Narrative Proposal

Summary Information Page

a. Project Title: Near-Source Characterization of High Risk Formaldehyde, Precursors and other HAPs posing significant risk in Houston to Inform Evaluation of Emission Reduction Measures

b. Applicant: Houston Health Department, Bureau of Pollution Control and Prevention
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c. Funding Requested. HHD is requesting $422,160 from EPA

d. Total Project Cost: $494,529. HHD will provide $72,369 in cost share.

e. Project period. September 2017 to March 2019

f. DUNS number - 1945865170000

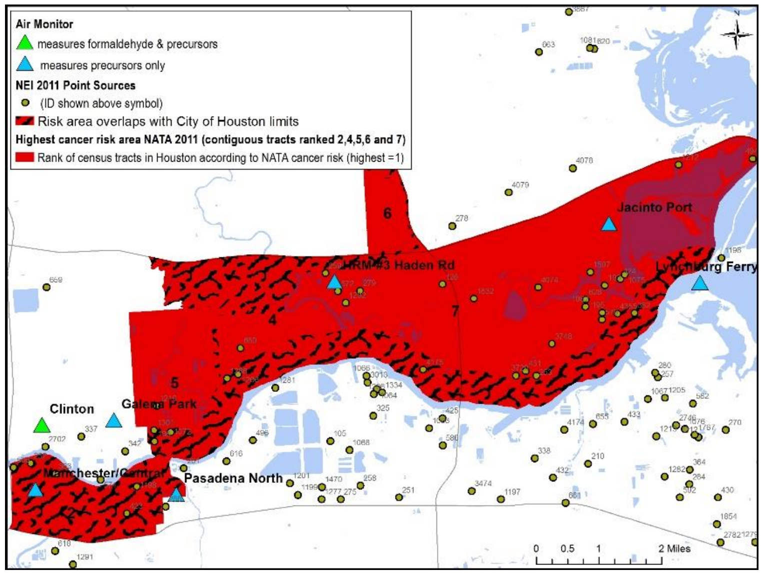
Narrative Proposal Work-Plan

1. Basis and Rationale (15 points):

This Houston Health Department Environmental Health Division (HHD EHD) project addresses category 1) community-scale monitoring, to “characterize near-source concentrations” from industry sectors and “obtain information regarding substantially elevated ambient concentrations of toxics” providing information to “assist regulators in their efforts to assess the impact of emission reduction measures.”

This project aims to: a) *identify and profile air toxic sources posing* the highest population risk in Houston, Texas census tracts according to NATA (2011) and b) *evaluate the impact of emission reduction measures*. In the high risk census tracts, identified by NATA in Houston, formaldehyde is the largest risk driver followed by acetaldehyde, benzene and 1, 3 butadiene. Therefore, the project focus is on point sources emitting formaldehyde (or its precursors of secondary formation) while also tracking the other significant contributors (acetaldehyde, benzene and 1, 3 butadiene). Note, ambient air concentrations of formaldehyde as well as benzene and 1,3 butadiene were also previously identified as posing a “definite health risk” to Houstonians by the Mayor's Health Effects of Air Pollution Task Force. [1]

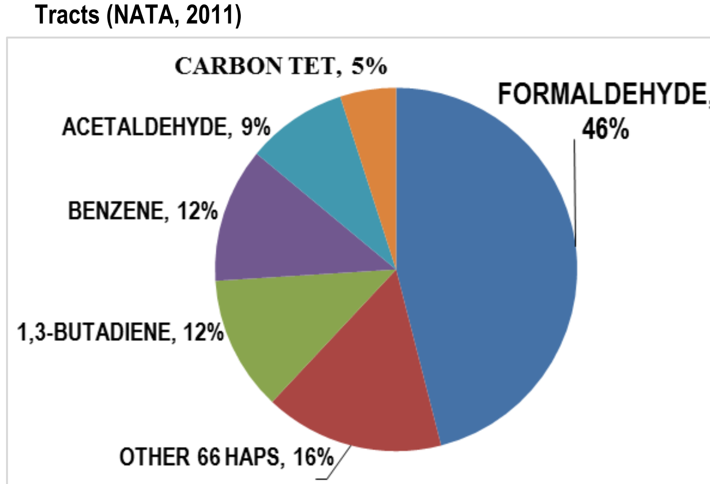
Figure 1: Highest Cancer Risk Census Tracts in Houston



Houston faces particularly difficult air toxic challenges due to the significant air emissions from one of the largest petrochemical complexes in the world and no residential zoning. Harris County, home to Houston, was exposed to over 23 million pounds of hazardous air pollutants in 2015, EPA's Release Inventory (TRI) report. Formaldehyde and acetaldehyde are high risk HAPs that generate significant amounts of peroxy radicals leading to enhanced ozone production and secondary PM formation and exemplify multipollutant linkages driven by atmospheric processes. [2]

Of the ten census tracts with the highest cancer risk in Houston, census tracts ranked 2, 4, 5, 6 and 7 are contiguous (highest risk =1) and represent the neighborhoods of Harrisburg, Manchester, Meadowbrook, Allendale, Northshore and Galena Park **(Figure 1).** These same tracts also pose acute and non-cancer respiratory hazards ranking 6-12. These tracts are the focus of this project. Each of these tracts is in close proximity to point sources. NATA data indicate that the ambient concentrations in the census tracts collectively pose a population health risk ranging from 61 to 63 per million people and the pollutant contributing the highest fraction of the risk is formaldehyde

Figure 2: Chemical Contributions to Risk in Project Area Census Tracts (NATA, 2011)

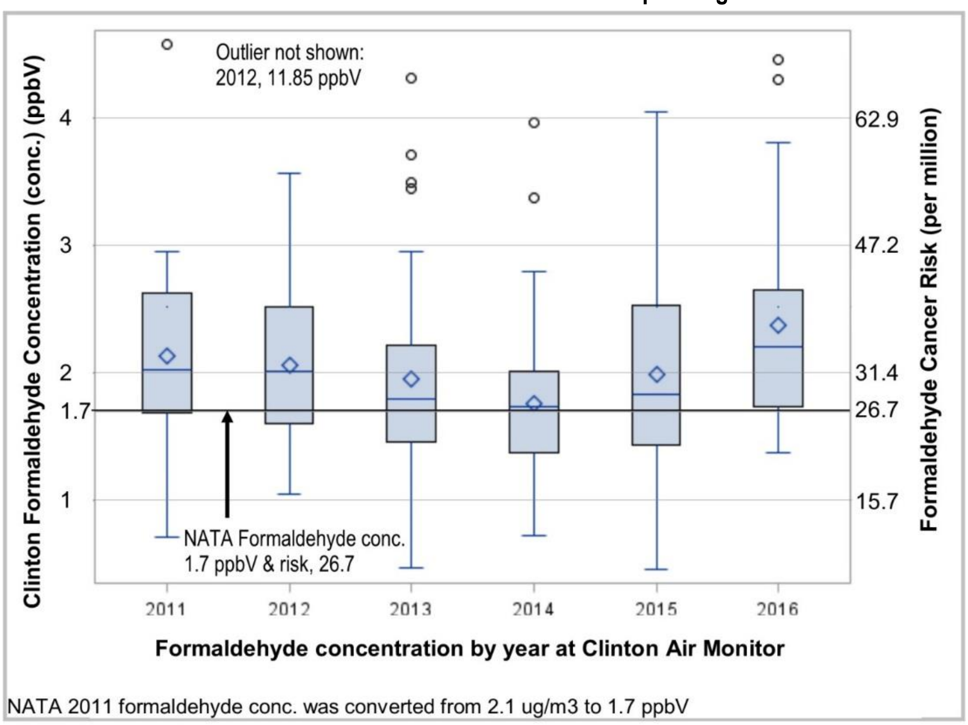


(46%) followed by benzene and 1,3 butadiene (12% each), acetaldehyde (9%), and then carbon tetrachloride (5%). The other 66 HAPs combined contribute 16% of the risk **(Figure 2).**

Formaldehyde can be emitted directly or formed during the atmospheric oxidation of **certain VOCs. It is ubiquitous because some of it is from mobile sources, emitted from a wide** variety of products (wood products, building materials, household products, preservatives, fertilizers and pesticides), or used to manufacture other chemicals. Recent research indicates, 95% of the formaldehyde in Houston is from secondary oxidation of VOCs, *and* almost all of the VOCs that are oxidized to form formaldehyde come from point sources. [3] The biggest sources of reactive VOCs (like the sources subject to the HRVOC regulations) would be the biggest contributors to the ambient formaldehyde levels that drive the risk numbers. A study of formaldehyde in Houston identified formation linked to ethene, propene and isoprene. [4]

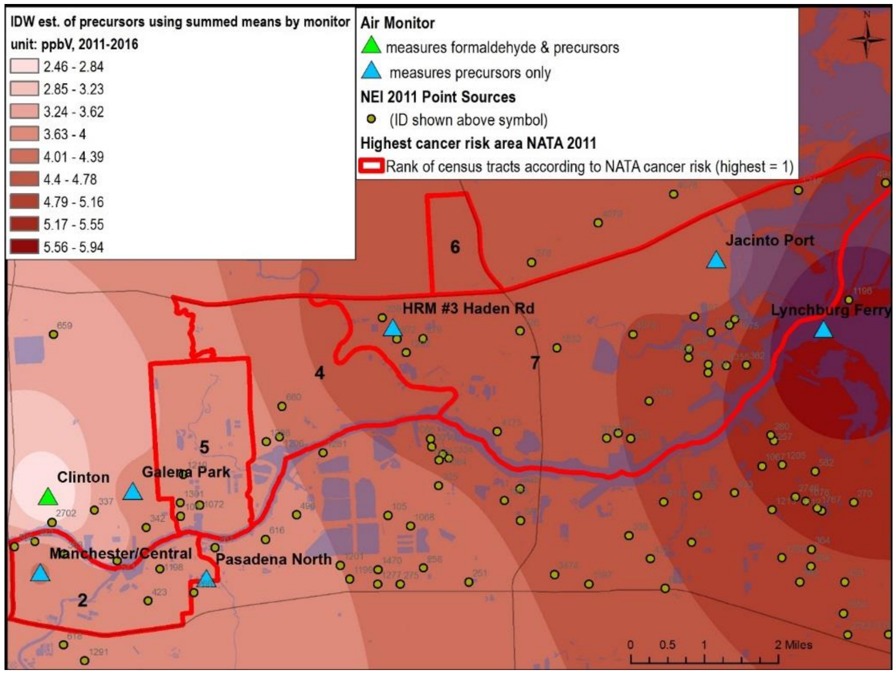
In NATA, concentrations of secondarily-formed formaldehyde were estimated using CMAQ at a 12 km grid resolution [5]. Although NATA, a tool for regulators to identify potential areas of concern, reports elevated risk for these census tracts (99th percentile in the state and 95th to 100 percentile in the region and USA), the concentration and subsequent risk of the main risk driver, formaldehyde, are likely higher than reported according to measured data. Results from the formaldehyde monitor nearest the project area, Clinton Drive, indicate NATA modeled concentrations for 2011 underestimate **(Figure 3)** average measured concentrations by 25% in 2011. In more recent years, with the exception of 2014, the concentrations are consistently found to be higher than the NATA 2011 prediction, with highest concentrations occurring in 2016 where the average measured formaldehyde is 40% higher than NATA. There is one other monitor measuring formaldehyde in Houston, Deer Park #2, which is farther from the study area, and has lower overall concentrations. Understanding and characterizing the formaldehyde in the study area is important to understand because: 1) it is the largest contributor to the highest increased health risk in Houston and in an environmental justice challenged area (see Section 4), 2) very little formaldehyde monitoring data exists—only one monitor (Clinton Drive) in the area of concern, 3) in the same census tract, formaldehyde data that does exist indicates the high NATA risk estimate, may actually be underestimating the true risk—the NATA estimated formaldehyde concentration is lower than the Clinton Drive monitor concentrations by 25% in 2011 and 2016 levels were highest, 4) in census tracts where no formaldehyde monitoring exists, the concentrations may be even more elevated than the NATA estimate--the concentrations of the precursors to formaldehyde formation vary spatially and are significantly higher than at the Clinton Drive monitor **(Figure 4)** (precursors are well monitored with seven monitors in the study area), and (5) not only does formaldehyde pose a direct human health risk (cancer and noncancer), it is also a precursor for ozone formation, for which the area is in nonattainment with vast time and resources continuing to be spent to reduce ozone and ozone precursor emissions.

Figure 3: Comparison of Formaldehyde Concentration and Cancer Risk in Study Area: Measured at Clinton Drive vs. NATA 2011 Estimated in Corresponding Census Tract



In addition, while formaldehyde is regulated as a HAP under the federal Clean Air Act, the federal standards do not address formaldehyde precursors, which are the predominant source of this toxic in Houston. [6] The Clean Air Act requires EPA to set standards for industrial sources that emit significant amounts of HAPs. Clean Air Act Section 112 requires EPA set these standards based on the maximum achievable control technology (MACT). EPA has set national toxics standards for dozens of industries, including some that emit formaldehyde. These air toxics standards are also known NESHAPS. [7] But, importantly, EPA's air toxics standards do not address Houston's formaldehyde problem, which is largely a consequence of secondary formation from the release of its alkene precursors, such as ethene, propene, and isoprene. Federal toxics standards have not been established for these alkene precursors, which are not designated as hazardous air pollutants. Given that control of only primary formaldehyde emission appears to be insufficient, this research would support development of new and strengthened <u>standards to account for secondary formation and increased controls of its alkene precursors as an effective regulatory strategy for reducing formaldehyde concentrations in Houston.</u>

Figure 4: Spatial Variation of 2011 Formaldehyde Precursors of Ethene, Propene and Isoprene 2011 Average Summed



<u>2. Technical Approach (15 pts):</u>

Bureau of Pollution Control and Prevention (BPCP), partnering with formaldehyde expert air scientists at University of Houston, the community groups Air Alliance Houston and Environmental Integrity Project and the solar occultation flux contractor FluxSense, Inc., proposes the following objectives to addresses category 1) community-scale monitoring, to "characterize near-source concentrations" from industry sectors and "obtain information regarding substantially elevated ambient concentrations of toxics" providing information to "assist regulators in their efforts to assess the impact of emission reduction measures."

1) <u>Significantly increase the spatial/temporal information on formaldehyde levels in the study area</u> with the addition of four Aero Laser monitors capable of measuring formaldehyde in the study area. These four Aero Lasers monitors will augment the existing TCEQ formaldehyde monitor at Clinton Drive, totaling five formaldehyde monitors in the study area). Note: University of Houston will contribute one Aero Laser monitor for the project sampling period, the other Aero Laser monitors may remain in place after project completion. The Aero Laser produces real-time data in 90 second increments (formaldehyde only) while the TCEQ data is a 3 hour composite that may include other aldehydes. The Aero Laser will allow creation of a more precise model for formaldehyde creation and destruction during the day as levels fluctuate. According to the literature, in the absence of interference the two methods have a correlation coefficient of 0.96. According to the literature, the Aero Laser should show a better overall performance in ambient Houston air because it suffers from fewer potential interferences from other aldehydes, reactive VOCs and ozone that are expected to be in Houston air than does the DNPH method. Sampling will take place for one year.
2) <u>Evaluate and verify the relationship between formaldehyde levels measured using the TCEQ formaldehyde monitor at Clinton Drive with levels measured with the Aero Laser monitor to be used in the study</u>. The Aero Laser already in UH's possession will be used to accomplish this task while awaiting delivery of the Aero Lasers to be purchased.

The data from the co-location period, minimally, one week time, will be statistically assessed using linear least squares regression in SAS. The results will inform any comparisons of data collected at other locations.

3) Statistically assess the spatial/temporal relationship between the new formaldehyde concentration information and the formaldehyde precursors by co-locating the Aero Lasers at existing fixed site locations in the study area (Figure 1) which already measure propene, ethene, isoprene, as well as 1,3 butadiene and benzene (e.g., Lynchburg, Jacinto Port, HRM #3 Haden Road, Channelview, Pasadena North, and/or Pasadena HL&P). Acetaldehyde is only measured at the Clinton Drive site. The BPCP will augment acetaldehyde sampling, as well as VOC sampling, using their Mobile Ambient Air Monitoring Lab (MAAML). Statistical assessment will include time series analysis, regression and geospatial interpretation (SAS 9.4 and ArcMAP 10.3.1 will be used).
4) Identify locations, which are likely contributing to the excess risk, for detailed formaldehyde and formaldehyde precursor source characterization, using the assessment in 3) above and as related to detailed facility emissions inventory data by point source. Statistical assessment will include time series analysis, regression and geospatial interpretation (SAS 9.4 and ArcMAP 10.3.1 will be used).
5) Conduct more detailed evaluations of emission sources identified in 4) above using the Solar Occultation Flux method from a moving vehicle to collect vertical column densities of primary and secondary emissions. This technique will generate "curtain" measurements that, when coupled with vertical wind profiles from a lidar or radiosonde and tracer releases, can estimate mass flux emission rates of specific sources using detailed back trajectory modeling. This data will allow for a direct comparison to emission inventory data to support the development of MACT for new specific source categories for precursors of formaldehyde.
6) Conduct community outreach, collaboration and education and engage community in the regulatory process (e.g., fact sheets in Spanish and English, community/neighborhood educational meetings regarding the project, the results and the effectiveness of controls). SOF analysis may involve community support in placement.

3. Data Analysis (10 pts):

Statistical analysis of the data will be conducted as part of objectives 2-5 using SAS 9.4 and ArcMAP 10.3.1. Regression analysis will be used to quantify the relationship between the two measurement devices (objective 2). This relationship will be used to inform comparisons at other locations. As part of objective 4, 5 and 6, appropriate environmental statistical methods, including geospatial and nonparametric methods, will be used to assess the spatial/temporal relationship of the year of all formaldehyde, precursor and other risk driver data after data cleaning, outlier, and normality testing. Exploratory data analysis such as spatial temporal correlations and regressions will be used to direct development of an empirical model of the area. The data collection outlined above was created to support the data quality objectives of this project.

4. Environmental Justice Impacts (10 pts):

The U.S. Environmental Protection Agency EJScreen tool indicates the study area is subject to significant environmental justice impacts. Among other indicators, EJScreen reports an EJ Index for NATA air toxic cancer risk for the study area at 92^{nd}, 96^{th}, and 96^{th} percentile for the state, EPA region and USA, respectively. The NATA air toxic cancer risk in the study area, according to EJScreen, is reported to be in the 99^{th} percentile in the state and 95^{th} to 100 percentile in the region and USA. As noted previously, almost half of the NATA air toxic cancer risk in the study area is attributed to formaldehyde.

Understanding and characterizing the substantially elevated formaldehyde concentration levels near the sources in the area will assist regulators in assessing the impact of emission reduction measures and provide insight into effective modifications, if necessary. Modifications reducing the substantially elevated formaldehyde will improve the area environmental conditions and create a marked reduction in the air toxic cancer risk (e.g., adjusting/expanding MACT to account for secondary formation of formaldehyde). Community education, outreach and collaboration, detailed in the section 5), will among other benefits, provide the community with new skills to participate in the regulatory decision making progress for this project and the future.

5. Community Collaboration/Outreach (10 pts):

Community Collaboration and outreach will occur with the support of two community groups: Air Alliance Houston (AAH) and Environmental Integrity Project (EIP). For 25 years, AAH has worked in low-income communities of color to improve air quality, environmental health, and public health. They have active community outreach and organizing efforts in the study area and know and work with the local civic club leaders, Super neighborhoods, schools, nonprofits, and other community leaders in the study area. EIP is a nonprofit dedicated to strict and fair enforcement of the nation's anti-pollution laws. EIP has extensive Clean Air Act, air toxics, and regulatory expertise. EIP works in partnership with Air Alliance Houston on communications and air quality matters in the Houston area. In collaboration with HHD, AAH and EIP will secure public involvement in this project. First, both Air Alliance and EIP will "translate" the research into communications pieces (e.g., fact sheets in Spanish and English, community/neighborhood educational meetings) and disseminate the information in targeted communities. EIP and AAH will develop a messaging and outreach plan in the early stages of the project to bring it to the attention of impacted communities, and to build support for future regulatory action, if warranted. Second, after the research is compiled and the monitoring studies indicate the need, EIP will prepare a petition to EPA, for the purpose of (a) bringing this critical new information to the federal government's attention, and (b) triggering the regulatory clock for the EPA to respond to the new research. The petition will be submitted to EPA on behalf of and with the support and input of local Houston health, environmental justice, civic, neighborhood, and/or other local groups. The skills the communities learn will continue to benefit the community in the future, beyond this project.

6. Environmental Results (10 pts)-Outcomes, Outputs and Performance Measures:

I. Output

- Formaldehyde data, based upon actual measurements from a variety of individual sources in the Houston study area, will be provided for EPA's Air Quality System database
- Improved understanding of link between formaldehyde ambient air concentrations and its predominant source in Houston by secondary formation from release of its precursors
- Identification, characterization and profile development of formaldehyde sources, both primary and secondary, which are likely contributing to risk for communities in study-area
- Community meetings and distribution of fact sheets for increasing community awareness
- Quarterly progress reports – a technical progress summary and summary of expenditures for the preceding quarter and planned activities report for the next quarter will be submitted to the EPA
- Final report – a final report detailing project activities and achievements, technical aspects, quality assurance results, and outcomes will be submitted to the EPA
- EPA Quality System (QAPP, QMP, DQO's)

II. Outcomes

- **Short-term**
  - Develop an accurate baseline reference frame of formaldehyde concentrations in study area by conducting ambient air monitoring
  - Improve precision of air quality models for formaldehyde creation and destruction during the day as levels fluctuate
  - Identify problem sources likely contributing to risk for communities in study-area, supported by statistical assessments of collected ambient air data, emissions inventory information and Solar Occultation Flux method
  - Increase community awareness regarding the project and results
- **Mid-term**
  - Capacity building for community to participate in the regulatory decision making progress for this project and the future.
  - Support the development of MACT for new specific source categories for precursors of formaldehyde
- **Long-term**
  - If MACT may be expanded to account for secondary formation of formaldehyde from release of its precursors, modifications may reduce the substantially elevated formaldehyde and improve the area environmental conditions, creating a marked reduction in the air toxic cancer risk for surrounding communities

III. Performance Measures

- Air sampling/monitoring to collect sufficient data over a period of one year
- List of locations in study area which are contributing to risk
- Bimonthly community meetings and minimum of fifty engagements/fact sheet distributions

7. Programmatic Capability and Past Performance (10 pts):

I. Organization and Staff Experience

HHD has a successful track record of working with EPA and other Federal entities on previous projects of similar scope. Specifically, BPCP has received and executed the following EPA funded grants and assistance agreements over the last fifteen years or more. The four projects below are of similar size to the proposed project. The projects 3 and 4 are within the last three years as they are ongoing:

1) Community Scale Air Toxics Ambient Monitoring Grant (XA-96665901-5) received 6/30/2008 for $643,112.00
2) Local Air Toxics Monitoring Grant (XA-96620501-2) received 5/22/2006 for $499,657.00
3) 105 Pass Through Monitoring Grant with a yearly amount of $388,427.00
4) 103 PM2.5 Monitoring Grant with an average yearly amount of $88,882.49

All of these projects are similar in scope to the proposed project as they involve ambient air monitoring. Project number 1 is most similar in scope in that it also had an objective of identifying, measuring and analyzing previously unknown or underestimated VOC air toxics emission sources in the Houston Ship Channel area. This project used DIAL technology for sampling in 2009 (Project Officer: Aunjanee Gautreaux, Grant ID number: XA-96665901-5, Project Start: 6/30/2008 and Project End: 5/31/2011). The Project 2 award established a mobile ambient air monitoring lab to measure air toxics in the Houston Ship Channel area (Project Officer: Aunjanee Gautreaux, Grant ID number: XA-96620501-2, Project Start: 5/22/2006 and Project End: 3/31/2010). This lab was used in the DIAL project, is currently in use and will assist in the proposed project. Project 3 and 4 are ongoing CAMS (eight fixed site stations) and PM2.5 monitoring (two fixed site stations).

Experience and expertise of selected project personnel are summarized below. Resumes of all personnel are included in the Attachment.

Dr. Loren Raun will serve as Project Director. Dr. Raun is an air pollution health risk expert in the Houston area twenty five years of experience. She serves as the Chief Environmental Science Officer for the city and has a dual position as assistant research professor in the Department of Statistics at Rice University. Dr. Raun has published extensively and has successfully managed federal grant projects from 80,000 to 300,000,000 in size and a staff of 14. She was involved in interpretation of the EPA DIAL (project 1 above). B.S Geophysics, 1985, University of Texas, M.S. Environmental Science, Rice University, 1988, Ph.D. Environmental Science, Rice University, 1998.

Don Richner, MS, CIH, will serve as Program Manager. Mr. Richner manages the mobile laboratory group within the BPCP and has over 40 years of experience in project manager, especially as related to pollution investigations, laboratory analysis, laboratory operation and management, quality assurance, air toxics studies, regulation, permitting, compliance, emission abatement, engineering. B.S. Geology, 1977, Case Western Reserve University, B.S. Chemistry, 1980, Lake Erie College, M.S. Analytical Chemistry, 1985, Cleveland State University, Certified Industrial Hygienist (chemical aspects), 1995.

Dr. James H. Flynn III will serve as the project formaldehyde air monitoring expert as our partner from University of Houston (UH). Dr. Flynn, an assistant research professor at UH, is an atmospheric scientist with specialization in atmospheric chemistry and extensive experience measuring formaldehyde. He manages the UH mobile lab and multiple air pollution sampling campaign projects. B.S Aviation Science, 2001, Baylor University, Waco, Texas, M.S. University of Houston, 2008, Ph.D. University of Houston, 2013.

II. Past performance in successfully completing and managing assistance agreements

BPCP has received and successful executed the aforementioned EPA funded grants and assistance agreements for projects similar to the proposed one, over the last fifteen years or more. In addition, our division manages other federal assistance agreements from HUD and CDC, all with highest approval ("green rating"). All reporting requirements were met and final reports completed.

III. History of meeting the reporting requirements under the assistance agreements

For all project grants, BPCP has consistently provided proper, timely documentation of grant progress. BPCP has continually submitted project-specific reports to EPA in a manner consistent with stated timeframes. For Project 1 and 2, project personnel have ensured that required quarterly reports and quality assurance documents reached the EPA Project Manager before the stated cut-off dates. Final reports were submitted within the agreed time frame and to EPA's satisfaction. BPCP has performed similarly for Project 3 by closing out grant disbursement reports within project timeframes, and submitted project reports as per project guidelines, including final reports. The Texas Commission on Environmental Quality (TCEQ) continues to praise BPCP staff performance through their auditing process of project duties, detailing how well they have met and exceeded project goals and objectives. BPCP has also continued to demonstrate exceptional performance concerning project management and completion for Project 4 as reflected in part by the timeliness of pertinent report submissions.

8. Budget (10 pts):

This budget spans one year of purchasing. The project time line is 18 months to include time for interpretation and reporting time or delays.

Personnel ($56,200 per year)

Project Director (0.20FTE)

Loren Raun, PhD, PI, City of Houston Chief Environmental Science Officer and Chief of Bureau of Community and Children's Environmental Health, will serve as project director in-kind and monitor the overall operations of the project and generate the final report.

Project Manager (0.05FTE)

Don Richner, will serve as the project manager and will be responsible for the day-to-day activities, working closely with Dr. Raun, project staff and collaborative partners to implement the project. The manager will supervise and monitor the activities of the BPCP staff and will have the overall responsibility of insuring the instruments are properly maintained and calibrated to meet project objectives. She/he will insure that equipment is available for project use and does not conflict with other department projects.

Chemist IV & Graduate Engineer (0.30FTE)

Peter Chen will serve as the project chemists will insure that Mobile Ambient Air Monitoring Lab (MAAML) GC/MS system and other instruments are calibrated and ready for use during deployment. Chemists will maintain QC data to show that instruments are operating within normal quality control limits and use meteorological data to identify potential emission sources, when feasible. Kulsum Lopez will serve as the Graduate Engineer will collect and evaluate instrument data during the project, produce trend graphs and send that information to the project manager, as requested and will work closely with other project members. .

Environmental Investigator III (1.0FTE)

TBD, Environmental Investigator III (EI III) (1) 100% in year 1), under the direction of the Project Manager, will maintain the fixed site Formaldehyde monitors. Program the instruments, perform daily calibration checks, change solvents and empty wastes, download data and perform all routine instrument maintenance, as needed. The EI III will assume the overall responsibility for maintaining all the Aero Laser AL4021 formaldehyde units to be deployed during the study and keeping them in near continuous operation. Electronic database for the school nurse to summarize in the consultation form sent to the provider.

Fringe Benefits ($29,786 per year): The rate of fringe benefits for staff at the City of Houston is 53%.

Travel ($4,950 year 1): Project team members will need to travel between work sites, community partner organizations and partner meetings. Attend training and conferences to meet the project goals.

Equipment ($111,850 year 1): Purchase and installation of 3 Aero Laser AL4120 units to continuously monitor formaldehyde within the Houston area at 3 sites selected by the Project Director to facilitate meeting the project goals and objectives.

Program Supplies ($30,848 year 1): Program supplies will include consumables for the Aero Laser AL4021 units, a reference GC/MS carbonyl standard the GC/MS onboard the MAAML and other miscellaneous supplies necessary to keep the fixed site instruments and the MAAML in operation during testing.

Contractual ($177,576 per year)

University of Houston $102,576: UH will provide the use of their Aero Laser AL4021 for one year along with its operational supplies and provide a research assistant to oversee training and operation of that unit during the project.

FluxSense Inc. ($65,000 per year): FluxSense Inc. will contract with BPCP to provide solar occultation flux data during a portion of the study to supplement the data collected by the other instruments. See their proposal for more information.

Air Alliance Houston/Environmental Integrity Project ($10,000 per year): Air Alliance Houston (AAH) and EIPs are important environmental advocacy groups in the Houston area and will provide a portion of the outreach component of this proposal.

Personnel	EPA Funding			Cost-Share
	Y1	Y2	Y3	
(1) Project Director (108,000 @20% FTE),	0	0	0	21,700
(1) Project Manager (86,000 @5% FTE)	0	0	0	4,400
(2) Chemist IV or Graduate Engineer Involvement (56,000@ 30%)	0	0	0	16,900
(1) Environmental Investigator III (EI III) ($27/hr 100% FTE)	56,200	0	0	0
TOTAL PERSONNEL	56, 200	0	0	43,000
Fringe Benefits				
FICA, Health Benefits, Retirement 53% of Salary and Wages	29, 786	0	0	22, 790
TOTAL FRINGE BENEFITS	29, 786	0	0	22, 790
Travel				
Travel for Project Manager and staff: Mileage @ $0.55 per mile. (750 miles per month) x 12 month (412.50 month), site visits, training, conferences	4,950	0	0	
TOTAL TRAVEL	4,950	0	0	
Equipment (3 Aero Laser AL4210 32,000 ea, + 3 Liquid Flow Controllers at 2,600 ea, 3 cooling boxes at 420 ea, 3,sets of reagent bottles at 750 ea, 3 stable Aluminum Shipping Containers at 330 ea, 1 laptop at 850 ea.	109,150			
Installation & Training	2,700	0	0	
TOTAL EQUIPMENT	111,850	0	0	
Supplies				
1 year consumable parts; 3 sets Peristaltic pump tubing at 960 ea. 3 sets of Trap material at 240 ea. 3 sets of Filters at 83 ea.	3,849	0	0	
1 year gas & reagent consumables for Aero Laser, 3 sets at 6300 ea. plus consumables for MAAML GC/MS and other onboard equipment at $6300 and one multi-component Carbonyl standard for GC/MS at $1,800	27,000	0	0	
TOTAL SUPPLIES	30,849	0	0	
Contractual				
University of Houston (Aero Laser AL4021 use & support)	102,576	0	0	
FluxSense Inc. (Solar Occultation Flux measurement)	65,000	0	0	
Air Alliance Houston (AAH)	5,000	0	0	
Environmental Integrity Project (EIP)	5,000			
Other Contracts	0	0	0	0
TOTAL CONTRACTUAL	177,576	0	0	
Other				
TOTAL OTHER	0	0	0	
TOTAL DIRECT CHARGES	413,561	0	0	
Indirect Charges				
Federal Negotiated Indirect Cost Rate = 10%	8,599	0	0	6,579
(Indirect Rate X Personnel = Indirect Costs)	8,599	0	0	6,579
TOTAL INDIRECT	8,599	0	0	6,579
TOTAL FUNDING	422,160	0	0	72,369
TOTAL PROJECT COST (federal and non-federal)	494,529	0	0	

9. Leveraging (5 pts):

HHD BPCP will provide the use of its Mobile Ambient Air Monitoring Laboratory (MAAML) with its onboard Agilent 5971 GC/MS, meteorological station and other measurement instrumentation to provide real time data in support of the fixed site monitoring conducted using the Aero Laser AL4021 units purchased for the grant. We will conduct onsite monitoring at various time during the grant and provide quantitative data of acetaldehyde and other reactive VOCs measured by our GC/MS plus information on PM, ozone and NO2. Our experienced PhD chemists will operate the equipment, perform calibrations and produce control charts to document performance in support of this project. One graduate engineer will also perform periodic review and correlation of data to assist in evaluating the progress of the project and its completion trajectory. A senior project manager with over 40 years of experience will also oversee tracking deployment and project targets and address issues with purchasing or subcontractors.

Facilities: The following equipment is available at UH including a AL4102 formaldehyde instrument, custom gas dilution and deliver system and data acquisition system.

10. Expenditure of Awarded Grant Funds (5 pts):

All City purchases of $50,000 require approval by City Council. If awarded, we believe we can have approval within 60 days of the award. After approval we will place the order with Aero Laser for the units. Note that Aero Laser is a sole source for this instrument, but we will contact their business partners in the U.S. prior to purchase to document whether or not we can obtain a lower price from one of them before making this purchase.

It is our intention to have all the purchase requisitions prepared during the first 60 days after project award, with the exception of any item that may have a short shelf life, so that we can place them before the arrival of the first instrument. Note that the GC/MS gas calibration standard for carbonyls will be purchased prior to that so that we may use it in the field with the University of Houston instrument Aero Laser AL4021 while doing field comparisons with the

TCEQ Formaldehyde monitor at the Clinton Avenue site.

Note that grant funds are tracked by the city Grants Management and they report monthly to the Project Manager to advise them on spending goals and funds availability. They also prepare the end of grant reports on expenditures for review and audit.

Specific Actions for Procurement and Fund Expenditures
Initial instrument procurement of Aero Laser units ($114,500) and instrument consumables purchased from manufacturer ($3,730)- 60 days to get the required City Council approval for all purchases over $50,000 and subsequently a PO issued. 90 to 120 days more for delivery after the PO is issued.
Purchase of Consumable gases and reagents ($27.000)- Will be completed within 30 days of City Council approval for the instrument purchases with the exception of any gas or reagent that does not have a shelf life of at least one year prior to opening.
Wages and benefits will be paid biweekly to employees ($29,800 per quarter) based on the grant package- Payroll biweekly
Subcontractor(s) to be paid within 30 days of invoice- Monthly