

AQRP Monthly Technical Report

PROJECT TITLE	Spatial and temporal resolution of primary and secondary particulate matter in Houston during DISCOVER-AQ	PROJECT #	14-029
PROJECT PARTICIPANTS	Rebecca J. Sheesley Sascha Usenko	DATE SUBMITTED	2/8/2015
REPORTING PERIOD	From: January 1, 2014 To: January 31, 2014	REPORT #	6

A Financial Status Report (FSR) and Invoice will be submitted separately from each of the Project Participants reflecting charges for this Reporting Period. I understand that the FSR and Invoice are due to the AQRP by the 15th of the month following the reporting period shown above.

Detailed Accomplishments by Task

The focus of January 2015 was to work on the remainder of the quartz fiber filter plans including inorganic ions, ¹⁴C measurements, organic contaminants and molecular markers. A filter plan is a systematic strategy that specifies the amount or area of filter to be used for each type of analysis. It is imperative that each set of analyses has a fully vetted filter plan. This will ensure that no analysis goes forward at the detriment of another. Deciding factors in filter area apportionment include: bulk carbon analysis, sampled air volume, analytical detection limits and co-located measurements. Co-located measurements can include TCEQ/EPA monitoring network results such as PM_{2.5}, inorganic ions and organic and elemental carbon.

A filter plan for the analysis of inorganic ions of quartz fiber filters was finalized. We established filter aliquots for Moody Tower to be shipped to the Desert Research Institute (DRI) for inorganic analysis. Filter aliquots should be shipped overnight to DRI for inorganic analysis during the second week of February. DRI was previously identified in the project's work plan for inorganic ion analysis. DRI is an accredited laboratory for the analysis of inorganic ions and has been approved by TCEQ. We have selected 26 samples (plus 4 blanks; in accordance with QAQC described in the project QAPP). A quote was requested and has been received from DRI for the analysis of inorganic ions on 30 samples (see Appendix 1: DRI Inorganic Ion quote). The total cost for inorganic ion analysis of Moody Tower quartz fiber filter was \$4750 or ~\$158 per sample. DRI gave an estimated turn-around time of ten days as of Feb 4, 2015. DRI is also performing the analysis of inorganic ions on quartz fiber filter aliquots from Conroe as part of 14-024. Note: Baylor graduate students associated with this project prepared the filter plan, cut and shipped filters to DRI in December of 2014. The inorganic ion analysis for Manvel Croix was performed using the particle into liquid sampler (PILS, 14-009). Both 14-009 and 14-024 have expressed interest in the Moody Tower inorganic ion dataset. Inorganic ion concentrations for September 2013 for Moody Tower are a deliverable for this project. All efforts enable fulfillment of that deliverable.

Elemental tracer (i.e. metal) daily concentrations will be measured on PM_{2.5} Teflon filters collected at Moody Tower. No filter plan was needed as the entire Teflon filter is consumed in the analysis. Elemental tracer daily concentrations are to be measured on 25 Teflon filter samples (plus 3 Teflon filter blanks for

QAQC). DRI has been selected by the project PIs for metals analysis utilizing X-ray fluorescence. DRI is an accredited laboratory for the analysis of metals by X-ray fluorescence and has been approved by TCEQ for this specific analysis. A quote for metal analysis utilizing X-ray fluorescence was requested in January and received in early February (Appendix 2: DRI Metal Analysis quote). Discussion of the selection of DRI for metal analysis will also be included in the February monthly report. The total cost for metal analysis of Moody Tower Teflon filters was \$2342 or ~\$84 per sample. DRI gave an estimated turn-around time of ten days as of Feb 4, 2015. Teflon filters should be shipped overnight to DRI for metal analysis during the second week of February. A rough figure of “~53” elements was included in the project’s Scope of Work, this has been finalized to 51 elements based on X-ray fluorescence reporting from DRI and direct communication.

Baylor PIs (principal investigators) and students have been in close communication with DRI (specifically, Steven Kohl) in the past month to insure that the Conroe inorganic ion analysis (for contract 14-024), Moody Tower inorganic ion analysis (14-029) and Moody Tower metals analysis (14-029) will be completed on time and within budget.

In addition, significant progress was made in the analysis of organic tracers, specifically levoglucosan. Levoglucosan is a molecular marker for the incomplete combustion of biomass. Specific tasks performed in January for the analysis of levoglucosan included the 1) installation of a levoglucosan analytical column, 2) preparation of a new levoglucosan standard, which was comparison to previous standards as per QAQC, 3) preparation of a five point calibration curve (compliance with the project’s QAQC), 4) validation of the silylation derivatization procedure for gas chromatography mass spectrometry analysis, and 5) spike and recover experiments for the entire analytical procedure. All these efforts fulfill QAQC protocol specified with the 14-029 QAPP and are a necessary component of the source apportionment deliverable for 14-029. Results from the levoglucosan analysis will be used to finalize the radiocarbon filter plan in the second week of February, as levoglucosan can be used as a preliminary estimate of biomass burning contribution to organic carbon in PM_{2.5}.

A significant portion of the budget is dedicated to the analysis of organic tracers. This analysis enables the source apportionment modeling for PM_{2.5}, which is a deliverable for this project. As filter plans are being finalized, graduate students worked in January on developing a detailed list of the necessary consumables including standards associated with this analysis. Purchase of these consumables is underway and will allow for the continuous analysis of filter samples. PAH standards were purchased in January and will be developed into verified calibration solutions, as per the QAPP, during February.

After submitting the December 2014 monthly technical report, we requested ambient concentration data from TCEQ for organic and elemental carbon and black carbon in Houston during September 2013. We received organic carbon and elemental carbon datasets for Deer Park and Aldine monitoring sites in Houston. Baylor PIs and graduate students have started preliminary data analysis of combined Moody Tower, Manvel Croix, Conroe, La Porte, Deer Park and Aldine datasets for organic, elemental and black carbon.

Preliminary data:

Preliminary ambient data has already been reported (see preceding monthly reports). QAQC efforts will be included in final reports.

Identify Problems or Issues Encountered and Proposed Solutions or Adjustments

In January, Drs. Sheesley and Usenko participated in an AQRP conference call. This conference call also included all of the AQRP DISCOVER-AQ investigators. This conference call was initiated by Shantha Daniel (TCEQ) to catch up with the progress of the projects. During this conference call we discussed the use of Wisconsin State Laboratory of Hygiene as the projects contract laboratory for metals analysis. This query was instigated by a formal request by the project's PIs on 1/21/15, requesting the use of Wisconsin State Laboratory of Hygiene. During this conference call it was highlighted that Wisconsin State Laboratory of Hygiene was not a TCEQ accepted laboratory. As a result of the conference call and subsequent email discussion, the project PIs went back and reviewed the Scope of Work and determined that DRI was the best choice for metals analysis. This was based reviewing: (1) the contracted Scope of Work, (2) timeline for completing deliverables and (3) a consideration of intercomparison with previous TCEQ datasets. This decision was formally submitted to AQRP and TCEQ on 2/4/15 and will also be discussed in the February monthly report.

During preparation of filter plans and quote requests for inorganic ion analysis during January 2015, we identified that an additional \$2000 in contract funds for the inorganic ion analysis was needed to improve data coverage. We contacted AQRP with a request for budget transfer from publication to contract analysis to cover this need.

Goals and Anticipated Issues for the Succeeding Reporting Period

Baylor PI, Dr. Sheesley is on a research sabbatical for Jan-May, 2015. In addition, Baylor PI, Dr. Usenko, has a reduction in teaching for the same period. This facilitates accomplishment of February goals and a successful completion of the project by June 30, 2015.

The major goals for February include:

1. Finalization of the remaining filter plans.
 - a. We anticipate no issues and PIs should complete this task in February.
2. Submit aliquots of quartz fiber filters to DRI for inorganic ion analysis (from Moody Tower).
 - a. We anticipate no issues and are anticipating having results within ten days of DRI receiving the samples. Project PIs have previously worked with this contract laboratory.
3. Submit entire Teflon filters to DRI for metals analysis using X-ray fluorescence (from Moody Tower).
 - a. We anticipate no issues and are anticipating having results within ten days of DRI receiving the samples. Project PIs have previously worked with this contract laboratory.
4. Submit aliquots of quartz fiber filters to NOSAMS for ^{14}C measurements.
 - a. We anticipate no issues. Project PIs have previously worked with this contract laboratory. Analysis time of roughly six-eight weeks is anticipated.

- b. Filter plans are for daily plus select high time resolution filter samples from Moody Tower, Manvel Croix, La Porte and Conroe for 9/21-9/28. This is in fulfillment of the projects radiocarbon source apportionment deliverable.
5. Continue to analyze aliquots of quartz fiber filters designated for organic tracers analysis.
 - a. We anticipate no issues and should make significant progress in completing this task.
6. Receive positive matrix factorization results from 14-024.
 - a. We anticipate no issues and should complete this task in February. PIs have a good working relationship with PIs from (14-024).
7. Requested organic carbon and elemental carbon datasets for Houston during September 2013 from TCEQ.
 - a. We have been in communication with Jim Price and anticipate no delays in receiving data. PIs have already received data for Deer Park and Aldine.
 - i. Clinton Drive: (waiting on DRI for organic carbon and elemental carbon) daily measurements for the duration of the project.
 - ii. Galveston: (waiting on DRI for organic carbon and elemental carbon) daily measurements for the duration of the project.
 - iii. Deer Park: black carbon and continuous organic carbon and elemental carbon for the duration of the project
 - iv. Aldine: organic carbon and elemental carbon every 6th day for the duration of the project

Detailed Analysis of the Progress of the Task Order to Date

List of project deliverables highlighted in the project work plan were subdivided into ten different, but connected, deliverables/tasks.

1. Daily organic carbon and elemental carbon measurements reported previously from PM samples collected at Moody Tower and Manvel Croix will be combined with daily measurements from Conroe and La Porte. **Completed**
 - a. Preliminary data has been shared with AQRP DISCOVER-AQ investigators.
 - b. QAQC deliverables
 - i. Duplicate analysis on 1 and 10
 - ii. Field, Lab, Instrument, Filter blanks
 - iii. Sugar spikes
 - iv. Method detection limits determined
 - v. Matrix spikes
 - vi. Field samples completed
 - c. Comparison of the trends for 9/21-9/28 with the DISCOVER-AQ NASA's Jim Crawford (December 2014: at the American Geophysical Union conference).
 - i. Poster titled "Spatial trends in surface-based carbonaceous aerosol, including organic, water-soluble and elemental carbon, during DISCOVER-AQ in Houston, TX"

2. Measure daily WSOC from PM samples collected from Moody Tower, Manvel Croix, and Conroe will be combined with the EPA WSOC La Porte dataset. **Completed**
 - a. Preliminary data has been shared with AQRP DISCOVER-AQ investigators
 - b. QAQC deliverables
 - i. Triplicate sample injections
 - ii. Duplicate analysis on 1 and 10
 - iii. Field, Lab, Instrument, Filter blanks
 - iv. Sugar spikes
 - v. Method detection limits determined
 - vi. Calibration curves developed (10 pt)
 - vii. Matrix spikes
 - viii. Field samples completed
 - c. Comparison of data and trends with the Environmental Protection Agency (December 2014: at the American Geophysical Union conference)
 - i. Poster titled “Spatial trends in surface-based carbonaceous aerosol, including organic, water-soluble and elemental carbon, during DISCOVER-AQ in Houston, TX”
3. Measure inorganic ions (SO₄, Cl, NO₃, NH₄ and K) concentrations at Moody Tower. Moody Tower dataset will be combined and compared with the particle-into-liquid sampler dataset collected from Manvel Croix (14-009) and inorganic ion dataset from Conroe PM filters samples (14-024).
 - a. Pulled AQS datasets and received particle-into-liquid sampler dataset (14-009)
 - i. Used to estimate inorganic concentrations
 - ii. Performed by PIs
 - b. Developed a filter plan for Conroe
 - i. Submitted filters from analysis by DRI (Dec 2014)
 - ii. To be charged to (14-024) as part of their deliverables
 - iii. Performed by Baylor PIs and graduate students
 - c. Developed a filter plan for Moody Tower
 - i. Submit second week of February to DRI
 1. Quote received: estimated cost \$4750 (ten day turn-around)
 - ii. Submit invoice by end of February or early March
 - iii. Data distribution by end of March
 - iv. Performed by graduate students under supervision of PIs
4. Daily concentrations of ~51 elemental tracers will be reported for Teflon PM Filters collected at Moody Tower.
 - a. DRI has been selected as an accredited TCEQ approved laboratory
 - b. Baylor will submit samples to DRI for analysis by X-ray fluorescence
 - i. No filter plan needed
 - ii. Submit second week of February to DRI
 1. Quote received: estimated cost \$2342 (ten day turn-around)
 - iii. Submit invoice by end of February or early March

5. A detailed characterization of relative high organic carbon (relative to elemental carbon) and ozone days (9/21-9/28) will be provided using organic tracers.
 - a. Filter plan to be complete in early February
 - i. Performed by PIs
 - ii. Determined the organic carbon-to-tracer ratio using method validation samples from Moody Tower and Manvel Croix (used to develop filter plan for organic tracer analysis)
 1. Performed by graduate students under the supervision of PIs
 2. Day vs Night
 3. Weekday vs Weekend
 - b. QAQC deliverables
 - i. Standard Reference Materials Analyzed
 - ii. Method detection limits determined
 - iii. Calibration curves developed
 - iv. Matrix spikes
 - v. Field Samples in progress
 - vi. Performed by graduate students under the supervision of PIs
 - c. Ozone data from TCEQ sites has been pulled
 - i. Performed by PIs
6. ^{14}C measurements for 4-24 hour filter samples.
 - a. Filter plan complete in early February
 - b. Batch (9/21-9/28) to be submitted second week February to National Ocean Sciences Accelerator Mass Spectrometry Facility (NOSAMS)
 - i. Timeline: 6-9 weeks
 - ii. Submit invoice by end of April
 - iii. Data distribution by beginning of May
7. The organic tracers will be used to apportion the primary organic aerosol at each site by molecular marker chemical mass balance modeling (MM-CMB) using known profiles.
 - a. Method validated by each student performing the analysis
 - i. Method presented at the December American Geophysical Union conference.
 1. Poster titled "A Pressurized Liquid Extraction Technique for the Analysis of Pesticides, PCBs, PBDEs, OPEs, PAHs, Alkanes, Hopanes, and Steranes from Atmospheric Particulate Matter".
 2. Manuscript was subsequently submitted for publication to the *Chemosphere*. The manuscript titled "Pressurized Liquid Extraction Technique for the Analysis of Pesticides, PCBs, PBDEs, OPEs, PAHs, Alkanes, Hopanes, and Steranes in Atmospheric Particulate Matter".
 - b. Development and purchase of consumable lists
 - c. Optimize chemical mass balance model for source apportionment
 - i. Preliminary chemical mass balance modeling will be based off of organic tracer data from manuscript in deliverable 7.a.i.2
 - ii. Performed by PIs

8. Fossil combustion-derived primary organic aerosol constrained by radiocarbon analysis
 - a. Timeline: Obtain the positive matrix factorization results from 14-024 in February
 - b. Timeline: Combine positive matrix factorization with preliminary chemical mass balance modeled results to select contemporary end members in March
 - i. Performed by PIs
 - c. ^{14}C source apportionment utilizes end members for contemporary and fossil carbon. The fossil end member is known: -1000‰. The contemporary end member is dependent on contemporary changes in ^{14}C based off of the nuclear bomb spike. Therefore wood and leaves/grass have different ^{14}C , with wood having higher ^{14}C (+108‰) and annual biogenic C having lower ^{14}C (+28‰). Emissions inventories and preliminary source apportionment can help define the local biogenic vs wood smoke split to enable an appropriate contemporary end member choice (see Gustafsson et al, 2009). For Houston, preliminary chemical mass balance and positive matrix factorization results will be used to define biogenic vs wood smoke split in March 2015, prior to receipt of the ^{14}C analysis.
 - i. Performed by PIs
9. Quantify changes in emission contributions for diesel- and gasoline-powered motor vehicles and biomass burning in the Houston metropolitan area since the 1997-98. Utilize chemical mass balance modeling to examine the efficacy of regulatory efforts and fleet modernization.
 - a. Timeline: May through June
 - b. Performed by PIs
10. Complement on-going PM characterization efforts at TCEQ monitoring sites by increasing the spatial extent and specificity of carbon apportionment.
 - a. Baylor analysis for organic carbon and elemental carbon and black carbon. **Completed**
 - i. Performed by graduate students under the supervision of PIs.
 - b. Received organic carbon and elemental carbon data from Jim Price (TCEQ)
 - i. Deer Park: black carbon and continuous organic carbon and elemental carbon for the duration of the project
 - ii. Clinton Drive: (waiting on DRI for organic carbon and elemental carbon) daily measurements for the duration of the project
 - iii. Galveston: (waiting on DRI for organic carbon and elemental carbon) daily measurements for the duration of the project
 - iv. Aldine: OCEC every 6th day for the duration of the project
 - c. Intercomparison with Baylor's organic carbon and elemental carbon
 - i. Timeline: Feb-April 2015
 - ii. Performed by graduate students under the supervision of PIs

APPENDIX 1

Desert Research Institute
Quote for Environmental Analysis Facility Services

Date: 2/4/15**DRI Quote #:** Baylor Univ. Samples**Client Name:** Baylor University**Total Cost:** \$4,750**Billing Address:****For Filters Received By:** 6/30/15**Baylor University**

One Bear Place #97266
Waco, TX 76798-7266

THIS QUOTE IS VALID THROUGH 9/30/15**Fiscal Year when *Lab Analysis is expected to be completed:*** FY15-16**Type of Contract:** (Firm Fixed Price – Indefinite Quantity)**Contact Person:** Stephanie Ortiz
Telephone: 1 254-710-3158**Prepared by:** Charles Whitaker
Telephone: 216 862-8772**e-mail:** Stephanie_Ortiz1@baylor.edu**e-mail:** charlesw@dri.edu**Terms & Conditions**

1. **Statement of Work.** Desert Research Institute (DRI) will provide the services indicated in this quote. Unexposed filters supplied to Client by DRI will be as described in this quote. DRI will prepare and ship the required number of unexposed filters to Client. Client is responsible for the cost of all unexposed filters shipped to Client, regardless of whether or not they are exposed and returned to DRI for analysis. Client is responsible for costs of shipping exposed filters to DRI for analysis in accordance with shipping instructions specified by DRI. If Client desires return of analyzed filters, Client will be responsible for costs of filter return (FOB Shipping Point). If Client does not request return of analyzed filters within ninety (90) days of termination of this order, the analyzed filters will become property of DRI.
2. **Reports:** Data will be delivered in a mutually agreed upon format.
3. **Payments:** DRI will invoice Client upon delivery of report(s). Client will pay invoices in U.S. dollars within thirty (30) days of receipt in accordance with invoice instructions. Bank charges for processing payments by credit card or wire transfer are not included in this quote and will be billed to Client as an additional cost.
4. **Disclaimer of Warranty.** Client acknowledges that DRI is an academic research institution and, as such, may utilize analytical methods that have not been accepted by standard setting organizations or certified by governmental agencies. DRI will, however, employ appropriate chain of custody and quality assurance/quality control procedures to ensure high quality results. RESULTS, REPORTS, DATA, AND DELIVERABLES ARE PROVIDED TO THE CLIENT AS IS, WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A

Appendix 1

PARTICULAR PURPOSE. DRI SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, CONSEQUENTIAL, SPECIAL, OR OTHER DAMAGES SUFFERED BY CLIENT AS A RESULT OF CLIENT'S USE OF PROJECT RESULTS, REPORTS, DATA, OR DELIVERABLES.

5. Title to Equipment, Supplies, and Materials: DRI shall retain title to any equipment, supplies, and materials purchased for use under this order.
6. Damage/Destruction/Theft of Equipment: If Client rents sampling equipment from DRI, Client assumes full financial responsibility for damage, destruction, or theft of DRI's equipment while it is deployed. Client will be billed for repair costs or, in the case of theft or destruction of the equipment, for the replacement cost of the equipment. Upon request, Client shall provide proof of insurance, with DRI named as an additional insured.
7. Client's Proprietary Information: Should it be necessary for DRI to receive Client's Proprietary Information, Client agrees to state in writing at the time of delivery that such information is proprietary, or if given orally, reduce it to writing, clearly marking it as "Proprietary," within ten (10) days of the oral disclosure. DRI agrees to safeguard Client's Proprietary Information to the same extent that it safeguards its own.
8. Rights in Data. Results, reports, data, and other deliverables developed under this order are the property of Client. Client grants to DRI the right to use these materials for research and educational purposes subject to the provisions of Paragraph 7. Upon Client's written request, DRI will give Client thirty (30) days to review draft manuscripts for publication in academic journals or presentation at

DRI Inorganic Ion quote

academic conferences to ensure non-disclosure of Client's Proprietary Information.

9. Intellectual Property: Title to any invention or discovery made during the fulfillment of this order shall vest with DRI with Client having the first right to obtain a license under reasonable terms and conditions.
10. Publicity: Neither party will use the name of the other party in any publicity, advertising, or news release without the prior written consent of the other. Client will not state or imply that DRI has tested or approved any product or process or drawn any conclusions about the data provided.
11. Independent Contractor: For the purposes of this Subcontract, the parties are independent contractors and neither is an employee of the other.
12. Termination: This order for services may be terminated in whole or in part by either party upon thirty (30) days written notice in the event of substantial failure by the other party to fulfill its obligations under this order through no fault of the terminating party.
13. General: This instrument contains the entire agreement between the parties with respect to the subject matter hereof. If Client issues a purchase order to initiate the work, the terms of this agreement supersede the terms of the purchase order. Modifications to the terms of this agreement are not valid unless made in writing and signed by authorized representatives of the parties. This agreement is governed according to the laws of the State of Nevada.
14. Validity of Quote: This quote will be good for 90 days from the date this quote was prepared unless extended by mutual agreement.

Client will pay freight to ship exposed filters to DRI for analysis.

Signatures below represent Client's acceptance of this Quote and the Terms & Conditions included herein and Client's authorization for DRI to begin work.

For CLIENT:

_____(Signature)
 (Date)

 (Typed Name and Title)

Client P.O. Number: _____

**For the Board of Regents of the Nevada System of Higher Education on behalf of the
 DESERT RESEARCH INSTITUTE:**

_____(Signature)
 (Date)

Director of Sponsored Projects

Baylor University			
Funding Source: State Government			
Baylor University Samples			
Environmental Analysis Facility Quote			
2/4/2015			
Description	Unit Cost	Qty	Amount
Laboratory Charges			
Receive Filters	\$ 2.67	30	\$ 80
ANALYSIS			
IONS - Anions (Cl ⁻ , NO ₃ ⁻ , SO ₄ ²⁻)	\$ 71.78	30	\$ 2,153
IONS -Cations (K ⁺ , Na ⁺ , NH ₄ ⁺)	\$ 71.78	30	\$ 2,153
Data Validation/Reporting	\$ 12.11	30	\$ 363
Total Costs			\$ 4,750

APPENDIX 2

Desert Research Institute Quote for Environmental Analysis Facility Services

Date: 2/2/15

DRI Quote #: Baylor Univ. 2-2-15

Client Name: Baylor University

Total Cost: \$2,342

Billing Address:

For Filters Received By: 6/30/15

Baylor UniversityOne Bear Place #97266
Waco, TX 76798-7266**THIS QUOTE IS VALID THROUGH 9/30/15**Fiscal Year when *Lab Analysis is expected to be completed*: FY15-16

Type of Contract: (Firm Fixed Price – Indefinite Quantity)

Contact Person: Rebecca J. Sheesley, PhD
Telephone: 1 254-710-3158Prepared by: Charles Whitaker
Telephone: 216 862-8772

e-mail: Rebecca_Sheesley@baylor.edu

e-mail: charlesw@dri.edu

Terms & Conditions

1. Statement of Work. Desert Research Institute (DRI) will provide the services indicated in this quote. Unexposed filters supplied to Client by DRI will be as described in this quote. DRI will prepare and ship the required number of unexposed filters to Client. Client is responsible for the cost of all unexposed filters shipped to Client, regardless of whether or not they are exposed and returned to DRI for analysis. Client is responsible for costs of shipping exposed filters to DRI for analysis in accordance with shipping instructions specified by DRI. If Client desires return of analyzed filters, Client will be responsible for costs of filter return (FOB Shipping Point). If Client does not request return of analyzed filters within ninety (90) days of termination of this order, the analyzed filters will become property of DRI.
2. Reports: Data will be delivered in a mutually agreed upon format.
3. Payments: DRI will invoice Client upon delivery of report(s). Client will pay invoices in U.S. dollars within thirty (30) days of receipt in accordance with invoice instructions. Bank charges for processing payments by credit card or wire transfer are not included in this quote and will be billed to Client as an additional cost.
4. Disclaimer of Warranty. Client acknowledges that DRI is an academic research institution and, as such, may utilize analytical methods that have not been accepted by standard setting organizations or certified by governmental agencies. DRI will, however, employ appropriate chain of custody and quality assurance/quality control procedures to ensure high quality results. RESULTS, REPORTS, DATA, AND DELIVERABLES ARE PROVIDED TO THE CLIENT AS IS, WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. DRI SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, CONSEQUENTIAL, SPECIAL, OR OTHER DAMAGES SUFFERED BY CLIENT AS A RESULT OF CLIENT'S USE OF PROJECT

Appendix 2

RESULTS, REPORTS, DATA, OR DELIVERABLES.

5. Title to Equipment, Supplies, and Materials: DRI shall retain title to any equipment, supplies, and materials purchased for use under this order.
6. Damage/Destruction/Theft of Equipment: If Client rents sampling equipment from DRI, Client assumes full financial responsibility for damage, destruction, or theft of DRI's equipment while it is deployed. Client will be billed for repair costs or, in the case of theft or destruction of the equipment, for the replacement cost of the equipment. Upon request, Client shall provide proof of insurance, with DRI named as an additional insured.
7. Client's Proprietary Information: Should it be necessary for DRI to receive Client's Proprietary Information, Client agrees to state in writing at the time of delivery that such information is proprietary, or if given orally, reduce it to writing, clearly marking it as "Proprietary," within ten (10) days of the oral disclosure. DRI agrees to safeguard Client's Proprietary Information to the same extent that it safeguards its own.
8. Rights in Data. Results, reports, data, and other deliverables developed under this order are the property of Client. Client grants to DRI the right to use these materials for research and educational purposes subject to the provisions of Paragraph 7. Upon Client's written request, DRI will give Client thirty (30) days to review draft manuscripts for publication in academic journals or presentation at academic conferences to ensure non-disclosure of Client's Proprietary Information.

DRI Inorganic Ion quote

9. Intellectual Property: Title to any invention or discovery made during the fulfillment of this order shall vest with DRI with Client having the first right to obtain a license under reasonable terms and conditions.
10. Publicity: Neither party will use the name of the other party in any publicity, advertising, or news release without the prior written consent of the other. Client will not state or imply that DRI has tested or approved any product or process or drawn any conclusions about the data provided.
11. Independent Contractor: For the purposes of this Subcontract, the parties are independent contractors and neither is an employee of the other.
12. Termination: This order for services may be terminated in whole or in part by either party upon thirty (30) days written notice in the event of substantial failure by the other party to fulfill its obligations under this order through no fault of the terminating party.
13. General: This instrument contains the entire agreement between the parties with respect to the subject matter hereof. If Client issues a purchase order to initiate the work, the terms of this agreement supersede the terms of the purchase order. Modifications to the terms of this agreement are not valid unless made in writing and signed by authorized representatives of the parties. This agreement is governed according to the laws of the State of Nevada.
14. Validity of Quote: This quote will be good for 90 days from the date this quote was prepared unless extended by mutual agreement.

Client will pay freight to ship exposed filters to DRI for analysis.

Signatures below represent Client's acceptance of this Quote and the Terms & Conditions included herein and Client's authorization for DRI to begin work.

For CLIENT:

 (Date) _____ (Signature)

 (Typed Name and Title)

Client P.O. Number: _____

**For the Board of Regents of the Nevada System of Higher Education on behalf of the
 DESERT RESEARCH INSTITUTE:**

 (Date) _____ (Signature)

Director of Sponsored Projects

Desert Research Institute - DAS			
Blyor University			
Department of Environmental Science			
Funding Source: Texas Commission of Env. Quality			
Laboratory Quote			
2-Feb-15			
	Fully Loaded		
Description	Rates	Qty	Amount
Receive Samples - Slides	\$ 2.67	28	\$ 75
Sampler Analysis - XRF	\$ 68.85	28	\$ 1,928
Data Validation & Reporting	\$ 12.11	28	\$ 339
Total Costs			\$ 2,342
Cost to Ship Samples to DRI is paid by Client			