	$0.00		$7,004.00
10% of Salaries and Wages					
Total Costs		**$100,000.00**	**$0.00**	**$0.00**	**$100,000.00**

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			$60,700.00
Fringe Benefits		$11,230.00			$11,230.00
Travel		$500.00			$500.00
Supplies		$7,500.00			$7,500.00
Equipment					
Other					
Contractual					
Total Direct Costs		$79,930.00	$0.00	$0.00	$79,930.00
Authorized Indirect Costs		$6,070.00			$6,070.00
10% of Salaries and Wages					
Total Costs		**$86,000.00**	**0.00**	**$0.00**	**$86,000.00**

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	$28,220.55	$0.00	$52,219.45
Fringe Benefits		$14,666.00	$6,182.19	$0.00	$8,483.81
Travel		$350.00	$0.00	$0.00	$350.00
Supplies		$10,000.00	$275.10	$0.00	$9,724.90
Equipment		$0.00	$0.00	$0.00	$0.00
Other		$0.00	$0.00	$0.00	$0.00
Contractual		$950,000.00	$0.00	$0.00	$950,000.00
ITAC		$10,500.00	$0.00	$0.00	$10,500.00
Project Management		$86,000.00	$0.00	$0.00	$86,000.00
Total Direct Costs		$1,151,956.00	$34,677.84	$0.00	$1,117,278.16
Authorized Indirect Costs		$8,044.00	$2,822.05	$0.00	$5,221.95
10% of Salaries and Wages					
Total Costs		**$1,160,000.00**	**$37,499.89**	**$0.00**	**$1,122,500.11**

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	$0.00	$0.00	$10,000.00
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	$0.00	$0.00	$992,996.00
Authorized Indirect Costs		$7,004.00	$0.00	$0.00	$7,004.00
10% of Salaries and Wages					
Total Costs		**$1,000,000.00**	**$0.00**	**$0.00**	**$1,000,000.00**

Appendix C

Publications

(Listed by Project Number)

10-008

Constraining ozone-precursor responsiveness using ambient measurements
A. Digar, D.S. Cohan, X. Xiao, K.M. Foley, B. Koo, G. Yarwood
Submitted to Journal of Geophysical Research, May 2012

D.S. Cohan and A. Digar, Observation-constrained probabilistic evaluation of modeled concentrations and sensitivities.
To be presented at CMAS Annual Conference, October 2012.

10-009

The following papers have been accepted in a Special Issue of the journal Industrial & Engineering Chemistry Research dedicated to Industrial Flaring. The paper edition of this special edition will come out in Fall 2012, but the online versions are available now.

Emissions of Nitrogen Oxides from Flares Operating at Low Flow Conditions
Torres, Vince; Herndon, Scott; Wood, Ezra; Al-Fadhli, Fahad; Allen, David
Industrial & Engineering Chemistry Research
Status: Published Online March 21, 2012
DOI: 10.1021/ie300179x

Impacts Of Emission Variability and Flare Combustion Efficiency on Ozone Formation in the Houston-Galveston-Brazoria Area
Pavlovic, Radovan; Al-Fadhli, Fahad; Kimura, Yosuke; Allen, David; McDonald-Buller, Elena
Industrial & Engineering Chemistry Research
Status: Published Online

Comparison of remote sensing and extractive sampling measurements of flare combustion efficiency
Wormhoudt, Joda; Herndon, Scott; Franklin, Jonathan; Wood, Ezra; Knighton, W.; Evans, Scott; Laush, Curtis; Sloss, Mark; Spellicy, Robert
Status: Published Online

Direct measurement of volatile organic compound emissions from industrial flares using real-time on-line techniques: Proton Transfer Reaction Mass Spectrometry and Tunable Infrared Laser Differential Absorption Spectroscopy.
Knighton, W.; Herndon, Scott; Franklin, Jon; Wood, Ezra; Wormhoudt, Joda; Brooks, William; Fortner, Edward; Allen, David
Industrial & Engineering Chemistry Research
Status: Published Online March 22, 2012
DOI: 10.1021/ie202695v

Particulate Emissions Measured During the TCEQ Comprehensive Flare Emission Study
Fortner, Edward; Brooks, William; Onasch, Timothy; Canagaratna, Manjula; Massoli, Paola; Jayne, John; Franklin, Jon; Knighton, W.; Wormhoudt, Joda; Worsnop, Douglas; Kolb, Charles; Herndon, Scott
Industrial & Engineering Chemistry Research

Status: Published Online

Industrial flare performance at low flow conditions: Part 1. Study Overview
Torres, Vince; Herndon, Scott; Kodesh, Zach; Allen, David
Industrial & Engineering Chemistry Research
Status: Published Online February 27, 2012
DOI: 10.1021/ie202674t

Industrial flare performance at low flow conditions: Part 2. Steam- and Air-Assisted Flares
Torres, Vince; Herndon, Scott; Allen, David
Industrial & Engineering Chemistry Research
Status: Published Online February 27, 2012
DOI: 10.1021/ie202675f

Application of the carbon balance method to flare emissions characteristics
Herndon, Scott; Nelson, David; Wood, Ezra; Knighton, W.; Kolb, Charles; Kodesh, Zach; Torres, Vince; Allen, David
Industrial & Engineering Chemistry Research
Status: Published Online April 6, 2012
DOI: 10.1021/ie202676b

Impact of flare destruction efficiency and products of incomplete combustion on ozone formation in Houston, Texas
Al-Fadhli, Fahad; Kimura, Yosuke; McDonald-Buller, Elena; Allen, David
Industrial & Engineering Chemistry Research
Status: Published Online

Multivariate Image Analysis (MIA) for Industrial Flare Combustion Control
Castineira, David; Rawlings, Blake; Edgar, Thomas
Industrial & Engineering Chemistry Research
Status: Published Online

The following presentations were given at the Air & Waste Management Association June 2012 Conference, and papers have been published in the Conference Proceedings:

Overview of the Texas Commission on Environmental Quality 2010 Flare Study
Torres, Allen, Herndon, Kodesh

NOx Emissions from Industrial Flaring
Torres, Fahad M. Al-Fadhli, Allen, Herndon, Ezra Wood

10-015

The following papers are currently under development:

Measurements of Nitryl Chloride in Several Metropolitan Areas and Comparison with Regional Models

J.M. Roberts, H. Osthoff, E.J. Williams, B. Lerner, J.A. Neuman, J.B. Nowak, S.B. Brown, W.P. Dube, N.L. Wagner, T.B. Ryerson, I.B. Pollack, J.S. Holloway, A. Middlebrook, R. Bahreini, B. Koo, G. Yarwood
In preparation for Journal of Geophysical Research

Hydrochloric acid at the Pasadena ground site during CalNex 2010 and its role as a source of aerosol chloride
J.M. Roberts, P.R. Veres, A.K. Cochran, C. Warneke, J. de Gouw, R. Weber, R. Ellis, T. Vandenboer, J. Murphy, B. Koo, G. Yarwood
In preparation for Journal of Geophysical Research

10-020

The Effects of NOx Control and Plume Mixing on Nighttime Chemical Processing of Plumes from Coal-Fired Power Plants.
Steven S. Brown, William P. Dubé, Prakash Karamchandani, Greg Yarwood, Jeff Peischl, Thomas B. Ryerson, J. Andrew Neuman, John B. Nowak, John S. Holloway, Rebecca A. Washenfelder, Charles A. Brock, Gregory J. Frost, Michael, Trainer, David D. Parrish, Frederick C. Fehsenfeld and A. R. Ravishankara
Journal of Geophysical Researech, VOL. 117, D07304, doi:10.1029/2011JD016954, 2012

In preparation for Journal of Geophysical Research:
Biogenic VOC Oxidation and Organic Aerosol Formation within an Urban Nocturnal Boundary Layer – Aircraft Vertical Profiles in Houston, TX.
Steven S. Brown, William P. Dubé, Roya Bahreini, Ann M. Middlebrook, Charles A. Brock, Carsten Warneke, Joost A. de Gouw, Rebecca A. Washenfelder, Elliot Atlas, Jeff Peischl, Thomas B. Ryerson, J. Andrew Neuman, Jonathan B. Nowak, Michael Trainer, David D. Parrish, Frederick C. Feshenfeld and A. R. Ravishankara

In preparation for Atmosphere:
Reactive Plume Modeling to Investigate NOx Reactions and Transport at Night
Prakash Karamchandani, Shu-Yun Chen, Greg Yarwood, Steven S. Brown, David Parrish

In preparation for Atmosphere:
Modeling Overnight Power Plant Plume Impacts on Next-Day Ozone Using a Plume-in-Grid Technique
Greg Yarwood, Chris Emery, Steven S. Brown, David Parrish

10-021

The Project Investigators presented findings from this project at the Air & Waste Management Association June 2012 Conference. The title of the abstract is *Dry Deposition of Ozone to Built*

Environment Surfaces and the authors are Yosuke Kimura, Dustin Poppendeck, Erin Darling, Elena McDonald-Buller, and Richard Corsi

10-022

Kanwar Devesh Singh, Tanaji Dabade, Hitesh Vaid, Preeti Gangadharan, Daniel Chen, Helen H. Lou, Xianchang Li, Kuyen Li, Christopher B. Martin, "Computational Fluid Dynamics Modeling of Industrial Flares Operated in Stand-By Mode," Industrial Flares special issue, Industrial & Engineering Chemistry Research, DOI: 10.1021/ie300639f, Publication Date (Web): July 9, 2012.

Helen H. Lou, Daniel Chen, Peyton Richmond, Hitesh Vaid, Kanwar Devesh Singh, "A Run Time Combustion Zoning Technique towards the EDC Approach in Large-Scale CFD Simulations," International Journal of Numerical Methods for Heat and Fluid Flow, 2012.

Helen H. Lou, Daniel Chen, Christopher B. Martin, Xianchang Li, Kuyen Li, Hitesh Vaid, Kanwar Devesh Singh, Preeti Gangadharan, "Optimal Reduction of the C1-C3 Combustion Mechanism for the Simulation of Flaring, "Publication Date (Web): February 13, 2012, *Industrial & Engineering Chemistry Research*, Industrial flares special issue, DOI: 10.1021/ie2027684.

H. Lou, C. Martin, D. Chen, X. Li, K. Li, H. Vaid, A. Tula, K. Singh, "Validation of a Reduced Combustion Mechanism for Light Hydrocarbons," Clean Technologies and Environmental Policy, 14(1) 1-12, 2012. Published online Dec 27, 2011. DOI 10.1007/s10098-011-0441-6.
Helen H. Lou, Christopher B. Martin, Daniel Chen, Xianchang Li, Kyuen Li, Hitesh Vaid, Anjan Tula Kumar, Kanwar Devesh Singh, & Doyle P. Bean, "A reduced reaction mechanism for the simulation in ethylene flare combustion," Clean Technologies and Environmental Policy, published on line, June 14, 2011. doi:10.1007/s10098-011-0394-9

10-032

The following article is currently undergoing review in Atmospheric Environment:
Atmospheric Oxidation Chemistry and Ozone Production: Results from SHARP 2009 in Houston, Texas
Xinrong Ren, Diana van Duin, Maria Cazorla, Shuang Chen, Jingqiu Mao, William H. Brune, James H. Flynn, Nicole Grossberg, Barry L. Lefer, Bernhard Rappenglück, Kam W. Wong, Catalina Tsai, Jochen Stutz, Jack E. Dibb, B. Thomas Jobson, Winston T. Luke, and Paul Kelley

10-042

The following articles are in progress:

In preparation for Atmospheric Environment: *Development of version 6 of the carbon bond (CB6) chemical mechanism*
Greg Yarwood, Gookyoung Heo, Elena C. McDonald-Buller, David T. Allen, Gary Z. Whitten

In preparation for Atmospheric Environment: *Environmental chamber experiments to evaluate NOx removal and recycling represented in atmospheric mechanisms for air quality modeling*
Gookyoung Heo, William Carter, Greg Yarwood, Gary Z. Whitten, David T. Allen

In preparation for Atmospheric Environment: *Evaluation of mechanisms for modeling ozone formation from isoprene in SAPRC-07 and CB6 using environmental chamber data with low initial NOx*
Gookyoung Heo, William Carter, Greg Yarwood

In preparation for Atmospheric Environment: *Evaluation of CB05, CB6 and SAPRC-07 using EUPHORE chamber data: evaluation of mechanisms for modeling ozone formation from toluene*
Gookyoung Heo, William Carter, Greg Yarwood, Gary Z. Whitten

10-045

The following papers have been published in Industrial & Engineering Chemistry Research in a Special Issue on Industrial Flaring. The paper edition of this special edition will come out in Fall 2012, but the online versions are available now.

Knighton, W.; Herndon, Scott; Wood, Ezra; Fortner, Edward; Onasch, Timothy; Wormhoudt, Joda; Kolb, Charles; Lee, Ben; Zavala, Miguel; Molina, Luisa; Jones, Marvin, "*Detecting fugitive emissions of 1,3-butadiene and styrene from a petrochemical facility: An application of a mobile laboratory and a modified proton transfer reaction mass spectrometer - NO+ PTR-MS"*
Status: Published Online

Wood, E.; Herndon, S.; Fortner, E. C.; Onasch, T.; Wormhoudt, J.; Kolb, C. E.; Knighton, W. B.; Lee, B.; Zavala, M.; Molina, L.; Jones, M., "*Combustion and Destruction/Removal efficiencies of in-use chemical flares in the greater Houston area*".
Status: Published Online

This project has also resulted in the following publications:

Olga Pikelnaya, Catalina Tsai, Barry Lefer, James H. Flynn, Dejian Fu, and Jochen Stutz,"*Imaging DOAS: a tool for monitoring of emission fluxes from small individual sources*", in preparation for Journal of Geophysical Research

Olga Pikelnaya, Jochen Stutz, Scott Herdon, Ezra Wood, Oluwayemisi Oluwole, George Mount, Elena Spinei, William Vizuette, Evan Causo, "*Formaldehyde and Olefin from Large Industrial Sources (FLAIR) in Houston, TX – Campaign Overview*", in preparation for Journal of Geophysical Research

Olga Pikelnaya, George Mount, Elena Spinei, and Jochen Stutz, "*Dual MAX-DOAS approach to determine facility-averaged emissions of pollutants from petrochemical facilities*", under development.

Olga Pikelnaya, Scott Herrdon, Ezra Wood, and Jochen Stutz, "*Observations of emissions from ships in the Houston Ship Channel during 2009 FLAIR campaign*," under development.